National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ05HA96D TO 47 R10	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center
Houston, TX 77058-3696
Org./Buyer: Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 02/01/2005 - 09/30/2011

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: See Block #1

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.

Name:

Signature: _____ Date: _____

10. Name: Ronald Johnson

Signtature: Ronald Johnson Date: 08/13/10
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Aeroscience and Flight Mechanics Division (EG) Engineering Services					
TO	**47 R10**					
	Est. Labor Costs	64			64	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$4,182,143.32

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date

Engineering and Science Contract

NNJ05HA96D-TO47 R10

Originator: Tuyen Hua (EG) (281) 483-8296 **TMR:**Tuyen Hua (EG) (281) 483-8296

Revision Summary: The purpose of revision 10:

1) Add resource requirements on 5.1.3 (SIGI Integration and Test) and 5.6.1 (RPOP Development and Maintenance).
2) Extend period of performance thru 9/30/2011.

1. Title of Effort: Aeroscience and Flight Mechanics Division (EG) Engineering Services

2. Date of Request: 08/02/2010

3. Statement of Work Task Description

a. **3.1.1 First Article Development**
The contractor shall perform trade studies; develop requirements and concepts; design, fabricate and assemble prototype, engineering development units, and first build flight hardware and software tools and products.

The contractor shall develop test requirements and plans; perform test bed buildup; develop test equipment for research and advanced hardware and software projects; and perform development, certification, and verification and acceptance testing.

b. **3.1.2 Engineering Tasks**
The contractor shall provide engineering services for human and robotic missions. These services shall include: mission architecture definition; mission design, and planning; and conceptual vehicle design and analyses for conducting trade studies to establish feasibility. Typical architecture elements include: launch vehicles; human-rated spacecraft; and elements including habitats and rovers used on planetary surfaces to enable human and robotic exploration.

The contractor shall perform engineering studies, analyses and crew training activities. Crew training activities include: development of mission scenarios; validation of initial conditions; production of visuals and displays; installation of session specific equipment; and verification of operational readiness.

The contractor shall provide engineering evaluation of facility systems and prepare proposals for the upgrade and modernization of facility systems. The contractor shall develop documentation for new systems including work instructions and hazard analyses.

The contractor shall perform engineering analyses and develop operational procedures for flight hardware and software products and on-orbit operational procedures.

The contractor shall integrate systems and payloads for Government and international partner hardware and software.

The contractor shall provide crew provisioning and manifesting for crew preference items in accordance with existing NASA regulations.

c. **3.1.4 Mission Support**
The contractor shall provide continuous Mission Evaluation Room (MER) technical services to perform pre-flight timeline reviews and real-time console monitoring during flight. The contractor shall perform administrative and documentation duties for the MER continuous operation for Space Vehicle missions including preparation before and follow-up after each flight and expedition. The contractor shall provide MER training and certification for MER mission engineers.

d. **3.1.5 Technical Reviews, Boards and Panels**
The contractor shall coordinate technical meetings, prepare system documentation, provide mission related products, and provide administrative support to program reviews, design reviews, control boards, and panels. The contractor shall document all products associated with technical services tasks.

e. **3.1.6 Anomaly Analysis**
The contractor shall perform anomaly analyses, propose anomaly issue resolution, implement corrective actions for facilities and laboratories, training and mockup hardware, ground support equipment configurations, and flight hardware and software. The contractor shall perform anomaly analysis for flight investigations.

f. **3.3 Research and Development**

The contractor shall perform research and development including: human planetary mission architecture, vehicular design; astromaterials; planetary missions; biological; physical-chemical systems; dexterous robotics; vision and perception technologies; automated systems including rendezvous and mating systems; thermal control systems (passive and active); life support systems; space suit systems; mechanical systems; Microelectromechanical Systems (MEMS); Nanotechnology; Guidance and Navigation control systems; fuel liquefaction and storage systems; on-orbit manufacturing systems; electromagnetic systems; sensor systems; tracking systems; power transmission systems; avionics architecture systems; communication systems; microwave systems; instrumentation and wireless instrumentation; artificial intelligence systems; orbital debris; image analyses; and Earth observations.

g. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Task Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/01/2005 and ends 09/30/2011. Updated Rev 10

5. Support Requirements

Aeroscience and Flight Mechanics Division (EG) Engineering and Technical Services Updated Rev 3

The contractor shall provide engineering and technical services to various projects and programs being managed and executed by the Aeroscience and Flight Mechanics Division as directed by action items issued by the Technical Monitor. Updated Rev 3

5.1 GN&C Development and Test (EG2) Updated Rev 10

a. Description

The contractor shall provide GN&C systems design, development, test, and evaluation (DDT&E). This includes basic engineering, technical, logistical, and hardware and software development, integration, and test for ongoing GN&C system DDT&E projects.

5.1.1 GITF Development, Integration and Test

This subtask is to develop generic test procedures which apply to all phases of GITF test operations. These procedures will include GITF activation, shutdown, flight software major mode transitions, post-test data reduction, and anomaly resolution guides for the various flight specific test configurations between ISS ULF1 and 12A.1. These procedures will include the necessary steps to perform the required function as well as cabling and configuration diagrams as required.

In addition, the contractor shall complete post-test processing for recorded 1553 Bus data, GN&C simulation data, and 1553 PASS data in accordance with GITF test objectives for each test case.

5.1.2 GITF Mission Scenario Testing

The contractor shall develop, perform, and document ISS mission specific test cases to meet ISS mission specific milestones. These test cases will include test case objectives, procedure and test script development, performing the test execution record, analysis of the test data, and generating documentation for test readiness and test results for the flights scheduled to be supported during FY05 ISS (ULF1, 12A, and 12A.1).

The contractor shall perform testing of on-orbit GN&C anomalies. Testing shall attempt to duplicate on-orbit anomaly conditions for the purpose of identifying root cause.

The contractor shall develop execution scripts for mission scenario tests of ISS GN&C S/W revisions with nominal and off-nominal hardware in the loop capabilities. These scripts will exercise R5 or later unique functionality.

The contractor shall perform testing of patches to ISS GN&C flight software to verify functionality and that the patch corrects the anomaly observed. In addition, the contractor shall

verify that the patch does not induce errors in other flight software functions.

5.1.3 Space Station SIGI Subsystem Integration and Test

This subtask provides for contractor planning, management, and implementation activities to assure the delivery and operation of the Space Station GPS subsystem. This subtask includes updates to certification of the SIGI and SIGI firmware loader capability to support ISS SIGI on-orbit firmware updates. This subtask also includes performance of GPS Antenna Assembly analysis and testing as required for ISS GPS anomaly resolution.

Specify and provide components and equipment required to perform GPS subsystem tests. The hardware required will be used to fabricate test cables and breakout boxes.

b. Skills

FROM:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Manager							
Supervisor							
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
IT 2							
IT 3							
Technician 2							
Technician 3							
Business Specialist 1							
Administration Specialist 1	0						
Administration Specialist 2	0						

Quality Assurance Specialist 1
Quality Assurance Specialist 2
Quality Engineer 1
Quality Engineer 2
Software Quality Assurance Engineer 3
Planner/Scheduler 3
Project Controls Specialist 1
Labor
Material
Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours

64

Support Requirement 5.1 Totals

Labor Total:
Material Total:
Travel Total:
M&T Burden Total:
Subtotal:
Est. Fee:
Total:
Total Hours:

64

Management Sensitive

TO:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Manager							
Supervisor							
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
IT 2							
IT 3							
Technician 2							
Technician 3							
Business Specialist 1							
Administration Specialist 1							
Administration Specialist 2							
Quality Assurance Specialist 1							
Quality Assurance Specialist 2							
Quality Engineer 1							
Quality Engineer 2							
Software Quality Assurance Engineer 3							
Planner/Scheduler 3							
Project Controls Specialist 1							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.1 Totals		Delta in Support Requirement 5.1 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Tot	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.2 Plume and Aeroscience Analysis (EG3) Updated Rev 3

a. Description

The contractor shall provide engineering products in plume flowfield analysis and modeling, plume contamination experiment flight hardware and related support, plume contamination modeling, aerodynamics analysis, and aerothermodynamic heating analysis for on-going Aeroscience Branch projects. Tasks include development of analysis methods, tool development, application of these methods & tools, experiment hardware development, fabrication and integration, and experiment documentation preparation.

5.2.1 **ISS Aeroscience Analysis**

Plume heating assessments in support of the planning and analysis of Shuttle Orbiter/ISS proximity and mated operations and related tool support and upgrades. Assessments pertain to plume heating from the US Shuttle Orbiter to ISS as well as visiting vehicles and ISS self-impingement. One assessment shall be performed during the performance period that quantifies the heating rates and temperature responses resulting from plume impingement occurring during the planned Orbiter pirouette manuever. Other assessments pertain to plume heating from new Orbiter jet firing history databases and heating assessment from HTV ACS jets.

b. Skills

FROM:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Manager							
Engineer 1							
Engineer 3				64			
Administration Specialist 2							

Labor

Material
Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours

64

Support Requirement 5.2 Totals
Labor Total:
Material Total:
Travel Total:
M&T Burden Total:
Subtotal:
Est. Fee:
Total:
Total Hours:

64

Management Sensitive

TO:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Manager							
Engineer 1							
Engineer 3							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.2 Totals

Delta in Support Requirement 5.2 Totals

Labor:		**Labor:**	
Material:		**Material:**	
Travel:	64	**Travel:**	
M&T Burden Total:		**M&T Burden Total:**	64
Subtotal:		**Subtotal:**	
Est. Fee:		**Est. Fee:**	
Total:		**Total:**	
Total Hours:		**Total Hours:**	

Management Sensitive

5.3 Space Shuttle Program Return to Flight Support Updated Rev 3

a. Description

This subtask provides the mechanism for acquiring technical products and services associated with EG Division support directed at Space Shuttle Program (SSP) Return to Flight (RTF) activities. These technical products and services include analyses, simulations, trade studies, and testing.

5.3.1 **Orbiter Entry Aerodynamic Analysis**

Contractor shall provide engineering services related to Orbiter entry aerodynamics. Products include creation and maintenance of engineering tools and databases that allow NASA to analyze aerodynamic pressure loads and integrated forces and moments experienced during Shuttle Orbiter entry from low earth orbit. Tools and databases will be based upon all available Space Shuttle Orbiter wind tunnel data and reports and will allow NASA to access and extract specific data.

5.3.2 **Orbiter Entry Aerothermodynamic Analysis**

Contractor shall provide engineering services to the Johnson Space Center Orbiter Entry Aerothermodynamics 'NASA Subsystem Engineer' (NSE) directed towards Orbiter thermal Protection System (TPS) repair activities. Activities will be focused on developing and supporting NASA conducted arc-jet, wind tunnel tests, conducting relevant CFD simulations at arc-jet, wind tunnel and flight conditions, and producing aerothermodynamic heating models. Participation in the review of Orbiter heating environments provided by the prime contractor will also be required.

5.3.3 **Shuttle Systems Integration Database Tool Development**

Contractor shall provide engineering services related to the integrated Space Shuttle System ascent aerodynamics. Products include creation and maintenance of engineering tools and databases that allow NASA to analyze aerodynamic pressure loads and integrated forces and moments experienced during Integrated Space Shuttle System ascent to low earth orbit. Tools and databases will be based upon all available Space Shuttle System wind tunnel data and reports and will allow NASA to access and extract specific data.

5.3.4 **Shuttle Systems Integration Aerothermodynamic Analysis**

This subtask encompasses the aerodynamic and plume heating for the mated space shuttle vehicle and the aerodynamic heating to the space shuttle main engine (SSME) during entry. It also includes the thermal interfaces (radiation and conduction) between the mated space shuttle elements (Orbiter, External Tank (ET), Solid Rocket Booster (SRB) and the SSME). Work will include analyzing the effects of changes to the outer mold line (OML), trajectories and propulsion systems for flight and wind tunnel test conditions. The analyses will be done using existing computer programs and references such as textbooks and papers. The analyses will be presented to space shuttle Thermal Integration Thermal Panel, and possibly to other boards. There will also be reviews of current and past analyses done by others. There may be travel to wind tunnel tests and review boards.

b. Skills

FROM:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Manager							
Engineer 1							
Engineer 2							
Engineer 3							
Senior Engineer Specialist							
IT 4							
Business Specialist 2							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

b4

b4

Support Requirement 5.3 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

b4

Management Sensitive

TO:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Manager							
Engineer 1							
Engineer 2				64			
Engineer 3							
Senior Engineer Specialist							
IT 4							
Business Specialist 2							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.3 Totals		Delta in Support Requirement 5.3 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:	64	Travel:	64
M&T Burden Total:		M&T Burden Total:	
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.4 Guidance, Navigation, and Control Analysis (EG4) Updated Rev 3

a. Description

The contractor shall provide engineering services to the Aeroscience and Flight Mechanics Division (AFMD/JSC) Guidance Navigation & Control (GN&C) Design and Analysis Branch (EG4). The contractor shall perform implementation, verification, and engineering analyses to ensure Shuttle and International Space Station (ISS) mission success.

5.4.1 ISS Dynamics and Control

The contractor shall provide technical and engineering services associated with the implementation, and verification of the International Space Station (ISS) GN&C systems. The scope of work includes performing ISS Attitude Control System (ACS), both propulsive and non-propulsive, performance analyses and ISS time domain simulation development. The contractor shall present the analysis results in the VIPeR meeting as part of the ISS mission Certification of Flight Readiness (CoFR) process. The contractor shall develop, modify, document, validate, and maintain the ISS GN&C Space Station Multiple Rigid Body Simulator (SSMRBS) analysis tool.

5.4.2 Shuttle Ascent Performance Enhancements

This subtask provides ascent/abort GN&C flight software (FSW) analysis for Shuttle flight-to-flight functions including flight rules, analysis tools, and anomaly resolution. New Shuttle FSW capabilities that become a part of the baseline Shuttle capability are to be developed under this task. The definition, analysis, certification, and verification of these new GN&C FSW capabilities and enhancement of current capabilities are to be provided. The unique mission-to-mission analysis necessary for ascent GN&C flight readiness is to be provided. Maintenance of analysis tools including the Ascent/Entry Shuttle Engineering Simulator (SES), the SES-II, and the Ascent Flexible Airframe Response (FAR) tool shall be provided. Development of a Consolidated Simulation capability using the A/E SES and SES-II operating in a TRICK environment shall be provided.

5.4.3 Entry GN&C Flight to Flight Support

This subtask provides for the entry/abort GN&C flight software (FSW) analysis for Orbiter flight-to-flight functions including flight rules, analysis tools, and anomaly resolution. New Orbiter FSW capabilities that become a part of the baseline capability are to be developed under this task. The definition, analysis, certification, and verification of these new GN&C FSW capabilities and enhancement of current capabilities are to be provided. The unique flight-to-flight analysis necessary for entry GN&C flight readiness is to be provided.

Maintenance of analysis tools which includes the batch, Monte Carlo, and real-time capabilities of the Ascent/Entry Shuttle Engineering Simulator (SES) program and the Entry Flexible Airframe Response (FAR) tool shall be provided. A/E SES system administration duties including operating system upgrades, monitoring system security and usage, performing backups, and network configuration and maintenance shall be provided. The contractor shall perform the scheduling and coordination of hardware and software procurement, maintenance, and upgrades for the A/E SES computer local network.

Development of a Consolidated Simulation capability using the A/E SES and SES-II operating in a TRICK environment shall be provided.

5.4.4 Ascent/Entry Trainer (AET) Upgrade

This subtask provides for the upgrade and maintenance of the Ascent/Entry Trainer (AET) in support of NASA/DT. The AET shall be upgraded to remain current with the latest version of the Space Shuttle Flight Software (FSW) Operational Increment (OI) release as specified by the Shuttle Avionics Software Control Board (SASCB). Maintenance of the AET shall include resolution of issues defined by the user community, upgrades to simulation software and databases, and delivery of mission specific initialization data.

b. Skills

FROM:

Skills	CY01	CY02	CY03	CY04	CY05	CY06	CY07

	Hours|Cost	Hours|Cost	Hours|Cost	Hours|Cost	Hours|Cost	Hours|Cost	Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
IT 2							
IT 3				64			
IT 4							
Technician 1							
Business Specialist 2							
Administration Specialist 1							
Administration Specialist 2							
Administration Specialist 3							
Software Quality Assurance Engineer 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.4 Totals

Labor Total: 64

Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
IT 2							
IT 3							
IT 4				64			
Technician 1							
Business Specialist 2							
Administration Specialist 1							
Administration Specialist 2							
Administration Specialist 3							
Software Quality Assurance Engineer 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							

Total CY
Total CY Hours 64

Support Requirement 5.4 Totals		Delta in Support Requirement 5.4 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.5 Flight Mechanics & Trajectory Design (EG5) Updated Rev 3

a. Description

This subtask is for the Aeroscience and Flight Mechanics Division's area of Advanced Mission Design. The objective of this subtask is to develop, execute, and maintain high fidelity performance analysis, mission definition, trajectory design and visualization, guidance requirements, vehicle requirements, and navigation tools for the Flight Mechanics & Trajectory Design Branch.

5.5.1 **Ascent, On-orbit, De-orbit, and Entry Analyses**

The contractor shall perform detailed trade studies for the Advanced Mission Design Branch in the areas of ascent, on-orbit, de-orbit, aerocapture and entry trajectory design and analysis. Specific areas of study include:
Perform ascent aborts from Shuttle Derived Launch Vehicle (SDLV) trajectories, evaluating vehicle loads and heating. SDLV trajectories shall be developed by NASA, and aborts shall be evaluated. The vehicles loads shall be compared to the medical limit allowable and include dispersions. Stability of entry vehicles during ascent aborts and atmospheric re-entry shall also be provided. The affect of CG location, rolling moment coefficients, and spinning by use of RCS shall be included.

Aerocapture analysis and guidance development shall be performed for Mars arrival speeds and conditions. Analysis shall include heating, loads and vehicle performance. Modifications to guidance algorithms, which improve performance, shall be investigated. Guidance gains using state of the art approach shall be incorporated, and compared.

b. Skills

FROM:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Senior Engineer				64			

Specialist							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.5 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Senior Engineer Specialist							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.5 Totals	Delta in Support Requirement 5.5 Totals

Labor:		**Labor:**	
Material:		**Material:**	
Travel:		**Travel:**	
M&T Burden Total:	64	**M&T Burden Total:**	64
Subtotal:		**Subtotal:**	
Est. Fee:		**Est. Fee:**	
Total:		**Total:**	
Total Hours:		**Total Hours:**	

Management Sensitive

5.6 GN&C Autonomous Flight Systems Office (EG6) Updated Rev 10

a. Description

The contractor shall provide engineering services to the GN&C Autonomous Flight Systems Office.

5.6.1 **RPOP Development and Maintenance**

This subtask involves pre-flight and post-flight engineering analysis, as well as training for the rendezvous Shuttle missions that are targeted to use this capability.

The contractor shall continue to incorporate development modifications into RPOP which address critical design deficiencies. Improve existing capabilities, and add new capabilities, as approved by the POCCB.

The contractor shall produce new RPOP executables and associated documentation.

5.6.2 **Engineering Trajectory Analysis Task for Rendezvous, Prox Ops, and Docking**

This subtask provides engineering assessment and trajectory analysis for the rendezvous and proximity operations community which includes the Rendezvous Prox Ops Working Group (RPOWG). This subtask will include analysis of sensor performance, trajectory dispersions, and other GN&C issues related to Shuttle rendezvous, proximity operations, and docking. Specifically, this work will include an assessment of rendezvous radar flight data to better characterize radar beam wander on the large ISS target. A characterization of the radar flight performance will be documented so that improvements to radar simulation models can be made by the community. (Improved radar models including characterization of beam wander will allow the community to perform a more accurate assessment of Shuttle onboard rendezvous navigation.) In addition, this work will include performance trend analysis for Shuttle rendezvous, proximity operations, and docking flights.

5.6.3 **Interactive Control Development Simulation (ICDS) Core**

The Interactive Control Development Simulation (ICDS) shall be maintained, enhanced, and verified to perform the necessary GN&C analyses for Orbiter approach and docking studies. Simulation and analyses shall be performed to solve potential GN&C problems associated with the approach and docking of vehicles with the Shuttle. Utility software shall be developed and maintained, and systems management shall be performed. This ST shall also include ICDS configuration management and procurement of hardware / software for lab upgrade.

5.6.4 **ICDS Crew Training**

Guidance, Navigation and Control (GN&C) models shall be developed, verified, and integrated into the Interactive Control and Dynamics Simulator (ICDS). ICDS shall be delivered to the Space Flight Training Division's (DT) Desktop Systems Trainer (DST) for the rendezvous training of flight crews, flight controller, and training personnel. User documentation of ICDS GN&C models shall be developed. This documentation shall be used by rendezvous training personnel to setup and configure ICDS GN&C for various rendezvous and proximity operations scenarios simulated in the DST . Monitor the setup and configuration of ICDS delivered to NASA.

5.6.5 **SAFM Architecture Development and Engineering Services**

This task provides the design, development, and integration of Shuttle Abort Flight Management (SAFM) architecture, algorithms, and displays into the A/E SES and SESII simulations. The task involves both SAFM requirements definition and facility development. Requirements definition includes development of SAFM architecture and algorithms, and integration of prototype displays into the A/E SES and SES-II simulation structure. Analysis to design, develop, and validate SAFM algorithms shall be provided. Review of CAU Program design documents shall be provided. Facility development shall include modification of the Ascent/Entry SES Forward Cockpit architecture for the display prototyping. Enhancements to the SES-II simulation environment shall be provided for SAFM development and prototyping.

5.6.6 **MEMS Performance Testing**

The contractor shall provide engineering services for MEMS gyro testing to derive performance characteristics, including thermal sensitivities, power cycle variations, and long-term performance. The contractor shall provide MEMS gyro-testing services to derive performance characteristics, including thermal sensitivities, power cycle variations, and long-term performance. Contractor shall perform data analysis and provide documentation summarizing results.

Note: task will be moved to 5.7 in FY07.

5.6.7 **CEV GN&C System Development and Engineering Services**

The contractor shall provide simulation-based analysis of GN&C systems functional performance and the capability required to support key programmatic decisions prior to full-scale development of Constellation elements. The support shall include:

- The design, development and analysis of Guidance, Navigation and Control (GN&C) systems, methodologies and algorithms.
- Execution of trade studies and performance assessments required to support the definition and development of the CEV GN&C based Interface Requirements Documents (IRDs).
- Providing technical publication services to support the documentation of Constellation analysis and requirements definition.

5.6.8 **ARES Simulation Development**

The contractor shall prvoide the development, integration, and verification of environmental and GN&C math models into an Architecture for Exploration Studies (ARES)

based simulation platform for the purposes of demonstrating (1) EG's GN&C capability, (2) the use of flight proven components and heritage simulation capabilities for the Exploration Program and (3) crew interaction with GN&C Systems. The following tasks shall be supported:
- Integration of ICDS/RPOP Display and Controls Executive (DCE), Crew Controls and Displays, and IGN&C math models into ARES.
- Development and integration of the CEV Onboard Abort Executive (OAE) event sequencer.
- Definition, integration, and verification of Crew Information Displays.
- Verification of ARES platform based models and integrated GN&C performance.
- Provide ARES simulation software configuration control using the ClearCase/ClearDDTS configuration management tool.

b. Skills

FROM:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
IT 2							
IT 4							
Technician 3							
Business Specialist 1							
Business Specialist 2							
Administration Specialist 1							
Administration Specialist 3							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							

64

Estimated Fee	
Total CY	
Total CY Hours	

b4

Support Requirement 5.6 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

b4

Management Sensitive

TO:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
IT 2							
IT 4							
Technician 3							
Business Specialist 1							
Business Specialist 2							
Administration Specialist 1							
Administration Specialist 3							
Labor							
Material							

b4

Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours 1

64

Support Requirement 5.6 Totals		Delta in Support Requirement 5.6 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:	64	Travel:	
M&T Burden Total:		M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.7 MEMS Performance Testing Updated Rev 6

a. Description

The contractor shall provide engineering services for and carry out MEMS gyro testing to derive performance characteristics, including in-run stability, thermal sensitivities, power cycle variations, and long-term performance. Support engineering provided by the contractor to support these tests shall include facility infrastructure maintenance, fixtures, cabling, drawings, table control software, data acquisition software, and test readiness reviews. Contractor shall perform data analysis and provide documentation summarizing results. The contractor shall provide support for various gyro test articles is deemed appropriate by NASA.

b. Skills

FROM:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Engineer 2							
Engineer 3				64			
Business Specialist 2							

Labor

Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.7 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Engineer 2							
Engineer 3							
Business Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.7 Totals	
Labor:	64

Delta in Support Requirement 5.7 Totals	
Labor:	64

Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	b4	M&T Burden Total:	b4
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

TOTALS INFORMATION:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost
Labor							
Materials							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

b4

Task Order Totals	
Labor:	
Material:	
Travel:	b4
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

Revision History:

Rev No.	Date	Summary
10	07/27/2010	The purpose of revision 10: 1) Add resource requirements on 5.1.3 (SIGI Integration and Test) and 5.6.1 (RPOP Development and Maintenance). 2) Extend period of performance thru 9/30/2011. Edit Rev Summary
9	10/22/2009	The purpose of revision 9: 1) Add resource requirements on 5.1.3 (SIGI Integration and Test) and 5.6.1 (RPOP Development and Maintenance). 2) Extend period of performance thru 9/30/2010.
8	07/20/2009	The purpose of revision 8: 1) Adjust the FY09 resource requirements on 5.1.3 (SIGI Integration and Test) 2) Extend period of performance thru 1/31/10 for 5.1.3 and 5.6.1 (RPOP Development and Maintenance).
7	03/31/2009	The purpose of revision 7 is to add resource requirements to 5.1.3 SIGI Integration and Test to provide engineering services to bridge the gap until Avionic Systems Division (EV) DO341 is processed and approved.
6	08/13/2008	The purpose of revision 6 is to adjust the FY08 resource requirements and extend period of performance thru FY09 (9/30/09) for the following tasks: - 5.1.3 SIGI Integration and Test - 5.6.1 RPOP Support
5	12/06/2007	The purpose of revision 5 is to increase the FY08 resource requirements on 5.1.3 SIGI Integration and Test due to additional work required for ISS GPS Antenna Assembly Thermal testing.
4	07/19/2007	The purpose of revision 4 is to adjust the FY07 resource requirements and extend period of performance thru FY08 (9/30/08) for the following tasks: - 5.1.3 SIGI Integration and Test

- 5.6.1 RPOP Support

- 5.7 MEMS support

3 07/27/2006 The purpose of revision 3:

1) Adjust skill mix on task 5.6.6 MEMS Support and add travel for FY06.

2) Reduce contract value to remove FY05 underrun. Adjustment was applied in August 2006.
3) Extend period of performance thru FY07 (9/30/07) for:

- 5.1.3 SIGI Integration and Test

- 5.6.1 RPOP Support

- Move 5.6.6 MEMS support to new WBS 5.7 in FY07

2 12/12/2005 1) Extend support on 5.1 thru 4/30/06. Adjust skill mix and resources accordingly.

2) Adjust skill mix and remove excess resources (funding, hours, material & travel) that were not used in sections 5.2, 5.3, 5.4 & 5.5. The work from these sections was moved to DO97 effective R1.

3) Change section titles and revise scope in section 5.6 for CEV GN&C System Development and Support (5.6.7) & ARES Simulation Development (5.6.8). Resources and skill mix were adjusted accordingly.

1 05/25/2005 The purpose of this revision includes:

1) De-scope GITF work performed in sections 5.1.1 and 5.1.2 for migration to DO62.

2) Add new scope in section 5.6 for AR&D Systems(5.6.7) & RPOP/ICDS Integration into ARES Platform (5.6.8)

3) Adjust resource requirements in sections 5.2 thru 5.6 to account for changing support requirements and priorities.

4) Moved scope in sections 5.2, 5.3, 5.4, and 5.5 to DO97 effective with this revision.

5) Extend period of performance thru 9/30/2006.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ05HB18T TO 66 R11

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 04/08/05 – 03/31/2012

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall
Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**
Signtature: Adrian D. Clayton Date: 11/04/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	KAARES Requirements Definition and Special Projects					
TO	**66 R10**	64			64	
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$4,104,855.94

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

Draft-TO66 R11

Originator: Susan Runco (KA) (281) 244-8848 **TMR:**Susan Runco (KA) (281) 244-8848

Revision Summary: To extend the R&D services in Organic Mass Spec lab

1. Title of Effort: KA\ ARES Requirements Definition and Special Projects

2. Date of Request: 10/25/2011

3. Statement of Work Task Description

a. **3.2 Astromaterials Curation**
The contractor shall develop plans for recovery, receiving, de-integration, and distribution of astromaterials. The contractor shall conduct astromaterials research to advance the understanding of innovative curation techniques and processes. The contractor shall perform continuous improvement of processing techniques and astromaterials sample handling. The contractor shall develop requirements for future curatorial facility designs.

b. **3.3 Research and Development**
The contractor shall perform research and development including: human planetary mission architecture, vehicular design; astromaterials; planetary missions; biological; physical-chemical systems; dexterous robotics; vision and perception technologies; automated systems including rendezvous and mating systems; thermal control systems (passive and active); life support systems; space suit systems; mechanical systems; Microelectromechanical Systems (MEMS); Nanotechnology; Guidance and Navigation control systems; fuel liquefaction and storage systems; on-orbit manufacturing systems; electromagnetic systems; sensor systems; tracking systems; power transmission systems; avionics architecture systems; communication systems; microwave systems; instrumentation and wireless instrumentation; artificial intelligence systems; orbital debris; image analyses; and Earth observations.

c. **3.3.1 Special Projects**
The contractor shall perform research and development including: human planetary mission architecture, vehicular design; astromaterials; planetary missions; biological; physical-chemical systems; dexterous robotics; vision and perception technologies; automated systems including rendezvous and mating systems; thermal control systems (passive and active); life support systems; space suit systems; mechanical systems; Microelectromechanical Systems (MEMS); Nanotechnology; Guidance and Navigation control systems; fuel liquefaction and storage systems; on-orbit manufacturing systems; electromagnetic systems; sensor systems; tracking systems; power transmission systems; avionics architecture systems; communication systems; microwave systems; instrumentation and wireless instrumentation; artificial intelligence systems; orbital debris; image analyses; and Earth observations.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Task Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 04/01/2005 and ends 03/31/2012. Updated Rev 10

5. Support Requirements

KA/ ARES Requirements definition and special projects

The contractor shall provide the skills and hours identified in section 5 that are needed to meet requirements. The contractor shall define requirements and perform special projects in curation, research, analyses required by the Astromaterials, Research, and Exploration Science (ARES) Directorate. The contractor shall adhere to the requirements of KA-WI-001 ARES Master Work Instruction, KA-WI-002 ARES Configuration Management, and KA-WI-003, ARES Management of Research Proposals. Progress and completion of support shall be provided quarterly, per DRD 25 KA/ARES Delivery/Acceptance Report. Updated Rev 1

5.1 ARES New Missions, New Business, and Special Projects Updated Rev 11

a. Description

The contractor shall meet the requirements of the Statement of Work (SOW) sections identified in section 3 of this TO. The contractor shall define requirements and perform special studies for curation, research, analysis, technical writing, and scientific contributions as required for the development of proposals for research, instrument development or testing, ad hoc image analysis projects, and other new starts. Specific actions in these areas will be assigned by the TMR/ TMR Alt. via Action Documents.

b. Skills

FROM:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Scientist 2								
Scientist 3								
Scientist 4								
Senior Scientist Specialist								
Engineer 2								
IT 2								
Technician 3								
Business								

Specialist 2								
Administration Specialist 2								
Software Quality Assurance Engineer 2								
Labor								
Material								
Travel								
M&T Burden								
Subtotal CY								
Estimated Fee								
Total CY								
Total CY Hours								

64

64

4

Support Requirement 5.1 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost

Scientist 2	
Scientist 3	
Scientist 4	
Senior Scientist Specialist	
Engineer 2	
IT 2	
Technician 3	
Business Specialist 2	
Administratic n Specialist 2	
Software Quality Assurance Engineer 2	
Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.1 Totals	
Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	

Delta in Support Requirement 5.1 Totals	
Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	

Total:	b4	Total:	b4
Total Hours:		Total Hours:	

Management Sensitive

TOTALS INFORMATION:

Skills	CY01 Hours|Cost	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Labor								
Materials								
Travel								
M&T Burden								
Subtotal CY								
Estimated Fee								
Total CY								
Total CY Hours								

b4

Task Order Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

b4

Management Sensitive

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ06HI51D TO 106 R9	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 244-1683 FAX: (281) 483-7890
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 10/01/2006 – 01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: 10/02/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**EC Division Services**					
TO	**106 R9**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

64

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. **Total**

$13,479,081.79

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ06HI51T-TO106 R9

Originator: Marie Kowal (EC) (281) 483-8875 **TMR:**Marie Kowal (EC) (281) 483-8875

Revision Summary: Revise for FY12 and add four new WBS's

1. Title of Effort: EC Division Services

2. Date of Request: 09/19/2011

3. Statement of Work Task Description

a. **3.1 Technical Services**
The contractor shall provide technical services per Task Orders for NASA programs and special projects.

b. **3.1.1 First Article Development**
The contractor shall perform trade studies; develop requirements and concepts; design, fabricate and assemble prototype, engineering development units, and first build flight hardware and software tools and products.

The contractor shall develop test requirements and plans; perform test bed buildup; develop test equipment for research and advanced hardware and software projects; and perform development, certification, and verification and acceptance testing.

c. **3.1.2 Engineering Tasks**
The contractor shall provide engineering services for human and robotic missions. These services shall include: mission architecture definition; mission design, and planning; and conceptual vehicle design and analyses for conducting trade studies to establish feasibility. Typical architecture elements include: launch vehicles; human-rated spacecraft; and elements including habitats and rovers used on planetary surfaces to enable human and robotic exploration.

The contractor shall perform engineering studies, analyses and crew training activities. Crew training activities include: development of mission scenarios; validation of initial conditions; production of visuals and displays; installation of session specific equipment; and verification of operational readiness.

The contractor shall provide engineering evaluation of facility systems and prepare proposals for the upgrade and modernization of facility systems. The contractor shall develop documentation for new systems including work instructions and hazard analyses.

The contractor shall perform engineering analyses and develop operational procedures for flight hardware and software products and on-orbit operational procedures.

The contractor shall integrate systems and payloads for Government and international partner hardware and software.

The contractor shall provide crew provisioning and manifesting for crew preference items in accordance with existing NASA regulations.

d. **3.1.4 Mission Support**
The contractor shall provide continuous Mission Evaluation Room (MER) technical services to perform pre-flight timeline reviews and real-time console monitoring during flight. The contractor shall perform administrative and documentation duties for the MER continuous operation for Space Vehicle missions including preparation before and follow-up after each flight and expedition. The contractor shall provide MER training and certification for MER mission engineers.

e. **3.1.5 Technical Reviews, Boards and Panels**
The contractor shall coordinate technical meetings, prepare system documentation, provide mission related products, and provide administrative support to program reviews, design reviews, control boards, and panels. The contractor shall document all products associated with technical services tasks.

f. **3.1.6 Anomaly Analysis**
The contractor shall perform anomaly analyses, propose anomaly issue resolution, implement corrective actions for facilities and laboratories, training and mockup hardware, ground support equipment configurations, and flight hardware and software. The contractor shall perform anomaly analysis for flight investigations.

g. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Task Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2006 and ends 01/31/2013. Updated Rev 8

5. Support Requirements

EC Division Engineering and Technical Services

The contractor shall provide engineering and technical services for the tasks as defined in section 3, Task Descriptions. The tasks are broken down into the sections listed below.
Rev 5 initiates Shuttle ECLSS and Crew Survivability system manager services in sections 5.22 & 5.23.
Revision 6 adds FY10 content into Contract Year 05. Significant effort for Wardroom Table was added to CLIN 14.
Revision 7 adds content for Contract Year 06 through September 2010. CLINs 16,17, 22 which contains system manager support will transition to the new Delivery Order 374 beginning in February 2010 for Contract Year 06.
Revision 8 adds content through January 31, 2013.
Revision 9 modifies FY12 and FY13 and adds four new WBS's Updated Rev 9

5.1 Exploration Systems Technical Services Updated Rev 8

a. Description

The contractor shall provide system and engineering services for Exploration Systems definition.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 4							
Senior Engineer Specialist							
Business Specialist 2							
Administration Specialist 2							
Quality Assurance Specialist 1							

64

Labor

Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	145

b4

Support Requirement 5.1 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

b4

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 4							
Senior Engineer Specialist							
Business Specialist 2							
Administration Specialist 2							
Quality Assurance Specialist 1							
Labor							
Material							

b4

Travel

M&T Burden

Subtotal CY

Estimated Fee

Total CY

Total CY Hours

64

Support Requirement 5.1 Totals		Delta in Support Requirement 5.1 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.2 Exploration Life Support (ELS) Systems Integration, Modeling, and Analysis (SIMA) Updated Rev 9

a. Description

The contractor shall provide engineering services for the analysis of the ELS SIMA project such as ELS technology development progress, ELS requirements and baseline values, and computer modeling and simulations for analysis of ELS technologies. The services shall be performed in accordance with the CTSD Engineering Analysis Tasks Plan.

The contractor shall provide engineering services for the analysis of the ELS SIMA project such as ELS technology development progress, ELS requirements and baseline values, and computer modeling and simulations for analysis of ELS technologies. The services shall be performed in accordance with the CTSD Engineering Analysis Tasks Plan.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Business Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

64

Support Requirement 5.2 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Engineer 3							
Engineer 4				64			
Senior Engineer Specialist							
Business Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee				64			
Total CY							
Total CY Hours							

Support Requirement 5.2 Totals		Delta in Support Requirement 5.2 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

5.3 Exploration Life Support (ELS) Thermal Control Systems (TCS) Development Updated Rev 8

a. Description

The contractor shall provide engineering and technical services for the development of the Exploration Thermal Control System specifically in the areas of radiators, heat transport fluids, heat pumps, and evaporative heat, in accordance with the EC2 FY07 Thermal Control System Hardware Development Plan.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Engineer 4				64			
Senior Engineer Specialist							
Technician 3							
Business Specialist 2							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							

Total CY	
Total CY Hours	

b4

Support Requirement 5.3 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

b4

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Technician 3							
Business Specialist 2							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							

b4

Total CY Hours b4

Support Requirement 5.3 Totals		Delta in Support Requirement 5.3 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	b4	M&T Burden Total:	b4
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.4 Cold Stowage Services Updated Rev 6

a. Description

The contractor shall provide engineering services for the development of ISS payload cold stowage projects. The tasks shall be provided in accordance with the Cold Stowage Task Plan.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3				b4			
Engineer 4							
IT 2							
Technician 2							

Technician 3	
Business Specialist 2	b4
Quality Assurance Specialist 2	
Labor	
Material	
Travel	
M&T Burden	b4
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

Support Requirement 5.4 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	b4
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2	(			b4			

Engineer 3	
Engineer 4	
IT 2	
Technician 2	
Technician 3	
Business Specialist 2	
Quality Assurance Specialist 2	
Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.4 Totals		Delta in Support Requirement 5.4 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

a. Description

The contractor shall provide services for the development of the ISS Waste Collection System with specific tasks being assigned at the weekly status meetings by the EC3 Technical Monitor.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Technician 3				64			
Business Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.5 Totals	
Labor Total:	
Material Total:	
Travel Total:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	

Total Hours: 64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Technician 3							
Business Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.5 Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Delta in Support Requirement 5.5 Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

5.6 ISS Urine Monitoring System (UMS) Updated Rev 8

a. Description

The contractor shall provide engineering services for the development of the ISS UMS Avionics Module and the Signal and Power Module Detailed Test Objective project including such tasks as preparation of work authorizing documents, Task Preparation Sheets, and discrepancy resolution. Specific tasks will be identified and assigned by the EC3 Technical Monitor at the weekly status meeting.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Technician							
Business Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fe							

Total CY	
Total CY Hours	64

Support Requirement 5.6 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Technician 2							
Business Specialist .							
				64			
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.6 Totals		Delta in Support Requirement 5.6 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

5.7 Special Safety Projects Updated Rev 1

a. Description

The contractor shall provide technical and engineering services associated with correcting facility safety issues as identified and assigned at the weekly EC safety meeting.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Engineer 1							
Engineer 2							
Engineer 3							
Technician 3							
Business							

64

Specialist 2	
Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.7 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Engineer 1							
Engineer 2							
Engineer 3							
Technician 3							
Business Specialist 2							

64

Labor
Material
Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours

b4

Support Requirement 5.7 Totals		Delta in Support Requirement 5.7 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Tota	b4	M&T Burden Total:	b4
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.8 Facilities Special Tasks Updated Rev 8

a. Description

The contractor shall provide technical and engineering services to support tests in the Gas and Water labs in B7 for activities such as ACTEX evaluation testing. The specific tasks will be assigned via action items at the weekly status meetings by the Branch Chief or delegate.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
IT 2							
Technician 2							
Technician 2							
Technician 3							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

64

Support Requirement 5.8 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	

64

Total Hours: 64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
IT 2							
Technician 2							
Technician 2							
Technician 3							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.8 Totals

Labor:

Material:

Travel: 64

M&T Burden Total:

Subtotal:

Delta in Support Requirement 5.8 Totals

Labor:

Material:

Travel: 64

M&T Burden Total:

Subtotal:

Est. Fee:	64	**Est. Fee:**	
Total:		**Total:**	64
Total Hours:		**Total Hours:**	

5.9 James Webb Space Telescope Updated Rev 1

a. Description

The contractor shall provide project planning, requirements definition, program coordination, and preliminary facility modification tasks for the James Webb Space Telescope project in Building 32 Chamber A. The specific tasks will be assigned by the EC4 technical monitor.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Supervisor							
Engineer 1				64			
Engineer 2							
Engineer 3							
Engineer 4							
Technician 1							
Technician 2							
Technician							
Business Specialist 1							
Business Specialist 2							

Administratio Specialist 2
Labor
Material
Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours

64

Support Requirement 5.9 Totals
Labor Total:
Material Total:
Travel Total:
M&T Burden Total:
Subtotal:
Est. Fee:
Total:
Total Hours:

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Supervisor							
Engineer 1							
Engineer 2							
Engineer 3							

64

Engineer 4	
Technician 1	
Technician 2	
Technician 3	
Business Specialis	
Business Specialist :	
Administration Specialist 2	
Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.9 Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Delta in Support Requirement 5.9 Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

jement Sensitive***

a. Description

The contractor shall perform engineering and technical tasks for the operation of the PM/IFHX life test. These tasks include reporting life test activities, evaluating life test health (fluid sampling), and maintaining the ISS ATCS life test schedule. The specific tasks will be identified and assigned by the Branch Chief or delegate at the weekly status meeting.

Revision 7: All scope except for fluid sampling moved to TO34.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3				64			
Senior Engineer Specialist							
Business Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY				64			
Total CY Hours							

Support Requirement 5.10 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3				64			
Senior Engineer Specialist							
Business Specialist							

Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

Support Requirement 5.10 Totals		Delta in Support Requirement 5.10 Totals	
Labor:	64	Labor:	64

Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	
Subtotal:		Subtotal:	64
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

5.11 EVA GFE Hardware Sustaining Updated Rev 6

a. Description

The contractor shall provide engineering and technical services for the sustaining of EVA GFE hardware to perform hardware evaluations; servicing, repair and processing of out of family EVA hardware; and update of EVA hardware certification documentation. The specific tasks will be identified and assigned by project directives at the weekly status meeting by the Branch Chief or delegate.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Scientist 3							
Engineer 1				64			
Engineer 2							
Engineer 3							
Engineer 4							
Senior							

Engineer Specialist							
Technician 3							
Business Specialist 1							
Business Specialist 2							
Administratio Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

64

Support Requirement 5.11 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Scientist 3							
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Technician 3							
Business Specialist 1							
Business Specialist 2							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.11 Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	

Delta in Support Requirement 5.11 Totals	
Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	

Total Hours: 64 Total Hours: 64

5.12 EVA GFE Hardware Subsystem Management Updated Rev 8

a. Description

The contractor shall provide technical representative services for EVA Bilateral and Shuttle Tools to resolve issues from the following: engineering review panels, test readiness boards, Crew Equipment Interface Test (CEIT) and Bench Reviews, hardware anomalies and resolution for flight and trainer hardware, PIRN/ICD resolution, management reviews, and DR/FIAR disposition/resolution.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3				64			
Engineer 4							
Senior Engineer Specialist							
Business Specialist 2							
Administration Specialist 1							
Administration Specialist 2							
Labor							
Material							

Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.12 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Business Specialist 2							
Administration Specialist 1							
Administration Specialist 2							

64

Labor
Material
Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours

b4

Support Requirement 5.12 Totals		Delta in Support Requirement 5.12 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	b4	M&T Burden Total:	b4
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

5.13 Exploration Life Support (ELS) Flight Experiments and Integrated Testing Updated Rev 1

a. Description

The contractor shall provide project engineering services for on-orbit and parabolic experiment and integration activities in collaboration with the ELS project. The specific tasks will be assigned at the monthly status meetings.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 3							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.13 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 3							
Labor							
Material							

64

Travel

M&T Burden

Subtotal CY

Estimated Fee

Total CY

Total CY Hours

b4

Support Requirement 5.13 Totals		Delta in Support Requirement 5.13 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:	b4	Travel:	
M&T Burden Total:		M&T Burden Total:	b4
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.14 Miscellaneous Engineering and Technical Services Updated Rev 8

a. Description

The contractor shall provide engineering and technical services for the Crew and Thermal Systems Division as assigned by the EC TMR in support of the various programs including Shuttle, ISS, Constellation, and CEV. These include short turnaround, ancillary tasks outside the original project scope.

Contractor is authorized to expend travel resources, within the authorized limits, and only as required to complete TMR assigned action items.

Beginning in Revision 6, the Wardroom Table project support will be authorized by Action Item / Project Directive as approved by the the TMR.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Engineer 4							
Technician 1							
Technician 2							
Technician 3							
Administration Specialist 2							
Quality Assurance Specialist 1							
Labor							
Material							
Travel							
M&T Burder							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

64

Support Requirement 5.14 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	

Est. Fee:
Total:
Total Hours:

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Engineer 4							
Technician 1							
Technician 2							
Technician 3							
Administration Specialist 2							
Quality Assurance Specialist 1							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.14 Totals

Labor:
Material:
Travel:

64

Delta in Support Requirement 5.14 Totals

Labor:
Material:
Travel:

64

M&T Burden Total:		**M&T Burden Total:**	
Subtotal:	64	**Subtotal:**	64
Est. Fee:		**Est. Fee:**	
Total:		**Total:**	
Total Hours:		**Total Hours:**	

5.15 Constellation Life Support and Thermal Analysis Tasks Updated Rev 8

a. Description

The contractor shall provide engineering services for the analysis of Constellation life support and thermal systems. The tasks include architecture evaluations and trade studies, technology development progress, requirements definition, analysis and technical support for technology testing, and computer modeling/simulations for analysis of life support and thermal technologies. The specific tasks will be assigned by the EC2 technical monitor.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 2				64			
Engineer 3							
Engineer 4							
Senior Engineer Specialist							

Labor	
Material	64
Travel	

M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hour	

64

Support Requirement 5.15 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							

64

Estimated Fee

Total CY

Total CY Hours

64

Support Requirement 5.15 Totals		Delta in Support Requirement 5.15 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.16 CEV ECLSS Subsystem Management Updated Rev 6

a. Description

The contractor shall provide technical representative services for CEV ECLSS to resolve issues from the following: engineering review panels, test readiness boards, project reviews, and Level II Ops concept meetings.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 4	0						
Senior Engineer Specialist	0						

64

Business Specialist 1
Business Specialist 2
Administratic Specialist 2

b4

Labor
Material
Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours

Support Requirement 5.16 Totals
Labor Total:
Material Total:
Travel Total:
M&T Burden Total:
Subtotal:
Est. Fee:
Total:
Total Hours:

b4

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 4							
Senior Engineer							

b4

Specialist	
Business Specialist 1	
Business Specialist 2	
Administration Specialist 2	
Labor	
Material	
Travel	
M&T Burden	64
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

Support Requirement 5.16 Totals		Delta in Support Requirement 5.16 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	
Subtotal:		Subtotal:	64
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.17 Advanced Space Suit to CEV Subsystem Management Updated Rev 6

a. Description

The contractor shall provide technical representative services for advanced space suit to CEV subsystem management to resolve

issues from the following: engineering review panels, design reviews, and Ops concepts meetings.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 4	-						
Senior Engineer Specialist							
Labor				64			
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.17 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

***Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 4							
Senior Engineer Specialist							
Labor				64			
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.17 Totals		Delta in Support Requirement 5.17 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	64
M&T Burden Total:	64	M&T Burden Total:	
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

a. Description

Provide technical services of Habitation Engineering for the development of critical need habitation technologies for Exploration Life Support.

Provide technical services of Habitation Engineering for the development of critical need habitation technologies for Exploration Life Support.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3				64			
Engineer 4							
Senior Engineer Specialist							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden				64			
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours	0						

Support Requirement 5.18 Totals

Labor Total: 64

Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

b4

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

b4

Support Requirement 5.18 Totals	
Labor:	
Material:	
Travel:	

b4

Delta in Support Requirement 5.18 Totals	
Labor:	
Material:	
Travel:	

b4

M&T Burden Total:		M&T Burden Total:	
Subtotal:		Subtotal:	
Est. Fee:	64	Est. Fee:	64
Total:		Total:	
Total Hours:		Total Hours:	

5.19 Habitation Project Updated Rev 8

a. Description

The contractor shall provide technical services for the development and sustaining engineering of habitation technologies and hardware. The specific tasks will be assigned by the EC3 technical monitor.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 4							
Senior Engineer Specialist							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							

64

Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.19 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 4							
Senior Engineer Specialist							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							

64

Total CY Hours 64

Support Requirement 5.19 Totals		Delta in Support Requirement 5.19 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.20 Analytical Tool Development and Analysis Updated Rev 9

a. Description

The contractor shall provide engineering services for the analysis of Environmental Control and Life Support System (ECLSS), Active Thermal Control System (ATCS), and Extravehicular Activity (EVA) systems. The specific tasks will be assigned by the EC2 technical monitor.

The contractor shall provide engineering services for the analysis of Environmental Control and Life Support System (ECLSS), Active Thermal Control System (ATCS), and Extravehicular Activity (EVA) systems. The specific tasks will be assigned by the EC2 technical monitor.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3				64			

Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fe	
Total CY	
Total CY Hou	

64

Support Requirement 5.20 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							

64

Estimated Fee

Total CY

Total CY Hours

Support Requirement 5.20 Totals		Delta in Support Requirement 5.20 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:		M&T Burden Total:	
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.21 SEV/Lunar Lander ECLSS Analysis Updated Rev 9

a. Description

The contractor shall provide engineering services for the analysis of Environmental Control and Life Support System (ECLSS) for the Lunar Lander. The tasks include architecture evaluations and trade studies, technology development progress, requirements definition, analysis and technical support for technology testing, and computer modeling/simulations for analysis of life support technologies. The specific tasks will be assigned by the EC2 technical monitor.

The contractor shall provide engineering services for the analysis of Environmental Control and Life Support System (ECLSS) for the Lunar Lander. The tasks include architecture evaluations and trade studies, technology development progress, requirements definition, analysis and technical support for technology testing, and computer modeling/simulations for analysis of life support technologies. The specific tasks will be assigned by the EC2 technical monitor.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3				64			
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.21 Totals

Labor Total:	
Material Total:	
Travel Total:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3				64			

Labor
Material
Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours

b4

Support Requirement 5.21 Totals		Delta in Support Requirement 5.21 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	b4	M&T Burden Total:	b4
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.22 Shuttle ECLSS Updated Rev 6

a. Description

The contractor shall meet the requirements of SOW paragraphs 3.1.2 Engineering Tasks; 3.1.4 Mission Support; 3.1.5 Technical Reviews, Boards and Panels; 3.1.6 Anomaly Analysis. The contractor will provide engineering and technical services for the Shuttle Environmental Controls and Life Support Systems (ECLSS) System Management. System Management is defined as technical oversight/insight of the sustaining engineering, real time system performance assessments, problem resolution, and change initiation/evaluation. The governing Work Instruction is EA42-WI-001, Shuttle DCE/NSE/RDE Team Process Procedure..

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 4							
Administration Specialist 2							

Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

Support Requirement 5.22 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

***Management S

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 4							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

b4

Support Requirement 5.22 Totals

Labor:

Material:

Travel:

M&T Burden Total:

Subtotal:

Est. Fee:

Total:

Total Hours:

b4

Delta in Support Requirement 5.22 Totals

Labor:

Material:

Travel:

M&T Burden Total:

Subtotal:

Est. Fee:

Total:

Total Hours:

b4

Management Sensitive

a. Description

The contractor shall provide technical services on the CEV Crew Survival subsystem to include technical engineering assessments, recommendations, and provide status reports to the NASA from engineering review panels, boards, reviews, and operations concepts meetings.

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Senior Engineer Specialist							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.23 Totals

Labor:

Material:

Travel:

M&T Burden Total:

Subtotal:

Est. Fee:

Total:

Total Hours:

Management S ...ive

5.24 Vehicle Integration Office Added Rev 9

a. Description

The contractor shall provide proj engineering services for the Vehicle Integration Office incl proj planning of SE&I milestones, tracking of project board action items, assy and distribution of tech status reports, maintaining accuracy of proj website, scheduling tech reviews, meeting coordination, and development of outreach materials incl multimedia products, newsletters, and exhibits materials.

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Senior Engineer Specialist							
Business Specialist 1							
Business Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.24 Totals

Labor:
Material:
Travel:
M&T Burden Total:
Subtotal:
Est. Fee:
Total:
Total Hours:

64

5.25 Division Projects Added Rev 9

a. Description

Contractor shall provide tech services for supporting EC office projects including but not limited to tech documentation support, graphics dev and business dev.

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 4							
Senior Engineer Specialist							
Administration Specialist 2				64			
Administration Specialist 3							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.25 Totals

Labor:

Material:

Travel:

M&T Burden Total:

64

Subtotal:
Est. Fee:
Total:
Total Hours: 64

Management Sensitive

5.26 Knowledge Capture Added Rev 9

a. Description

The contractor shall provide engineering and admin services for coordinating the documentation dev and presentation of knowledge capture events relative to EVA and space suit sys. Proj shall also coordinate export control and the dev and archiving of these events with other NASA resources.

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Senior Engineer Specialist							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Support Requirement 5.26 Totals

Labor: 64

Material:	
Travel:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

5.27 EVA Systems Support Added Rev 9

a. Description

Contractor shall provide engineering and tec resources for analysis and design of EVA Space Suit systems in the areas of Systems Engineering and Integration, Design & Packaging, and test dev and coordination

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Engineer 4							
Senior Engineer Specialist							
Administration Specialist 2							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							

64

Total CY

Total CY Hours 64

Support Requirement 5.27 Totals

Labor:

Material:

Travel:

M&T Burden Total: 64

Subtotal:

Est. Fee:

Total:

Total Hours:

***Management Sensitive

TOTALS INFORMATION:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Labor							
Materials							
Travel							
M&T Burden				64			
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Task Order Totals

Labor:

Material: 64

Travel:

M&T Burden Total:

Subtotal:

Est. Fee:	$911,173.36
Total:	$13,479,081.79
Total Hours:	215831

Management Sensitive

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. **NNJ06HI55D TO 107 R23**

2. **Date Of Order**
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 281-483-0034, FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/24/2006 – 1/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, c. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: **Ray DeVall**
Signature: _____ Date: _____

10. Name: **Peter S. Hollis**
Signtature: **Peter S. Hollis** Date: 08/26/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**EV / Avionic Systems Division Support II**					
TO	**107 R23**					
	Est. Labor Costs	64				
	Materials/Subcontracts				64	
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. **Total**
$3,338,835.99

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ06HI55D-TO107 R23

Originator: Samantha McDonald (EV) (281) 244-5877 **TMR:**Cordelia Foster (EV) (281) 483-5265

Revision Summary: Provides additional hours for quick turnaround TEPC, RFID, Ellington, and UBNT tasks not covered in existing DOs.

1. Title of Effort: EV / Avionic Systems Division Engineering Services II

2. Date of Request: 08/25/2011

3. Statement of Work Task Description

a. **3.1 Technical Services**
The contractor shall provide technical services per Task Orders for NASA programs and special projects.

b. **3.1.1 First Article Development**
The contractor shall perform trade studies; develop requirements and concepts; design, fabricate and assemble prototype, engineering development units, and first build flight hardware and software tools and products.

The contractor shall develop test requirements and plans; perform test bed buildup; develop test equipment for research and advanced hardware and software projects; and perform development, certification, and verification and acceptance testing.

c. **3.1.2 Engineering Tasks**
The contractor shall provide engineering services for human and robotic missions. These services shall include: mission architecture definition; mission design, and planning; and conceptual vehicle design and analyses for conducting trade studies to establish feasibility. Typical architecture elements include: launch vehicles; human-rated spacecraft; and elements including habitats and rovers used on planetary surfaces to enable human and robotic exploration.

The contractor shall perform engineering studies, analyses and crew training activities. Crew training activities include: development of mission scenarios; validation of initial conditions; production of visuals and displays; installation of session specific equipment; and verification of operational readiness.

The contractor shall provide engineering evaluation of facility systems and prepare proposals for the upgrade and modernization of facility systems. The contractor shall develop documentation for new systems including work instructions and hazard analyses.

The contractor shall perform engineering analyses and develop operational procedures for flight hardware and software products and on-orbit operational procedures.

The contractor shall integrate systems and payloads for Government and international partner hardware and software.

The contractor shall provide crew provisioning and manifesting for crew preference items in accordance with existing NASA regulations.

d. **3.1.3 Flight Experiments**
The contractor shall develop flight experiment test processes for flying equipment on reduced gravity aircraft. The contractor shall develop equipment and integrate Detailed Test Objectives (DTO) and flight experiments into the vehicle.

e. **3.1.4 Mission Support**
The contractor shall provide continuous Mission Evaluation Room (MER) technical services to perform pre-flight timeline reviews and real-time console monitoring during flight. The contractor shall perform administrative and documentation duties for the MER continuous operation for Space Vehicle missions including preparation before and follow-up after each flight and expedition. The contractor shall provide MER training and certification for MER mission engineers.

f. **3.1.5 Technical Reviews, Boards and Panels**
The contractor shall coordinate technical meetings, prepare system documentation, provide mission related products, and provide administrative support to program reviews, design reviews, control boards, and panels. The contractor shall document all products associated with technical services tasks.

g. **3.1.6 Anomaly Analysis**

The contractor shall perform anomaly analyses, propose anomaly issue resolution, implement corrective actions for facilities and laboratories, training and mockup hardware, ground support equipment configurations, and flight hardware and software. The contractor shall perform anomaly analysis for flight investigations.

h. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Task Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/16/2006 and ends 01/31/2013. Updated Rev 18

5. Support Requirements

Requirements Development Updated Rev 10

The contractor shall provide engineering and estimating services for the tasks defined as follows: Updated Rev 2

5.1 Estimating Services Updated Rev 23

a. Description

The contractor shall provide engineering services for short turn-around requests and requirements development of new products within the division.

Contractor is authorized to expend travel resources, within the authorized limits, and only as required to complete the NASA assigned action items.

b. Skills

FROM:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Supervisor							
Engineer 1							
Engineer 2							
Engineer 2							
Engineer 3							
Engineer 3							
Engineer 3							
Engineer 4							
Engineer 4							
Engineer 4							

64

Senior Engineer Specialist							
Senior Engineer Specialist							
Engineering Technologist 2							
Engineering Technologist 3							
IT 2							
IT 3							
Technician 2							
Technician 3							
Business Specialist 1							
Administration Specialist 3							
Quality Assurance Specialist 1							
Quality Assurance Specialist 2							
Safety Engineer							
Quality Engineer 3							
Labor							
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							

Total CY	
Total CY Hours	64

Support Requirement 5.1 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Manager							
Supervisor							
Engineer 1							
Engineer 2							
Engineer 2							
Engineer 3							
Engineer 3							
Engineer 3							
Engineer 4							
Engineer 4							
Engineer 4							
Senior Engineer Specialist							
Senior Engineer Specialist							
Engineering Technologist 2							

64

Engineering Technologist 3	
IT 2	
IT 3	
Technician 2	
Technician 3	
Business Specialist 1	
Administration Specialist 2	
Administration Specialist 3	
Quality Assurance Specialist 1	
Quality Assurance Specialist 2	
Safety Engineer	
Quality Engineer	
Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

b4

Support Requirement 5.1 Totals	
Labor:	
Material:	
Travel:	b4
M&T Burden Total:	
Subtotal:	
Est. Fee:	

Delta in Support Requirement 5.1 Totals	
Labor:	
Material:	
Travel:	b4
M&T Burden Total:	
Subtotal:	
Est. Fee:	

Total:	64	**Total:**	64
Total Hours:		**Total Hours:**	

Management Sensitive

5.2 Programming services Added Rev 1

a. Description

The contractor shall provide programming services for the division's project management tool prototype task.

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
IT 2							
Labor							
Material							
Travel				64			
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.2 Totals

Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

5.3 Software Defined Radio Added Rev 3

a. Description

Provide engineering services for software defined radio technology development tasks.

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1							
Engineer 3							
Labor				64			
Material							
Travel							
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.3 Totals

Labor:
Material:
Travel:
M&T Burden Total: 64
Subtotal:
Est. Fee:
Total:
Total Hours:

5.4 Pan/Tilt Unit Restraint development Added Rev 4

a. Description

The contractor shall provide engineeing expertice for the design, production and verification of restraints to be used on the SRMS Elbow Camera PTU for STS-124. Furthermore the contractor shall provide engineering expertice to begin work on an Initial Assessment of Criticality (IAC).

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							

Labor	64
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

Support Requirement 5.4 Totals

Labor:	
Material:	
Travel:	
M&T Burden Total:	
Subtotal:	64
Est. Fee:	
Total:	
Total Hours:	

5.5 HDV Development Added Rev 6

a. Description

The contractor shall provide engineering services supporting the design, production, and verification of HDV products.

b. Skills

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2							
Engineer 3							
Labor							
Material							
Travel				64			
M&T Burden							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

Support Requirement 5.5 Totals

Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

TOTALS INFORMATION:

Skills	CY02 Hours|Cost	CY03 Hours|Cost	CY04 Hours|Cost	CY05 Hours|Cost	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Labor							
Materials							
Travel							
M&T Burder							
Subtotal CY							
Estimated Fee							
Total CY							
Total CY Hours							

64

Task Order Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HE62D TO 156 Rev 2	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Chris Gaspard
Tel. No.: (281) 483-0034, FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 10/01/2010-01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: **Ray DeVall**

Signature: _____ Date: _____

10. Name: Adrian D. Clayton

Signtature: Adrian D. Clayton **Date:** 09/30/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ES6 Integrated Dynamic Analysis					
TO	**156 R2**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

64

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$340,340.80

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ10HE62T-TO156 R2

Originator: Jorge Tovar (ES6) (281) -24-5920 **TMR:**Rhonda Moore (ES) (281) 483-5282

Revision Summary: Update to include additional scope in CY 07 as result of increased work due to STS-135 schedule slip.

1. Title of Effort: ES6 Integrated Dynamic Analysis

2. Date of Request: 09/16/2011

3. Statement of Work Task Description

a. **3.1 Technical Services**
The contractor shall provide technical services per Task Orders for NASA programs and special projects.

b. **3.1.2 Engineering Tasks**
The contractor shall provide engineering services for human and robotic missions. These services shall include: mission architecture definition; mission design, and planning; and conceptual vehicle design and analyses for conducting trade studies to establish feasibility. Typical architecture elements include: launch vehicles; human-rated spacecraft; and elements including habitats and rovers used on planetary surfaces to enable human and robotic exploration.

The contractor shall perform engineering studies, analyses and crew training activities. Crew training activities include: development of mission scenarios; validation of initial conditions; production of visuals and displays; installation of session specific equipment; and verification of operational readiness.

The contractor shall provide engineering evaluation of facility systems and prepare proposals for the upgrade and modernization of facility systems. The contractor shall develop documentation for new systems including work instructions and hazard analyses.

The contractor shall perform engineering analyses and develop operational procedures for flight hardware and software products and on-orbit operational procedures.

The contractor shall integrate systems and payloads for Government and international partner hardware and software.

The contractor shall provide crew provisioning and manifesting for crew preference items in accordance with existing NASA regulations.

c. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Task Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 01/31/2013.

5. Support Requirements

Engineering Services for ES6 Integrated Dynamic Analysis

The contractor shall provide engineering services for JSC Programs and Projects.

5.1 Berthing Techniques and Procedures Updated Rev 2

a. Description

The contractor shall provide engineering services for integrated system performance and loads for ISS berthing.

Actions to do specific tasks shall be assigned by the technical manager through action items.

b. Skills

FROM:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1			
Engineer 2		64	
Engineer 4			
Senior Engineer Specialist			
Administration Specialist 2			
Labor			
Material			
Travel		64	
M&T Burden			
Subtotal CY			

Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.1 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

***Management Sensitive

TO:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1			
Engineer 2			
Engineer 4			
Senior Engineer Specialist			
Administration Specialist 2			
Labor			
Material			
Travel			
M&T Burden			
Subtotal CY			
Estimated Fee			
Total CY			
Total CY Hours			

64

Support Requirement 5.1 Totals		Delta in Support Requirement 5.1 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Tota	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive***

5.2 Reserved Deleted Rev 2

a. Description

The contractor shall provide engineering services for integrated docking loads.

Actions to do specific tasks shall be assigned by the technical manager through action items.

THIS SUBTASK IS RESERVED FOR FUTURE REVISION.

Task Removed 09-15-11

b. Skills

FROM:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost

Engineer 1	
Engineer 2	
Engineer 4	64
Senior Engineer Specialist	
Administration Specialist 2	

Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

Support Requirement 5.2 Totals

Labor Total:	
Material Total:	
Travel Total:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost

Engineer 1

Engineer 2

Engineer 4

Senior Engineer Specialist

Administration Specialist 2

Labor

Material

Travel

M&T Burden

Subtotal CY

Estimated Fee

Total CY

Total CY Hours

Support Requirement 5.2 Totals		Delta in Support Requirement 5.2 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

TOTALS INFORMATION:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost

Labor

Materials

Travel

M&T Burden

Subtotal CY

Estimated Fee

Total CY

Total CY Hours

64

Task Order Totals	
Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

National Aeronautics and Space Administration Lyndon B. Johnson Space Center Houston, TX 77058	**ORDER FOR SUPPLIES OR SERVICES**	Page 1 of 14

1. Order No.	**2. Date Of Order**	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HC84T TO 157 R7	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034, FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 09/16/2010-01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: **Ray DeVall**

Signature: _____ Date: _____

10. Name: Adrian D. Clayton

Signtature: Adrian D. Clayton **Date:** 09/30/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Structural Engineering Services					
TO	**157 R7**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$717,135.20

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ10HC84T-TO157 R7

Originator:JOHN HARRISON (ZV) (281) .24-5632 **TMR:**Rhonda Moore (ES) (281) 483-5282

Revision Summary: This revision extends period of performance of this TO until Jan 31, 2013. This Revision also adds additional scope to (1) TO 157-01, "Structural Engineering Services - GFE" to provide services through Jan 31, 2013 and to (2) subtask TO 157-05, ?Technology Development? to support Technology Development activities through the extended period of performance.

1. Title of Effort: Structural Engineering Services

2. Date of Request: 09/29/2011

3. Statement of Work Task Description

a. **3.1 Technical Services**
The contractor shall provide technical services per Task Orders for NASA programs and special projects.

b. **3.1.2 Engineering Tasks**
The contractor shall provide engineering services for human and robotic missions. These services shall include: mission architecture definition; mission design, and planning; and conceptual vehicle design and analyses for conducting trade studies to establish feasibility. Typical architecture elements include: launch vehicles; human-rated spacecraft; and elements including habitats and rovers used on planetary surfaces to enable human and robotic exploration.

The contractor shall perform engineering studies, analyses and crew training activities. Crew training activities include: development of mission scenarios; validation of initial conditions; production of visuals and displays; installation of session specific equipment; and verification of operational readiness.

The contractor shall provide engineering evaluation of facility systems and prepare proposals for the upgrade and modernization of facility systems. The contractor shall develop documentation for new systems including work instructions and hazard analyses.

The contractor shall perform engineering analyses and develop operational procedures for flight hardware and software products and on-orbit operational procedures.

The contractor shall integrate systems and payloads for Government and international partner hardware and software.

The contractor shall provide crew provisioning and manifesting for crew preference items in accordance with existing NASA regulations.

c. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Task Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 01/31/2013. Updated Rev 7

5. Support Requirements

Structural Engineering Services

The contractor shall provide engineering services for JSC Programs and Projects.

5.1 Structural Engineering Services - GFE Updated Rev 7

a. Description

The contractor shall provide structural engineering services related to GFE Projects including review of structural engineering estimates, performance of trade studies, performance of structural engineering assessments and analysis, GCAR reviews, development of anomaly resolution recommendations, and participation in GFE project technical reviews.

The contractor shall provide structural engineering services related to GFE Projects including review of structural engineering estimates, performance of trade studies, performance of structural engineering assessments and analysis, GCAR reviews, development of anomaly resolution recommendations, and participation in GFE project technical reviews.

b. Skills

FROM:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1			
Engineer 2		64	
Engineer 4			
Senior Engineer Specialist			
Administration Specialist 2			
Labor			
Material			

Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

64

Support Requirement 5.1 Totals

Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 1			
Engineer 2			
Engineer 3			
Engineer 4			
Senior Engineer Specialist			
Administration Specialist 2			

64

Labor	
Material	
Travel	
M&T Burden	

Subtotal CY	
Estimated Fee	
Total CY	64
Total CY Hours	

Support Requirement 5.1 Totals		Delta in Support Requirement 5.1 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Tota	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

5.2 Structural Engineering Services - Orbiter

a. Description

The contractor shall provide structural engineering services related to Space shuttle Orbiter including structural engineering assessments, analysis, and recommending anomaly resolution.

Provide structural engineering expertise to project and program change reviews, meetings, and boards.

Provide structural engineering assessments during mission operations.

Actions to do specific tasks shall be assigned by the technical manager through action items.

b. Skills

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2			
Senior Engineer Specialist			
Administration Specialist 2		64	
Labor			
Material			
Travel			
M&T Burden			
Subtotal CY			
Estimated Fee			
Total CY			
Total CY Hours			

Support Requirement 5.2 Totals
Labor:
Material:
Travel:
M&T Burden Total 64
Subtotal:
Est. Fee:
Total:
Total Hours:

Management Sensitive

5.3 COLT Assembly Documentation and Drawings Updated Rev 2

a. Description

High-level task description for COLT = Contingency Operations Large Adapter Plate Assembly (LAPA) Tool:

Contractor shall develop documentation updates required to incorporate an "acceptable alternate" Receptacle, fabricated with EBF3 material, into the COLT assembly.

If NASA approval is given to incorporate the EBF3 Receptacle into COLT, then task would be to transition the EBF3 documentation into the COLT CARD package, and update the part and assembly drawings to include the EBF3 Receptacle.

Contractor shall coordinate with government and contractor technical and safety disciplines as required.

b. Skills

FROM:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2			
Engineer 3			
Engineer 4			
Senior Engineer Specialist			
Labor		64	
Material			
Travel			
M&T Burden			
Subtotal CY			
Estimated Fee			
Total CY			
Total CY Hours			

Support Requirement 5.3 Totals	
Labor Total:	
Material Total:	64
Travel Total:	
M&T Burden Total:	

Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

64

Management Sensitive

TO:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2			
Engineer 3			
Engineer 4			
Senior Engineer Specialist			
Labor			
Material			
Travel			
M&T Burden			
Subtotal CY			
Estimated Fee			
Total CY			
Total CY Hours			

64

Support Requirement 5.3 Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total	
Subtotal:	
Est. Fee:	
Total:	

64

Delta in Support Requirement 5.3 Totals	
Labor:	
Material:	
Travel:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	

64

Total Hours:	64	**Total Hours:**	64

5.4 Ellington Field Support Updated Rev 6

a. Description

Provide structural engineering services for the modifications of spacecraft/aircraft pylons for Ellinston Field stationed aircraft to support under wing payload transport. Modifications may include bulkheads, lugs, skins, adaptor fittings, as well as doubler plates or other "beef-up" parts. These services include developing CAD models from existing drawings of the pylon to represent the as-designed configuration as well as modifications to pylons.

Actions to do specific tasks shall be assigned by the technical manager through action items.

b. Skills

FROM:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 3			
Engineer 4			
Senior Engineer Specialist			
Labor		64	
Material			
Travel			
M&T Burden			
Subtotal CY			
Estimated Fee			

Total CY	
Total CY Hours	

b4

Support Requirement 5.4 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

b4

Management Sensitive

TO:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 3			
Engineer 4			
Senior Engineer Specialist			
Labor			
Material			
Travel			
M&T Burden			
Subtotal CY			
Estimated Fee			
Total CY			
Total CY Hours			

b4

Support Requirement 5.4 Totals	
Labor:	

b4

Delta in Support Requirement 5.4 Totals	
Labor:	

b4

Material:		**Material:**	
Travel:		**Travel:**	
M&T Burden Total:	64	**M&T Burden Total:**	64
Subtotal:		**Subtotal:**	
Est. Fee:		**Est. Fee:**	
Total:		**Total:**	
Total Hours:		**Total Hours:**	

Management Sensitive

5.5 Technology Development Updated Rev 7

a. Description

Provide engineering services for perliminary requirements development and tools assessments to support technology development activities which are in their early concept stages.

Provide engineering services for preliminary requirements development, tools assessments and ROM development for technology development activities which are in their early concept stages.

b. Skills

FROM:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2			
Senior Engineer Specialist		64	
IT 2			
Business Specialist 3			
Administration Specialist 2			

Administration Specialist 3
Project Controls Specialist 1
Project Controls Specialist 2

Labor
Material
Travel
M&T Burden
Subtotal CY
Estimated Fee
Total CY
Total CY Hours

b4

Support Requirement 5.5 Totals
Labor Total:
Material Total:
Travel Total:
M&T Burden Total:
Subtotal:
Est. Fee:
Total:
Total Hours:

b4

***Management S

TO:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Engineer 2			
Engineer 3			
Senior Engineer Specialist			

b4

IT 2	
Business Specialist 2	
Business Specialist 3	
Administration Specialist 2	
Administration Specialist 3	
Project Controls Specialist 1	
Project Controls Specialist 2	

64

Labor	
Material	
Travel	
M&T Burden	
Subtotal CY	
Estimated Fee	
Total CY	
Total CY Hours	

Support Requirement 5.5 Totals		Delta in Support Requirement 5.5 Totals	
Labor:		Labor:	
Material:		Material:	
Travel:		Travel:	
M&T Burden Total:	64	M&T Burden Total:	64
Subtotal:		Subtotal:	
Est. Fee:		Est. Fee:	
Total:		Total:	
Total Hours:		Total Hours:	

Management Sensitive

TOTALS INFORMATION:

Skills	CY06 Hours|Cost	CY07 Hours|Cost	CY08 Hours|Cost
Labor			
Materials			
Travel			
M&T Burden			
Subtotal CY			
Estimated Fee			
Total CY			
Total CY Hours			

b4

Task Order Totals	
Labor:	$
Material:	$
Travel:	
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

b4

Management Sensitive

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ11HC20T TO 159 Rev 3

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/Chris Gaspard
Tel. No.: (281) 483-0034, FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 04/04/2011-09/30/2012

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: **Ray DeVall**
Signature: _____ Date: _____

10. Name: Adrian D. Clayton
Signtature: Adrian D. Clayton **Date:** 11/04/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001						
TO	**159 Software, Robotics and Simulation Engineering Services Rev 3**					
	Est. Labor Costs	64			64	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$26,339.80

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ11HC20T -TO159 R3

Originator: Jared Woodfill (ER) (281) 483-6331 **TMR:**Jared Woodfill (ER) (281) 483-6331

Revision Summary: This revision adds hours to perform mathematics modelling services for ER7 algoriths.

1. Title of Effort: Software, Robotics, and Simulation Engineering Services

2. Date of Request: 11/01/2011

3. Statement of Work Task Description

a. **3.1.2 Engineering Tasks**
The contractor shall provide engineering services for human and robotic missions. These services shall include: mission architecture definition; mission design, and planning; and conceptual vehicle design and analyses for conducting trade studies to establish feasibility. Typical architecture elements include: launch vehicles; human-rated spacecraft; and elements including habitats and rovers used on planetary surfaces to enable human and robotic exploration.

The contractor shall perform engineering studies, analyses and crew training activities. Crew training activities include: development of mission scenarios; validation of initial conditions; production of visuals and displays; installation of session specific equipment; and verification of operational readiness.

The contractor shall provide engineering evaluation of facility systems and prepare proposals for the upgrade and modernization of facility systems. The contractor shall develop documentation for new systems including work instructions and hazard analyses.

The contractor shall perform engineering analyses and develop operational procedures for flight hardware and software products and on-orbit operational procedures.

The contractor shall integrate systems and payloads for Government and international partner hardware and software.

The contractor shall provide crew provisioning and manifesting for crew preference items in accordance with existing NASA regulations.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Task Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 04/04/2011 and ends 09/30/2012. Updated Rev 2

5. Support Requirements

Software, Robotics, and Simulation Engineering Services

The nature of engineering services provided by TO-159 are varied but within the purview of the projects of the Software, Robotics, and Simulation Division (SR&SD).

5.1 Software, Robotics, and Simulation Engineering Services Updated Rev 3

a. Description

Contractor shall perform Software, Robotics, and Simulation engineering services in accordance with actions items approved by the Software, Robotics, and Simulation Division (SR&SD) TMR.

b. Skills

FROM:

Skills	CY07 Hours|Cost	CY08 Hours|Cost
Scientist 3	1	
Labor		
Material	64	
Travel		
M&T Burden		
Subtotal CY		
Estimated Fee		
Total CY		
Total CY Hours	1	

Support Requirement 5.1 Totals	
Labor Total:	
Material Total:	
Travel Total:	
M&T Burden Total:	64
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

TO:

Skills	CY07 Hours|Cost	CY08 Hours|Cost
Scientist 3		
Labor		
Material		64
Travel		
M&T Burden		
Subtotal CY		
Estimated Fee		
Total CY		
Total CY Hours		

Support Requirement 5.1 Totals	
Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	

Delta in Support Requirement 5.1 Totals	
Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	

Est. Fee:		Est. Fee:	
Total:	64	Total:	64
Total Hours:		Total Hours:	

Management Sensitive

TOTALS INFORMATION:

Skills	CY07 Hours|Cost	CY08 Hours|Cost
Labor		
Materials		
Travel		
M&T Burden		64
Subtotal CY		
Estimated Fee		
Total CY		
Total CY Hours		

Task Order Totals	
Labor:	
Material:	
Travel:	64
M&T Burden Total:	
Subtotal:	
Est. Fee:	
Total:	
Total Hours:	

Management Sensitive

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ05HC05D DO 17 R15

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 05/09/05 – 09/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:
Signature: _____ Date: _____

10. Name: **Adrian Clayton**
Signtature: Adrian Clayton Date: **08/12/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Communications & Tracking (C&T) Systems Analysis**					
DO	**17 R15**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel/NLR Misc					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. The orders requirements however take precedence over the contractors proposal.					

b4

b4

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$11,621,252.37

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ05HC05D-DO17 REV 15

Originator: Michael Manering (EV) (281) 483-2618 **TMR:** Cordelia Foster (EV) (281) 483-5265

Revision Summary:
Extend C2V2 task through the end of FY11.

1. Title of Effort: Communications & Tracking (C&T) Systems Analysis

2. Date of Request: 06/15/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

d. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

e. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

f. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

g. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 13

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 05/09/2005 and ends 09/30/2011.

5. Product Requirements

5.1 Space Station Systems Analysis

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform Communications & Tracking and avionics systems analysis tasks including system engineering of conceptual designs/development (including system upgrades), system requirements development & verification, compatibility assessment, interference analysis, communication performance evaluation (including computer simulations), and link analysis. The contractor shall also perform antenna analysis, coverage analysis, test planning and assessment, interface control document development/maintenance/update, anomaly resolution, mission definition and requirements development, and end-to-end communications link viability/security/availability evaluation. The contractor shall perform evaluation and processing of JSC Program/project frequency authorization requests and perform assessment of potential performance impacts to ISS RF systems due to external frequency requests and proposed modifications to radio regulations. The contractor shall present in Technical Interchange Meetings (TIMs), including International travel, to disseminate analysis results. Contractor shall meet with NASA monthly to provide status and schedule for the project.

5.1.1 Space Station Systems Analysis Updated Rev 14
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C
EV7-06-4136 Added Rev 5	Communications & Tracking Analysis Project Plan	A

c. **Required DRDs**

5.1.1 Space Station Systems Analysis

DRD #	DRD Title	Quantity/Frequency
218 Deleted Rev 7	Engineering Analysis	15
218 Updated Rev 11	Engineering Analysis	1 per analysis

d. **Products**

5.1.1 Space Station Systems Analysis

Product(s)	Quantity	Delivery Date
ISS Wireless Access Point Placement Analysis	1	06/15/05
Analysis reports Deleted Rev 7	13	per C&T CCB master schedule
WVS Coverage Analysis Report	1	5/31/05
Engineering Analysis reports	51	per EV7-06-4136,
ISS link Margin Data Book Update (Rev K)	1	per EV7-06-4136,
S & Ku Band Coverage for new External Stowage Platforms	1	per EV7-06-4136,

e. **Product Verification**

5.1.1 Space Station Systems Analysis

i. ISS Wireless Access Point Placement Analysis
- EV7 branch review upon delivery.

ii. Analysis reports Deleted Rev 7
- EV7 branch review upon delivery. Deleted Rev 7

iii. WVS Coverage Analysis Report
- EV7 branch review upon delivery.

iv. Engineering Analysis reports
- EV7 branch review upon delivery.

v. ISS link Margin Data Book Update (Rev K)

- EV7 branch review upon delivery.
vi. S & Ku Band Coverage for new External Stowage Platforms
- EV7 branch review upon delivery.

5.2 Space Shuttle System Analysis Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform Communications & Tracking and avionics systems analysis including system engineering of conceptual designs/development (including system upgrades), system requirements development & verification, compatibility assessment, interference analysis, communication performance evaluation (including computer simulations), and link analysis. The contractor shall provide real time mission support including training and simulations. The contractor shall also perform antenna analysis, coverage analysis, test planning and assessment, interface control document development/maintenance/update, anomaly resolution, Space Shuttle mission definition and requirements development, and end-to-end communications link viability/security/availability evaluation. The contractor shall present in Technical Interchange Meetings, including International travel, to disseminate analysis results. Contractor shall meet with NASA monthly to provide status and schedule for the project. Updated Rev 5

5.2.1 Shuttle C&T Analysis Updated Rev 6
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C
EV7-06-4136 Added Rev 5	Communications & Tracking Analysis Project Plan	A

c. **Required DRDs**

5.2.1 Shuttle C&T Analysis

DRD #	DRD Title	Quantity/Frequency
218 Deleted Rev 7	Engineering Analysis	14
218 Updated Rev 11	Engineering Analysis	1 per analysis

d. **Products**

5.2.1 Shuttle C&T Analysis

Product(s)	Quantity	Delivery Date
STS-121 Preflight Analysis Report	1	Launch -12weeks
Preliminary STS-115 Preflight Analysis Report	1	Launch -20weeks
Final STS-115 Preflight Analysis Report	1	Launch -16weeks
Engineering Analysis Reports Deleted Rev 7	11	per C&T CCB Master schedule
Engineering Analysis Reports	33	per EV7-06-4136,
STS-123 Pre Flight Analysis Report Added Rev 7	1	Launch -16weeks
STS-124 Pre Flight Analysis Report Added Rev 7	1	Launch -16weeks

e. **Product Verification**

5.2.1 Shuttle C&T Analysis

i. STS-121 Preflight Analysis Report
- Shuttle C&T Panel Review

ii. Preliminary STS-115 Preflight Analysis Report
- Shuttle C&T Panel Review

iii. Final STS-115 Preflight Analysis Report
- Shuttle C&T Panel Review

iv. Engineering Analysis Reports Deleted Rev 7
- EV7 branch review upon delivery Deleted Rev 7
v. Engineering Analysis Reports
- EV7 branch review upon delivery
vi. STS-123 Pre Flight Analysis Report
- Shuttle C&T Panel Review Added Rev 7
vii. STS-124 Pre Flight Analysis Report
- Shuttle C&T Panel Review Added Rev 7

5.3 Communication System Analysis for ELVIS

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall review ELVIS test reports, provide comments, and perform analysis to verify requirements. The contractor shall close out remaining ELVIS Verification Compliance Notices. Contractor shall meet with NASA monthly to provide status and schedule for the project.

5.3.1 Engineering Analysis

Project Code:

Contractor shall provide engineering analysis reports to document analyses performed. VCNs shall be completed on the required VCN format.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C
EV7-06-4136 Added Rev 4	Communications & Tracking Analysis Project Plan	May 2006

c. **Required DRDs**

5.3.1 Engineering Analysis

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	2

d. **Products**

5.3.1 Engineering Analysis

Product(s)	Quantity	Delivery Date
ET camera coverage report	1	9/30/05
VCN report	1	9/30/05

e. **Product Verification**

5.3.1 Engineering Analysis

i. ET camera coverage report
- EV7 Branch review upon delivery
ii. VCN report
- EV7 Branch review upon delivery

5.4 Orbiter Boom/Sensor Analysis and System Engineering

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform analysis and monitoring and assessment of the Orbiter Boom Sensor System tests. Tests include KSC, ESTL and EMI testing of the OBSS. Analysis includes completing the Keep Out zone and coverage analysis report. The contractor shall also perform analysis to close out Verification Compliance Notices. Contractor shall meet with NASA monthly to provide status and schedule for the project.

5.4.1 Engineering Analysis
Project Code:

Contractor shall provide engineering analysis reports to document analyses performed.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C
EV7-06-4136 Added Rev 4	Communications & Tracking Analysis Project Plan	May 2006

c. **Required DRDs**

5.4.1 Engineering Analysis		
DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	3

d. **Products**

5.4.1 Engineering Analysis		
Product(s)	Quantity	Delivery Date
KSC Test Report	1	5/27/05
Ethernet Testing and Anomaly Report	1	5/27/05
Keep out Zone and coverage report	1	5/27/05

e. **Product Verification**

5.4.1 Engineering Analysis
i. KSC Test Report
- EV7 branch review upon delivery
ii. Ethernet Testing and Anomaly Report
- EV7 branch review upon delivery
iii. Keep out Zone and coverage report
- EV7 branch review upon delivery

5.5 Frequency Management Systems Analysis

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform analysis for Radio Frequency Authorization requests and conduct review of local frequencies for NTIA 5 year review. The contractor shall perform evaluation and processing of JSC Program/project frequency authorization requests and perform assessment of potential performance impacts to JSC local RF systems due to external frequency requests and proposed modifications to radio regulations. Travel to present in TIMs will be required. Contractor shall meet with NASA monthly to provide status and schedule for the project.

5.5.1 Engineering Analysis Updated Rev 6
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C
EV7-06-4136 Added Rev 5	Communications & Tracking Analysis Project Plan	A
NTIA Manual	Manual of Regualtions and Procedures for Federal Radio Frequency Management	May 2004

c. **Required DRDs**

5.5.1 Engineering Analysis

DRD #	DRD Title	Quantity/Frequency
218 Updated Rev 6	Engineering Analysis	2

d. **Products**

5.5.1 Engineering Analysis

Product(s)	Quantity	Delivery Date
RFA analysis for FY05	1	per EV7-06-4136, "Communications & Tracking Analysis Project Plan
Local NTIA 5 year review	1	per EV7-06-4136, "Communications & Tracking Analysis Project Plan

e. **Product Verification**

5.5.1 Engineering Analysis

i. RFA analysis for FY05

- EV7 Branch review upon delivery

ii. Local NTIA 5 year review

- EV7 Branch review upon delivery

5.6 Shuttle Frequency Management

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform evaluation and processing of JSC Program/project frequency authorization requests and perform assessment of potential performance impacts to Shuttle RF systems due to external frequency requests and proposed modifications to radio regulations. Contractor shall meet with NASA monthly to provide status and schedule for the project.

5.6.1 Engineering Analysis Reports Updated Rev 14
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C
EV7-06-4136 Added Rev 5	Communications & Tracking Analysis Project Plan	A

c. **Required DRDs**

5.6.1 Engineering Analysis Reports

DRD #	DRD Title	Quantity/Frequency
218 Deleted Rev 7	Engineering Analysis	6
218 Updated Rev 11	Engineering Analysis	1 per analysis

d. **Products**

5.6.1 Engineering Analysis Reports

Product(s)	Quantity	Delivery Date
Analysis Report Deleted Rev 7	6	per C&T CCB master

Analysis Report		schedule
	16	per EV7-06-4136,

e. **Product Verification**

5.6.1 Engineering Analysis Reports
i. Analysis Report Deleted Rev 7
- EV7 branch review upon delivery Deleted Rev 7
ii. Analysis Report
- EV7 branch review upon delivery

5.7 CEV C&T Analysis Updated Rev 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform communications and tracking analyses to assess CEV performance. These analyses shall include link margin analysis, CEV coverage analysis and compatibility and interference analysis. The contractor shall develop models for lunar coverage analysis. The contractor shall provide technical assessment of CEV contractor analyses, simulations, proposed system architectures and designs. The contractor shall provide requirements development and verification for SRD, IRDs, ICDs and subsystem specifications. The contractor shall assess the CEV project reviews and provide comments and recommendations. The contractor shall upgrade CSSL models for CEV analysis and simulation. The contractor shall perform evaluation and processing of project frequency authorization requests and perform assessment of potential performance impacts to CEV RF systems due to external frequency requests and proposed modifications to radio regulations. The contractor shall provide written weekly status reports to the CEV C&T System Manager. Contractor shall provide NASA with monthly status and schedule for the project. Updated Rev 8

5.7.1 CEV C&T Analysis Updated Rev 6
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV7-06-4136 Added Rev 5	Communications & Tracking Analysis Project Plan	A
EV-022 Added Rev 2	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C

c. **Required DRDs**

5.7.1 CEV C&T Analysis		
DRD #	**DRD Title**	**Quantity/Frequency**
218 Deleted Rev 7	Engineering Analysis	14
218 Updated Rev 11	Engineering Analysis	1 per analysis

d. **Products**

5.7.1 CEV C&T Analysis		
Product(s)	**Quantity**	**Delivery Date**
Preliminary Link Margin Assessment	1	per EV7-06-4136,
IEEE 802.16e assessment	1	per EV7-06-4136,
Final Link Margin Assessment	1	per EV7-06-4136,
Compatibility/Interference Analysis	1	per EV7-06-4136,
CEV Link Parameter Database	1	per EV7-06-4136,
CEV Coverage Analysis Deleted Rev 7	1	per C&T Analysis CCB Master schedule
Engineering Analysis Reports Deleted Rev 7	6	per C&T Analysis CCB Master schedule
Link Margin Updates	2	per EV7-06-4136,

Engineering Analysis Reports	43	per EV7-06-4136,
Compatibility/Interference Analysis Added Rev 7	1	per EV7-06-4136,
CEV Coverage Analysis	3	per EV7-06-4136,
CEV Link Book (CLB) Update Added Rev 7	1	per EV7-06-4136,

e. **Product Verification**

5.7.1 CEV C&T Analysis
i. Preliminary Link Margin Assessment
- EV7 branch review upon delivery
ii. IEEE 802.16e assessment
- EV7 branch review upon delivery
iii. Final Link Margin Assessment
- EV7 branch review upon delivery
iv. Compatibility/Interference Analysis
- EV7 branch review upon delivery
v. CEV Link Parameter Database
- EV7 branch review upon delivery
vi. CEV Coverage Analysis Deleted Rev 7
- EV7 branch review upon delivery Deleted Rev 7
vii. Engineering Analysis Reports Deleted Rev 7
- EV7 branch review upon delivery Deleted Rev 7
viii. Link Margin Updates
- EV7 branch review upon delivery
ix. Engineering Analysis Reports
- EV7 branch review upon delivery
x. Compatibility/Interference Analysis
- EV7 branch review upon delivery Added Rev 7
xi. CEV Coverage Analysis
- EV7 branch review upon delivery
xii. CEV Link Book (CLB) Update
- EV7 branch review upon delivery Added Rev 7

5.8 UWB Analysis Updated Rev 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall conduct research and development (R&D) of Communications & Tracking systems for space exploration. The contractor shall perofrm engineering assessments for technical requirements, theoretical analysis, algorithm development, simulation implementation, prototype design, test and evaluation, integration and customization, demo and publication. The contractor shall perform real time testing of UWB. Contractor shall provide NASA with monthly status and schedule for the project. Updated Rev 8

5.8.1 UWB Analysis Added Rev 2
Project Code:

Contractor shall provide engineering analysis reports to document analyses performed.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV7-022 Added Rev 2	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C
EV7-06-4136 Added Rev 5	Communications & Tracking Analysis Project Plan	A

c. **Required DRDs**

5.8.1 UWB Analysis		
DRD #	DRD Title	Quantity/Frequency
218 Updated Rev	Engineering Analysis	3

5

d. **Products**

5.8.1 UWB Analysis

Product(s)	Quantity	Delivery Date
Theoretical analysis of UWB communication system and tracking methodologies Report	2	per EV7-06-4136,
Matlab simulations based on the developed algorithms	1	per EV7-06-4136,

e. **Product Verification**

5.8.1 UWB Analysis

i. Theoretical analysis of UWB communication system and tracking methodologies Report

- EV7 Branch review upon delivery

ii. Matlab simulations based on the developed algorithms

- EV7 Branch review upon delivery

5.9 Constellation Avionics Test & Verification (T&V) Services Updated Rev 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall develop and populate Section 4 verification requirements for Constellation Architecture Requirements Document (CARD) avionics areas (computers/C&DH, software, communication and tracking, displays & control), Constellation Systems communication and tracking IRDs, C3I Volume 1 for the C3I and SAIR SIGs and develop test plans for verification of the end to end communication links for Constellation Systems. Updated Rev 8

5.9.1 Verification Requirements Updated Rev 6
Project Code:

5.9.2 T&V Services to C3I and SAIR SIGs Updated Rev 7
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV7-06-4136 Added Rev 5	Communications & Tracking Analysis Project Plan	A
NPR 7123.1 Added Rev 3	NASA Systems Engineering Processes and Requirements	Baseline

c. **Required DRDs**

5.9.1 Verification Requirements

DRD #	DRD Title	Quantity/Frequency
218 Deleted Rev 7	Engineering Analysis	4
218 Updated Rev 11	Engineering Analysis	1 per analysis

5.9.2 T&V Services to C3I and SAIR SIGs

DRD #	DRD Title	Quantity/Frequency
218 Deleted Rev 7	Engineering Analysis	3
218 Updated Rev 11	Engineering Analysis	1 per analysis

d. **Products**

5.9.1 Verification Requirements

Product(s)	Quantity	Delivery Date
Interim Verification Requirements Report Added Rev 3	1	5/16/06
Final Verification Requirements Report Added Rev 3	1	SRR - 6 weeks
Verification Requirements Reports Deleted Rev 8	2	per EV7-06-4136,
Verification Requirements Reports	4	per EV7-06-4136,

5.9.2 T&V Services to C3I and SAIR SIGs

Product(s)	Quantity	Delivery Date
Engineering Analysis Reports	6	per EV7-06-4136,

e. **Product Verification**

5.9.1 Verification Requirements

i. Interim Verification Requirements Report
- This deliverable will be reviewed by EV7 Added Rev 3

ii. Final Verification Requirements Report
- This deliverable will be reviewed by EV7 Added Rev 3

iii. Verification Requirements Reports Deleted Rev 8
- This deliverable will be reviewed by EV7 Deleted Rev 8

iv. Verification Requirements Reports
- This deliverable will be reviewed by EV7

5.9.2 T&V Services to C3I and SAIR SIGs

i. Engineering Analysis Reports
- This deliverable will be reviewed by EV7

5.10 Constellation C&T Analysis Updated Rev 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide Constellation Systems communications and tracking analyses, requirements development, and Constellation spectrum plan development. The analyses shall include link margin analysis, coverage analysis, and compatibility and interference analysis. The contractor shall develop tools for Constellation link parameters and models for lunar coverage analysis. The Constellation communications and tracking requirements development shall include technical interchange with the Constellation to Communications and Tracking Network Interface Requirements Document Working Group; developing, maintaining, and reviewing IRD, ICD, and other requirements. The Constellation spectrum plan development shall include technical assessment for development of the Constellation Spectrum plan and preparing requests for frequency authorization. The contractor shall meet with NASA monthly to provide status and schedule for the project. Updated Rev 8

5.10.1 Constellation C&T Analyses Updated Rev 6
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV7-06-4136 Added Rev 5	Communications and Tracking Analysis Project Plan	A
EV-022 Added Rev 4	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work Instruction	C

c. **Required DRDs**

5.10.1 Constellation C&T Analyses

DRD #	DRD Title	Quantity/Frequency

218 Deleted Rev 7	Engineering Analysis	
218 Updated Rev 11	Engineering Analysis	9
		1 per analysis

d. **Products**

5.10.1 Constellation C&T Analyses

Product(s)	Quantity	Delivery Date
Coverage Model Report	1	per per EV7-06-4136,
C&T Analysis to support communication interface requirements	1	per per EV7-06-4136,
Spectrum Analysis to support Constellation Spectrum Plan Updated Rev 8	1	per C&T Analysis CCB Master schedule
Constellation RF parameter database	1	per per EV7-06-4136,
Initial Constellation link budgets	1	per per EV7-06-4136,
Engineering Analysis Reports Updated Rev 8	4	per C&T Analysis CCB Master schedule
Engineering Analysis Reports	11	per per EV7-06-4136,
Constellation Master Link Book (MLB) Update	1	per per EV7-06-4136,
Spectrum Analysis to support Constellation Spectrum Plan	2	per per EV7-06-4136,

e. **Product Verification**

5.10.1 Constellation C&T Analyses

i. Coverage Model Report
- - EV7 branch review upon delivery

ii. C&T Analysis to support communication interface requirements
- - EV7 branch review upon delivery

iii. Spectrum Analysis to support Constellation Spectrum Plan Updated Rev 8
- - EV7 branch review upon delivery Updated Rev 8

iv. Constellation RF parameter database
- - EV7 branch review upon delivery

v. Initial Constellation link budgets
- - EV7 branch review upon delivery

vi. Engineering Analysis Reports Updated Rev 8
- - EV7 branch review upon delivery Updated Rev 8

vii. Engineering Analysis Reports
- EV7 branch review upon delivery

viii. Constellation Master Link Book (MLB) Update
- EV7 branch review upon delivery

ix. Spectrum Analysis to support Constellation Spectrum Plan
- EV7 branch review upon delivery

5.11 Orbiter C&T Flight Operations and Integration Updated Rev 14

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform preflight systems analyses, including RF compatibility , link, and blockage/coverage analysis to ensure RF and end-to-end data link performance integrity of the onboard C&T systems. Updated Rev 14

5.11.1 Shuttle C&T Analysis Updated Rev 14
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022 Added Rev 5	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work	C

	Instruction	
EV7-06-4136 Added Rev 5	Communications & Tracking Analysis Project Plan	A

c. **Required DRDs**

5.11.1 Shuttle C&T Analysis

DRD #	DRD Title	Quantity/Frequency
218 Deleted Rev 7	Engineering Analysis	4
218 Updated Rev 11	Engineering Analysis	1 per analysis

d. **Products**

5.11.1 Shuttle C&T Analysis

Product(s)	Quantity	Delivery Date
Engineering Analysis Reports Deleted Rev 7	4	per C&T CCB Master schedule
Engineering Analysis Reports	14	per EV7-06-4136,

e. **Product Verification**

5.11.1 Shuttle C&T Analysis

i. Engineering Analysis Reports Deleted Rev 7

- - EV7 branch review upon delivery Deleted Rev 7

ii. Engineering Analysis Reports

- - EV7 branch review upon delivery

5.12 ODAR C&T Analysis Added Rev 9

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide communications and tracking analyses, communications and tracking requirements development, and obtain frequency authorization for the Obsolescence Driven Avionics Redesign (ODAR) task for ISS.

Specifically contractor shall provide technical analyses for updating the Circuit Margin Data Book and RF Interface Control Documents, establish keepout zones based on C&T performance requirements and human physiological protection criteria to ensure proper equipment performance and mission success and perform RF coverage and multipath analysis to predict link availability. Contractor shall perform analyses in support of tests for requirement verification, maintain/develop/upgrade C&T systems models (computer models). Contractor shall provide technical assessment of ISS (ODAR) contractor analyses, simulations, proposed system architectures and designs. Contractor may be required to travel for requirement and design reviews. Added Rev 9

5.12.1 ODAR C&T Analysis Added Rev 9
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022 Added Rev 9	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work	C
EV7-09-4400 Added Rev 9	Communication & Tracking Analysis Project Plan	Orig. Sept. 2008

c. **Required DRDs**

5.12.1 ODAR C&T Analysis

DRD #	DRD Title	Quantity/Frequency
218 Added Rev 9	Engineering Analysis	1 per analysis

d. **Products**

5.12.1 ODAR C&T Analysis

Product(s)	Quantity	Delivery Date
Analysis reports	7	Per C&T CCB master schedule

e. **Product Verification**

5.12.1 ODAR C&T Analysis

i. Analysis reports

- - EV7 branch review upon delivery

5.13 Altair C&T Analysis Added Rev 9

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform communications and tracking analyses to assess Altair performance.

Specifically contractor shall perform link margin analysis, RF coverage analysis and compatibility and interference analysis. Contractor shall upgrade CSSL models to support Altair analysis and simulation. Contractor may need to travel for technical reviews and TIMs. Added Rev 9

5.13.1 Altair C&T Analysis Added Rev 9
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022 Added Rev 9	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work	C
EV7-09-4400 Added Rev 9	Communication & Tracking Analysis Project Plan	Orig. Sept. 2008

c. **Required DRDs**

5.13.1 Altair C&T Analysis

DRD #	DRD Title	Quantity/Frequency
218 Added Rev 9	Engineering Analysis	1 per analysis

d. **Products**

5.13.1 Altair C&T Analysis

Product(s)	Quantity	Delivery Date
Analysis Report Added Rev 9	1	Per C&T CCB master schedule

e. **Product Verification**

5.13.1 Altair C&T Analysis

i. Analysis Report

- - EV7 branch review upon delivery Added Rev 9

5.14 CoNNeCT C&T Analysis Added Rev 9

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform communications and tracking analyses to assess CoNNeCT performance.

Specifically contractor shall perform RF coverage analysis, RF compatibility and interference analysis and RF protection analysis. Contractor shall upgrade CSSL models for CoNNeCT analysis and simulation. ESCG may need to travel for technical reviews and TIMs.
Added Rev 9

5.14.1 CoNNeCT C&T Analysis Added Rev 9
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-022 Added Rev 9	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work	C
EV7-09-4400 Added Rev 9	Communication & Tracking Analysis Project Plan	Orig. Sept. 2008

c. **Required DRDs**

5.14.1 CoNNeCT C&T Analysis

DRD #	DRD Title	Quantity/Frequency
218 Added Rev 9	Engineering Analysis	1 per analysis

d. **Products**

5.14.1 CoNNeCT C&T Analysis

Product(s)	Quantity	Delivery Date
Analysis Report	6	Per C&T CCB master schedule

e. **Product Verification**

5.14.1 CoNNeCT C&T Analysis

i. Analysis Report

- - EV7 branch review upon delivery

5.15 CSSL Modernization and Technical Services Added Rev 13

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide technical products and services to implement modernization of the CSSL and provide on-going CSSL capabilities. Added Rev 13

5.15.1 CSSL Modernization and Technical Services Added Rev 13
Project Code:

The Contractor shall deliver required products and technical services listed in the EV CSSL Product Requirements document, EV-081 for accomplishing CSSL modernization and providing on-going CSSL capabilities.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-081 Added Rev 13	EV CSSL Product Requirements Document	Current

c. **Required DRDs**

5.15.1 CSSL Modernization and Technical Services

DRD #	DRD Title	Quantity/Frequency
Added Rev 13	No Requirement	

d. **Products**

5.15.1 CSSL Modernization and Technical Services		
Product(s)		
CSSL Modernization Products per EV-081 Added Rev 13	**Quantity**	**Delivery Date**
	1 summary report	9/30/2011

e. **Product Verification**

5.15.1 CSSL Modernization and Technical Services
i. CSSL Modernization Products per EV-081
- Product acceptance and inspection by NASA Lab Monitor Added Rev 13

5.16 C2V2 C&T Analysis Added Rev 14

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide communications and tracking analyses, communications and tracking requirements development, and obtain frequency authorization for the Common Communications for Visiting Vehicles (C2V2) task for ISS.

Specifically contractor shall provide technical analyses for updating the Circuit Margin Data Book and RF Interface Control Documents, establish keepout zones based on C&T performance requirements and human physiological protection criteria to ensure proper equipment performance and mission success and perform RF coverage and multipath analysis to predict link availability. Contractor shall perform analyses in support of tests for requirement verification, maintain/develop/upgrade C&T systems models (computer models). Contractor shall provide technical assessment of ISS (C2V2) contractor analyses, simulations, proposed system architectures and designs. Contractor may be required to travel for requirement and design reviews. Added Rev 14

5.16.1 C2V2 C&T Analysis Added Rev 14
Project Code:

b. **Applicable Documents**

Document Number	**Document Name**	**Rev.**
EV-022 Added Rev 14	Radio Frequency Communications Electromagnetic Environmental Effects Analysis Work	C
EV7-09-4400 Added Rev 14	Communication & Tracking Analysis Project Plan	Orig. Sept. 2008

c. **Required DRDs**

5.16.1 C2V2 C&T Analysis		
DRD #	**DRD Title**	**Quantity/Frequency**
218 Added Rev 14	Engineering Analysis	1 per analysis

d. **Products**

5.16.1 C2V2 C&T Analysis		
Product(s)		
Analysis Reports Updated REV 15	**Quantity**	**Delivery Date**
	4	Per C&T CCB master schedule

e. **Product Verification**

5.16.1 C2V2 C&T Analysis
i. Analysis Reports
- -- EV7 branch review upon delivery

6.0 Contract Summary and Revision History

SLC	Type	CY1	CY2	CY3	CY4	CY5	CY6	CY7	G Total
AS1	Sum of Hours								
	Sum of Dollars								
AS2	Sum of Hours								
	Sum of Dollars								
AS3	Sum of Hours								
	Sum of Dollars								
BS2	Sum of Hours								
	Sum of Dollars								
EN1	Sum of Hours								
	Sum of Dollars								
EN2	Sum of Hours								
	Sum of Dollars								
EN3	Sum of Hours								
	Sum of Dollars								
EN4	Sum of Hours								
	Sum of Dollars								
ESS	Sum of Hours								
	Sum of Dollars								
ET1	Sum of Hours								
	Sum of Dollars								
ET2	Sum of Hours								
	Sum of Dollars								
ETS	Sum of Hours								
	Sum of Dollars								
IT1	Sum of Hours								
	Sum of Dollars								
IT2	Sum of Hours								
	Sum of Dollars								
IT3	Sum of Hours								
	Sum of Dollars								
MGR	Sum of Hours								
	Sum of Dollars								
PC2	Sum of Hours								
	Sum of Dollars								
PC3	Sum of Hours								
	Sum of Dollars								
SQ4	Sum of Hours								
	Sum of Dollars								
SV	Sum of Hours								
	Sum of Dollars								
Total Direct Labor Hours									
Total Direct Labor Costs									
Travel Costs									
Subcontract									
NLR Misc									
Materials									
Burden on Non-Labor									
Total Non Labor									
Total Costs									
Fee									
Total									$11,670,919.91

DO 17 Revision history	Total cost	Reason for revision
Original	$390,066	New DO with work proposed from FY07.
R1	$973,502	Section 4.0: Extended scope to September 30, 2006. Section 5.1: Increased DRD 218 quantities to 9. Increased Analysis Reports quantities 7, extended delivery date to September 30, 2006. Section 5.2: Increased DRD 218 quantities to 10. Increased Analysis Reports quantitie to 7, extended delivery date to September 30, 2006. Section 5.6: Increased DRD 218 quantities to 4. Increased Analysis Reports quantities 4, extended delivery date to September 30, 2006.
R2	$991,699	Section 5.1 – 5.6: Added the DO17 Work Plan to Applicable Documents table Section 5.7: Added new work to support the CEV program Section 5.8: Added new work to research Ultra Wide Band devices Section 7: Added Risk Assessment for WBS 5.7 and 5.8
R3	$1,201,577	Section 5.9: Added new work to support Constellation Avionics Test & Verification effc Section 7: Added Risk Assessment for WBS 5.9
R4	$1,407,158	Section 5.7: Extended the work to continue the support for the C&T system of the CEV Section 5.10: Added new work to support the C&T system of the Constellation program Section 7: Added Risk Assessment for WBS 5.10 Introduced the document EV7-06-4136, Communication & Tracking Analysis Project Plan to replace EV6-06-4119, DO17 Work Plan.
R5	$3,855,110	Sections 5.1: Extended the work to continue the support for FY07 Sections 5.2: Extended the work to continue the support for FY07 Sections 5.5: Extended the work to continue the support for FY07 Sections 5.6: Extended the work to continue the support for FY07 Sections 5.7: Extended the work to continue the support for FY07 Sections 5.8: Extended the work to continue the support for FY07 Sections 5.9: Extended the work to continue the support for FY07 Sections 5.10: Extended the work to continue the support for FY07 Section 5.11: Added new work to support the Shuttle C&T Flight Operations and Integration Section 7: Added Risk Assessment for WBS 5.11
R6	$3,425,153	Removed the baseline work that was incorporated at the beginning of FY07. Sections 5.1: Reduce the quantity of deliverables Sections 5.2: Reduce the quantity of deliverables Sections 5.5: Reduce the quantity of deliverables Sections 5.6: Reduce the quantity of deliverables Sections 5.7: Reduce the quantity of deliverables Sections 5.9: Reduce the quantity of deliverables Sections 5.10: Reduce the quantity of deliverables Section 5.11: Reduce the quantity of deliverables
R7	$5,240,955	Change the Delivery Order period to October 2005 to September .30, 2008. Sections 5.1: Increase the quantity of deliverables Sections 5.2: Increase the quantity of deliverables Sections 5.6: Increase the quantity of deliverables Sections 5.7: Increase the quantity of deliverables Sections 5.9: Increase the quantity of deliverables Sections 5.10: Increase the quantity of deliverables Section 5.11: Increase the quantity of deliverables
R8	$7,336,999	Changed end date of period of performance to September 30, 2009. Increased deliverable quantities in each active WBS to include FY09 deliverables. Reduced FY08 deliverables

		for WBS 5.9. Active WBS' are 5.1, 5.2, 5.3, 5.6, 5.7, 5.9, 5.10 and 5.11. Added two n WBS' 5.12 and 5.13.
R9	$7,341,032	Reduced cost for WBS 5.12. Reduced travel for WBS 5.1 and 5.7. Added Material cost for WBS 5.7. Added a new WBS 5.14
R10	$7,392,213	Added additional work and travel for WBS 5.14
R11	$8,056,501	Changed end date of period of performance to January 31, 2009. Increased deliverable quantities in each active WBS to include FY10 deliverables. Active WBS' are 5.1, 5.2, 5.6, 5.7, 5.9, 5.10, 5.11, 5.12 and 5.14.
R12	$9,625,062	Change the Delivery Order period to February 2010 to September .30, 2010. Sections 5.1: Increase the quantity of deliverables Sections 5.2: Increase the quantity of deliverables Sections 5.6: Increase the quantity of deliverables Sections 5.7: Increase the quantity of deliverables Sections 5.9: Increase the quantity of deliverables Sections 5.10: Increase the quantity of deliverables Section 5.11: Increase the quantity of deliverables Section 5.12: Increase the quantity of deliverables Section 5.14: Increase the quantity of deliverables Active WBS' are 5.1, 5.2, 5.6, 5.7, 5.9, 5.10, 5.11, 5.12 and 5.14.
R13	$11,571,189	Change the Delivery Order period to September 30, 2011. Sections 5.1: Increase the quantity of deliverables Sections 5.2: Increase the quantity of deliverables Sections 5.6: Increase the quantity of deliverables Sections 5.7: Increase the quantity of deliverables Section 5.11: Increase the quantity of deliverables Section 5.12: Increase the quantity of deliverables Section 5.14: Increase the quantity of deliverables Added a new WBS, Section 5.15 Added procurement capabilities per EV-081 Rev K Active WBS' are 5.1, 5.2, 5.6, 5.7, 5.9, 5.10, 5.11, 5.12, 5.14 and 5.15.
R14	$11,621,252	Sections 5.2: Increase the quantity of deliverables Sections 5.6: Increase the quantity of deliverables Section 5.11: Increase the quantity of deliverables Added a new WBS, Section 5.16 for C2V2 C&T work Active WBS' are 5.1, 5.2, 5.6, 5.7, 5.11, 5.12, 5.14, 5.15 and 5.16
R15	$11,670,920	Section 5.16: Increase the quantity of deliverables

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ05HB13D DO 21 R9

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 02/01/2005 - 01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:
Signature: _____ Date: _____

10. Name: Ronald Johnson
Signtature: Ronald Johnson Date: 02/18/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Energy Systems Facility Tests and Upgrades					
DO	21 R9					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. The orders requirements however take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$ 27,043,160

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ05HB13D-DO21 R8BP1

Originator: Roberto Garcia (EP) (281) 483-2076 **TMR:** Roberto Garcia (EP) (281) 483-2076

Revision Summary:

Reduce test quantities to reflect FY11-12 program requirements changes. Change period of performance for Quality Assurance and Engineering reponsibility to end January 31, 2011. Revision R9 also removes the verification and validation accountability and responsibility from the ESC contract in the ESTA.

1. Title of Effort: Energy Systems Facility Tests and Upgrades

2. Date of Request: 01/24/2011

3. Statement of Work Task Description

a. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

b. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and SA facilities. The contractor shall transition facility operational readiness conditions for EA and SA facilities.

c. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 8

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/01/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Energy Systems Facility Tests and Upgrades Updated R8BP1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Provide test services in the Electrical Power Systems Laboratory (EPSL) and the Energy Systems Test Area (ESTA) for Energy Systems Division projects in support of Space Shuttle, ISS, and Advanced Programs. Provide upgrades of facility and laboratory systems to enhance test productivity and capability. The Energy Systems test priority schedules are defined in the EP6 Task Database which can be viewed through the Master Planning Schedule report file located at

\\jsc-ifs-02\data\EA\EP_SHR\ESTA\EP6\Reports\MPS.xls

Effective Rev. 9: The ESC contractor?s responsibility and accountability associated with verification and validation functions associated with tests and facility modification in ESTA ends two weeks after the ESC contractor?s proposal is accepted. Updated R8BP1

5.1.1 Electrical Power Systems Laboratory Tests and Upgrades Deleted Rev 5

5.1.2 Energy Systems Test Area Tests and Upgrades Updated R8BP1
Project Code:

The contractor shall perform tests and facility developments or upgrades in the ESTA for the technical areas of Fuel Cells, Batteries, Electrical Power Distribution and Control, Power Quality, High Pressure Systems, Cryogenics, Propulsion, and other High Energy Components for the Space Shuttle Program, Space Station Program, and Advanced Programs, and in the EPSL for the technical areas of EPDC for the Space Shuttle Program, Space Station Program, and Advanced Programs. The contractor shall comply with the test requirements in the EA GOPM, the ESTA/EPSL GOPM, and the test requester's requirements. For test requirements defined on Test Requests (JSC Form 90), the contractor shall perform planning of test development and operations, design test systems, develop and fabricate test systems and hardware, prepare test procedures and hazard analyses, perform readiness reviews, present and support TRRs, operate test systems, and document test programs through test reports or task histories. ESD functional test requirements include environmental, off-nominal, performance, qualification, and acceptance testing of fuel cell systems and components, high pressure fluid and cryogenic systems, spacecraft and general-purpose batteries, and spacecraft and planetary surface instrument. Other high energy, hazardous test activities that are not acceptable at JSC facilities outside of ESTA shall be performed to the extent allowable by the ESTA facility configuration and Center safety requirements. For ESD facility upgrade requirements defined on Test Requests (JSC Form 90), perform planning of the development or modification of facility test support system (FTSS), design FTSS hardware and systems, develop and fabricate FTSS hardware and systems, prepare FTSS operating procedures and hazard analyses, provide engineering services for FTSS Use Readiness Reviews (URR) and facility Operational Readiness Inspections (ORI), perform FTSS checkout and functional verification. Perform facility enhancements, with EP6 CCB approval, that increase safety, lower test costs, provide more rapid test turnaround, and provide higher quality test data products.

A typical ESTA test is based on buildup and operations of a flight battery thermal vacuum qualification test. Test and facility upgrade quantities are based on the complexity of this typical test having a Weighted value of 1. Other tests typically range in complexity from 0.1 to 10.0 times this complexity. Complexity of test, specified in the Master Planning Schedule as Weight of Test, shall be used by the contractor in estimating resources and schedule for Actual Tests, including facility upgrades.

The following are the total required weighted tests for all EP6 Test Facilities.

CY	1	2	3	4	5	6	7	8
Weighted Tests	70	67	68	68	78	65	51	55

Quality engineering and assurance functions for test operations and flight hardware processing in ESTA are authorized under this Delivery Order through January 31, 2011.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
EP-WI-004 Added Rev 6	ESTA General Operating Procedures Manual	current
JPR 1700.1 Added R8BP1	JSC Safety & Health Handbook	J
JPR 1700.1 Added Rev 8	JSC Safety & Helath Handbook	Current
SSP 52051 Vol 1	User Electric Power Specifications and Standards	Baseline

c. **Required DRDs**

5.1.1 Electrical Power Systems Laboratory Tests and Upgrades Deleted Rev 5

DRD #	DRD Title	Quantity/Frequency

5.1.2 Energy Systems Test Area Tests and Upgrades

DRD #	DRD Title	Quantity/Frequency
101 Deleted Rev 6	Project Schedule	Monthly
107 Updated Rev 5	Test Report	1/actual test

d. **Products**

5.1.1 Electrical Power Systems Laboratory Tests and Upgrades Deleted Rev 5

Product(s)	Quantity	Delivery Date

5.1.2 Energy Systems Test Area Tests and Upgrades

Product(s)	Quantity	Delivery Date
Tests and Upgrades, Weighted Updated R8BP1	523	Specified in MPS
EP Test Facilities Monthly Status Report	66	15th of following month

e. **Product Verification**

5.1.1 Electrical Power Systems Laboratory Tests and Upgrades Deleted Rev 5

5.1.2 Energy Systems Test Area Tests and Upgrades

i. Tests and Upgrades, Weighted

- The above stated products shall be verified through Master Planning Schedule (MPS) review at scheduled weekly CCB status meetings and review of test reports, task histories, and internal notes with NASA EP6 branch personnel.

ii. EP Test Facilities Monthly Status Report

- The monthly status reports shall be verified by review with NASA EP6 branch personnel.

6.0 Cost Summary and Revision History:

DO 021 R9 Summary		Contract Year								
SLC		CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS3										
	Sum of Hrs									
	Sum of Dollars									
EN1										
	Sum of Hrs									
	Sum of Dollars									
EN3										
	Sum of Hrs									
	Sum of Dollars									
EN4										
	Sum of Hrs									
	Sum of Dollars									
ESS										
	Sum of Hrs									
	Sum of Dollars									
MGR										
	Sum of Hrs									
	Sum of Dollars									
QA2										
	Sum of Hrs									
	Sum of Dollars									
TN3										
	Sum of Hrs									
	Sum of Dollars									
AS2										
	Sum of Hrs									
	Sum of Dollars									
EN2										
	Sum of Hrs									
	Sum of Dollars									
ET3										
	Sum of Hrs									
	Sum of Dollars									
PC2										
	Sum of Hrs									
	Sum of Dollars									
QA1										

	Sum of Hrs Sum of Dollars
QE1	
	Sum of Hrs Sum of Dollars
QE2	
	Sum of Hrs Sum of Dollars
QE3	
	Sum of Hrs Sum of Dollars
SE3	
	Sum of Hrs Sum of Dollars
SV	
	Sum of Hrs Sum of Dollars
TN1	
	Sum of Hrs Sum of Dollars
TN2	
	Sum of Hrs Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**27,043,160**

b4

Revision History:

	Total cost	Reason for revision
Original	309,445	45-day Contract startup authorization.
Revision 1	12,522,899	Full Contract authorization (5-year).
Revision 2	10,217,723	Change in Return to Flight test quantity requirements
Revision 3	12,736,300	Addition of pyrotechnic test facility operations and increased test quantities.
Revision 4	13,040,708	Addition of vibration tests at pyrotechnic test facility and increased test quantities for advanced programs.
Revision 5	16,353,014	Eliminate the 5.1.1 WBS due to combination of the Electrical Power Systems Laboratory under Energy Systems Test Branch responsibility, convert EPSL weighted tests requirements to ESTA test requirements, increase total test requirements to facilitate major facility upgrades and tests including the buildup of the Exploration Electrical Systems Testbed (EEST) at Building 361, development of multiple In Situ Resource Utilization (ISRU) Test beds, and functional test activities for Liquid Oxygen and Methane propulsion systems.
Revision 6	16,968,278	Moves Quality Assurance and Quality Engineering to the delivery order from baseline. Adds 2 EN2's and 3 TN3's due to an increase in the test load.
Revision 7	16,463,149	Accounts for an increase in test quantity requirements
Revision 8	29,464,923	Extends the DO from 10/31/2009 to 1/31/2013
Revision 9	27,043,160	Removes the verification and validation accountability and responsibility from the ESC contract in the ESTA, a reduction in material purchases for FY11 – FY13 and the reduction in force since the last revision of the DO.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ05HB83D DO34 R4

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Sverdrup Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 04/01/05 – 01/31/13

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: **01/19/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**ARES Image Science and Analysis**					
DO	**34 R4**					
	Est. Labor Costs	b4				
	Materials/Subcontracts					
	Travel				b4	
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$25,854,471

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ05HB83D-DO34 REV. 4

Originator: Susan Runco (KA) (281) 244-8848 **TMR:** Susan Runco (KA) (281) 244-8848

Revision Summary:

- To add services related to the Shuttle Program in FY11 and services for the Commercial Crew and Cargo Program Office (C3PO)

1. Title of Effort: ARES Image Science and Analysis

2. Date of Request: 12/09/2010

3. Statement of Work Task Description

a. **2.1.6.2 Earth and Space Science**
The contractor shall perform Earth and space science research for human space flight and other activities. The contractor shall collect and catalog data, conduct analyses, update databases, and provide analytical products in the areas of Earth science, image science and analysis, hypervelocity debris impacts of spacecraft and in orbital debris monitoring.

b. **2.1.6.2.1 Earth Science**
The contractor shall perform tasks for ongoing real-time and on-call (24/7 as needed) services including: ephemeris planning for the International Space Station?s (ISS?s) Window Observational Research Facility (WORF) and its Earth Science remote sensing payloads; the ISS's Earth Science Toward Exploration Research (ESTER) payload; Crew Earth Observation (CEO) photography (Shuttle & ISS); and other means of photographic and imagery collection for all crewed vehicles. The contractor shall operate the Earth Observation Laboratory and the JSC Telescience Center. The contractor shall geolocate, interpret, catalog, maintain, and distribute returned WORF, ESTER, CEO and other imagery. The contractor shall train astronauts in earth science and remote sensing mission objectives for WORF, ESTER, and CEO.

c. **2.1.6.2.2 Image Science and Analysis**
The contractor shall perform quantitative engineering image analyses utilizing the Video Digital Analysis System (VDAS) laboratory and other tools for NASA programs for problem solving, mission safety, vehicle maintenance, vehicle performance and the Certification of Flight Readiness Process. Analyses shall be performed on film (still and motion), video, and electronic imagery acquired from both ground and flight cameras. The contractor shall provide 24-hour, on-call support for vehicle anomaly investigations and damage assessments.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 3

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 04/01/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Space Shuttle, ISS, Constellation, and C3PO Mission Image Science and Analysis Services Updated REV. 4

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide image science and analysis services for the Space Shuttle, Space Station, Constellation, and any other NASA Programs in accordance with the requirements stated in the following documents(controlled via ARES configuration control process): JSC Image Science & Analysis Group Operations Plan for Mission Support, JSC-62688, and the JSC Image Science and Analysis Facilities CoFR Plan, KX-IA-001. The contractor shall also

provide Earth Observations services in accordance with the ARES Earth Observations Operations Plan KX-EO-001. Deliverable Products are listed in the Specific Product Requirements section. No flight hardware or software services are provided by this Delivery Order. Updated REV. 4

5.1.1 Image Science and Analysis Services Specific Requirements. Project Code: Updated REV. 4

a. Space Shuttle Pre-Launch preparation
The contractor shall develop mission image analysis plans and participate in Shuttle simulations and crew training. The contractor shall also maintain ISAL and image analyses procedures.

b. Space Shuttle Mission Operations and Analysis
The contractor shall perform Shuttle image analyses, including planned analyses, mission anomaly analyses, and those coordinated through the MER.

c. Space Shuttle Post-Landing Service
Update the mission website with Shuttle image Analysis information.

d. ISS Pre-Mission Preparation (Imagery Analysis Operations, Planning, Information and Training Services)
The contractor shall develop mission image analysis plans and participate in crew training

e. ISS Imagery Services During Missions and Increments (Imagery Analysis Operations, Planning, and Information Services & Imagery Analysis Sustaining Engineering)
The contractor shall perform ISS image analyses, including planned analyses, mission anomaly analyses, and those coordinated through the MER.

f. ISS Post Mission Services (Imagery Analysis Operations, Planning, Information and Training Services & Imagery Analysis Sustaining Engineering)
The contractor shall provide reports for ISS image analysis and update the mission website.

g. Earth Observations Operations
The contractor shall provide crew training, on-orbit observations planning, and database updates.

h. Constellation Imagery Requirements Development
The contractor shall provide research into the Constellation program organization, technical understanding of the Crew Exploration Vehicle and other vehicles and launchers in the Constellation program, and develop Constellation imagery requirements. The contractor shall provide image analyses for Constellation vehicle development and testing. Vehicles include, but are not limited to, the Orion Crew Exploration Vehicle (CEV), CEV Parachute Assembly System, and ARES 1X, I, & V. The contractor shall provide mission technical programmatic planning and ISAL process development for Cx test flight and mission services.

i. Commercial Crew and Cargo Program Office Services
ESCG shall provide imagery acquisition and analysis services for C3PO to facilitate the design, testing, and safe operation of commercial launch systems. Commercial launch vehicles include, but are not limited to, SpaceX (Falcon 9 rocket and Dragon spacecraft) and Orbital Science Corporation's Taurus II rocket.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 3	JSC Lessons Learned Process	10-02
JPD 2800.4 Added Rev 3	JSC Information Technology (IT) Program Management	03-01
JPG 2800.3 Added Rev 3	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JPR 1700.1 Added Rev 3	JSC Safety and Health Handbook	Rev J, 04-2008
JPR 2810.1 Added Rev 3	JSC Information Technology Security Handbook	Rev. C, 10-2004
JSC-62688	JSC Image Science & Analysis Group Operations Plan for Mission Support	Current
KA-WI-001 Added Rev	ARES Master Work Instruction	Current

1		
KA-WI-002 Added Rev 1	ARES Configuration Management	Current
KA-WI-003 Added Rev 1	ARES Management of Research Proposals	Current
KX-001 Added Rev 1	Office for Human Exploration Science Configuration Management Process	Current
KX-EO-001 Added Rev 3	ARES Earth Observations Operations Plan	Current
KX-IA-001 Added Rev 1	JSC Image Science and Analysis Facilities CoFR Plan	Current
SPKA0005 Added Rev 3	Information Technology Security Plan Image Science and Analysis Laboratory Astromaterials Research and Exploration Science (ARES)	Current

c. **Required DRDs**

5.1.1 Image Science and Analysis Services Specific Requirements.

DRD #	DRD Title	Quantity/Frequency
Updated Rev 3	No Requirement	DRD25 for reporting requirements

d. **Products**

5.1.1 Image Science and Analysis Services Specific Requirements.

Product(s)	Quantity	Delivery Date
Integrated Imagery management COTS HW/SW for TIC MER Updated REV. 4	1	RTF- 4 weeks, completed
Integrated Image Screening and Analysis COTS HW/SW in Bld. 30 POCC Updated REV. 4	1	RTF- 4 weeks, completed
Integrated Image Screening and Analysis COTS HW/SW in JSC Image Analysis Lab Updated REV. 4	1	RTF-4 weeks, completed
Space Shuttle Training Simulations Updated REV. 4	1/month	RTF- 2 weeks, completed
Image Analysis Facility Certification Updated REV. 4	1/ mission	L- 4 weeks, completed
Certification Training for On-Orbit and Launch/Landing Imagery Review and Analysis Updated REV. 4	1/ mission	RTF- 2 weeks, completed
On-orbit imagery data management, screening, and analysis procedure document version 1 Updated REV. 4	1	RTF L- 4 weeks, completed
Launch and Landing screening and analysis procedure document version 1. Updated REV. 4	1	RTF L- 4 weeks, completed
TPS Imagery Inspection Management Systems (TIIMS) updates Updated REV. 4	1/ mission	L- 4 weeks
Launch and Landing Imagery Management System (LLIMS) updates. Updated REV. 4	1/ mission	L- 4 weeks
Space Shuttle Mission Readiness Review Updated REV. 4	1/mission	L - 5 days
Space Shuttle Crew Training Updated REV. 4	1/mission	L-4 weeks
Space Shuttle Launch and Landing Imagery Screening and Analysis Services Updated REV. 4	1/mission	mission schedule
Space Shuttle MER Operational Services Updated REV. 4	1/mission	mission schedule
Space Shuttle On-orbit Inspection Operations and Analysis Updated REV. 4	1/mission	mission schedule
Space Shuttle Investigation Analyses Updated REV. 4	as required by mission	mission schedule
Space Shuttle Final Mission Report Updated Rev 2	1/mission	Lndg+45 days
Space Shuttle Mission Database and Web Page Update Updated REV. 4	1/mission	Lndg+45 days
ISS Mission Support Plans Updated REV. 4	1/mission	L-1 month
ISS Crew Training Updated REV. 4	1/mission	L- 3 months
ISS FDF Input Updated REV. 4	1/mission	L-1 month
ISS Mission Readiness Review Updated REV. 4	1/mission	L-5 days
ISS External Survey Services Updated REV. 4	1/mission/increment	mission/increment schedule

ISS Investigation Analyses Updated REV. 4	as required by mission/increment	mission/increment schedule
ISS Imagery Summary Report Updated Rev 2	1/mission	Lndg +45 days
ISS External Survey Report Updated REV. 4	1/mission	Lndg+60 days
ISS Web Page Update Updated REV. 4	1/mission	Lndg+45 days
ISS Image Analysis Services per the Mission Support Plan Updated REV. 4	1/mission	mission/increment schedule
Earth Observations Training Modules and Updates Updated REV. 4	8/year	increment schedule
CEO Target Uplink Message Generation	5/week	once per week day
Earth Imagery Database Updates	daily	increment schedule
Earth Observations Public Website Updates	daily	increment schedule
Earth Observatory Image w/Caption Submittal	1/week	weekly
Delivery/Acceptance Report (Per DRD 25) Updated REV. 4	1/month	monthly
Laser Dynamic Range Imager (LDRI) Processing Training and Simulations	1/FY07	9/30/07 Completed
Laser Dynamic Range Imager (LDRI) Data Processing Added Rev 2	1/mission	Mission schedule i.a.w. JSC 62688
Constellation/CEV Program image analysis and requirements development Added Rev 2	As required by Constellation and CEV Program milestones	Constellation and CEV program milestones
Commercial Crew and Cargo Program Office (C3PO) Imaging and Image Analysis Planning and Services Added REV. 4	As required by C3PO milestones	C3PO milestones
Hubble Space Telescope (HST) Micrometeoroid and Orbital Debris (MMOD) survey Added REV. 4	1	Completed 11/2010

e. **Product Verification**

5.1.1 Image Science and Analysis Services Specific Requirements.
i. Integrated Imagery management COTS HW/SW for TIC MER
- Reviewed by Image Analysis Control Board and Status Checked by the internal Mission Readiness Review (MRR). Acceptance by TM will be documented through TMR/Alternate.
ii. Integrated Image Screening and Analysis COTS HW/SW in Bld. 30 POCC
- Reviewed by Image Analysis Control Board and Status Checked by the internal Mission Readiness Review (MRR). Acceptance by TM will be documented through TMR/Alternate.
iii. Integrated Image Screening and Analysis COTS HW/SW in JSC Image Analysis Lab
- Reviewed by Image Analysis Control Board and Status Checked by the internal Mission Readiness Review (MRR). Acceptance by TM will be documented through TMR/Alternate.
iv. Space Shuttle Training Simulations
- Personnel, Procedures and Facilities are ready for mission operations. training records and readiness will be reviewed by the internal MRR. Acceptance by TM will be documented through TMR/Alternate.
v. Image Analysis Facility Certification
- Reviewed by Image Analysis Control Board and Status Checked by the internal Mission Readiness Review (MRR). Acceptance by TM will be documented through TMR/Alternate.
vi. Certification Training for On-Orbit and Launch/Landing Imagery Review and Analysis
- Personnel, Procedures and Facilities are ready for mission operations. Training records and readiness will be reviewed by the internal MRR. Acceptance by TM will be documented through TMR/Alternate.
vii. On-orbit imagery data management, screening, and analysis procedure document version 1
- Personnel understand and execute procedures which will be reviewed by the Technical Monitor. Acceptance by TM will be documented through TMR/Alternate.
viii. Launch and Landing screening and analysis procedure document version 1.
- Personnel understand and execute procedures. The document will be reviewed by the Technical Monitor. Acceptance by TM will be documented through TMR/Alternate.
ix. TPS Imagery Inspection Management Systems (TIIMS) updates
- Reviewed by Image Analysis Control Board and Status Checked by the internal Mission Readiness Review (MRR). Acceptance by TM will be documented through TMR/Alternate.
x. Launch and Landing Imagery Management System (LLIMS) updates.
- Reviewed by Image Analysis Control Board and Status Checked by the internal Mission Readiness Review (MRR). Acceptance by TM will be documented through TMR/Alternate.

xi. Space Shuttle Mission Readiness Review
- Personnel and Facilities are mission ready. Image Analysis Control Board reviews all status reports and any issues. Acceptance by TM will be documented through TMR/Alternate.
xii. Space Shuttle Crew Training
- - Personnel understand and execute training which will be reviewed by the Technical Monitor. Acceptance by TM will be documented through TMR/Alternate.
xiii. Space Shuttle Launch and Landing Imagery Screening and Analysis Services
- All observable, possibly unusual, features are documented. The report is reviewed by the TM. TM is informed by weekly status reports Acceptance by TM will be documented through TMR/Alternate.
xiv. Space Shuttle MER Operational Services
- TM is informed by weekly status reports. Acceptance by TM will be documented through TMR/Alternate.
xv. Space Shuttle On-orbit Inspection Operations and Analysis
- TM is informed by weekly status reports. Acceptance by TM will be documented through TMR/Alternate.
xvi. Space Shuttle Investigation Analyses
- All observable features are analyzed and documented. The final analysis report is reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate.
xvii. Space Shuttle Final Mission Report Updated Rev 2
- Summary of Imagery Analysis findings. The report is reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate. Updated Rev 2
xviii. Space Shuttle Mission Database and Web Page Update
- Summary of Imagery Analysis findings. The report is reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate.
xix. ISS Mission Support Plans
- Reviewed by Image Analysis Control Board and Status checked by the internal Mission Readiness Review (MRR). Acceptance by TM will be documented through TMR/Alternate.
xx. ISS Crew Training
- Reported in the weekly status report. Acceptance by TM will be documented through TMR/Alternate.
xxi. ISS FDF Input
- Reported in the weekly status report . Acceptance by TM will be documented through TMR/Alternate.
xxii. ISS Mission Readiness Review
- Personnel and Facilities are mission ready. Image Analysis Control Board reviews all status reports and any issues. Acceptance by TM will be documented through TMR/Alternate.
xxiii. ISS External Survey Services
- Analysis report is reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate.
xxiv. ISS Investigation Analyses
- All observable features are analyzed and documented. The final analysis report is reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate.
xxv. ISS Imagery Summary Report Updated Rev 2
- Summary of Imagery Analysis findings. The report is reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate. Updated Rev 2
xxvi. ISS External Survey Report
- Summary of Imagery Analysis findings. The report is reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate.
xxvii. ISS Web Page Update
- Summary of Imagery Analysis findings. The web page is reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate.
xxviii. ISS Image Analysis Services per the Mission Support Plan
- Imagery Analysis of all mission imagery, reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate.
xxix. Earth Observations Training Modules and Updates
- Crews understand modules which are reviewed by the TM. Acceptance by TM will be documented through TMR/Alternate.
xxx. CEO Target Uplink Message Generation
- Review by TM. Acceptance by TM will be documented through TMR/Alternate.
xxxi. Earth Imagery Database Updates
- Review by TM. Acceptance by TM will be documented through TMR/Alternate.
xxxii. Earth Observations Public Website Updates

- Review by TM. Acceptance by TM will be documented through TMR/Alternate.
xxxiii. Earth Observatory Image w/Caption Submittal
- Review by TM. Acceptance by TM will be documented through TMR/Alternate.
xxxiv. Delivery/Acceptance Report (Per DRD 25)
- NASA approval in DDMS of Delivery/Acceptance Report
xxxv. Laser Dynamic Range Imager (LDRI) Processing Training and Simulations
- Review by TM. Acceptance by TM will be documented through TMR/Alternate.
xxxvi. Laser Dynamic Range Imager (LDRI) Data Processing
- Review by TM. Acceptance by TM will be documented through TMR/Alternate. Added Rev 2
xxxvii. Constellation/CEV Program image analysis and requirements development
- Review by TM. Acceptance by TM will be documented through TMR/Alternate. Added Rev 2
xxxviii. Commercial Crew and Cargo Program Office (C3PO) Imaging and Image Analysis Planning and Services
- Review by TM. Acceptance by TM will be documented through TMR/Alternate. Added REV. 4
xxxix. Hubble Space Telescope (HST) Micrometeoroid and Orbital Debris (MMOD) survey
- Review by TM. Acceptance by TM will be documented through TMR/Alternate. Added REV. 4

6.0 Cost Summary and Revision History:

DO 034 R4 Summary		Contract Year								
SLC		CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
BS1										
	Sum of Hrs									
	Sum of Dollars									
EN1										
	Sum of Hrs									
	Sum of Dollars									
EN2										
	Sum of Hrs									
	Sum of Dollars									
EN3										
	Sum of Hrs									
	Sum of Dollars									
EN4										
	Sum of Hrs									
	Sum of Dollars									
IT1										
	Sum of Hrs									
	Sum of Dollars									
IT2										
	Sum of Hrs									
	Sum of Dollars									
IT3										
	Sum of Hrs									
	Sum of Dollars									
IT4										
	Sum of Hrs									
	Sum of Dollars									
SC1										
	Sum of Hrs									
	Sum of Dollars									
SC2										

64

	Sum of Hrs Sum of Dollars
SC3	
	Sum of Hrs Sum of Dollars
SC4	
	Sum of Hrs Sum of Dollars
SCS	
	Sum of Hrs Sum of Dollars
TN1	
	Sum of Hrs Sum of Dollars
TN2	
	Sum of Hrs Sum of Dollars
TN3	
	Sum of Hrs Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material Travel	
NLR Misc Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**25,854,471**

b4

Revision History:

DO34 revision history	Total cost	Reason for revision
Original	$14,911,000	
Revision 1	$14,911,000	The ESC Group accepts all changes to DO34 as outlined in RFP-DO34 RBP1. We have analyzed the suggested changes, and accept them with no cost impact. Applicable documents updated to incorporate new ARES Work Instructions. New product added: "Delivery/Acceptance Report" per new DRD 25. Note: Applicable documents and DRD 25 were reviewed by ARES ESC DTM as part of ARES CM process and found to have no impacts. This change should have no scope, schedule, or cost impacts.
Revision 2	$16,972,026	Added Laser Dynamic Range Imager Processing and Constellation/CEV work.
Revision 3	$25,008,302	To extend the period of performance to January 31, 2013, to de-scope services related to the Shuttle Program end in FY10, and to increase services related to the Constellation Program.
Revision 4	$25,854,471	To add services related to the Shuttle Program in FY11 and services for C3PO.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ05HB80D DO 35 R3	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 483-7890
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, Texas 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 04/07/05 – 01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: Jessica Corley

Signtature: Jessica Corley Date: 12/02/2009
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**ARES Astromaterials Curation**					
DO	**35 R3**					
	Est. Labor Costs				b4	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				b4	
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$17,281,512

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ05HB80D-DO35 Rev 3

Originator: Susan Runco (KA) (281) 244-8848 **TMR:** Susan Runco (KA) (281) 244-8848

Revision Summary:
Extend the period of performance to Jan 31, 2013
Add Facility Engineering services for major curation system and design modifications

1. Title of Effort: ARES Astromaterials Curation

2. Date of Request: 10/15/2009

3. Statement of Work Task Description

a. **2.1.6.1-Astromaterials, Curation and Sample Handling**
The contractor shall perform curation of samples including: Apollo Lunar samples; Antarctic meteorites; cosmic dust collected at high altitude; space exposed hardware as required by NPD 7100.1D; and future returned Lunar, Martian and cosmic returned samples. The contractor shall perform tasks which include: characterize and preserve collections in pristine condition; store them under controlled conditions; maintain security appropriate to the type of samples; distribute information about materials to the scientific and academic communities; prepare and distribute samples for allocation to approved investigators for scientific and educational purposes in accordance with allocation plans developed by NASA panels; and document and inventory such samples in accordance with approved procedures for each collection.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 3

This delivery order period of performance starts 04/01/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Astromaterials Curation Updated Rev 1

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide specialized science, engineering, and technical products for the Astromaterials Acquisition and Curation Office as detailed in the following specific product requirements and in accordance with applicable documents - controlled per ARES Configuration Control Process. No flight products are required. Updated Rev 1

5.1.1 Astromaterials Collections, Processing, Allocation, Documentation, Data and Sample Control, and Information Dissemination Updated Rev 3

Project Code:

The contractor shall provide science and engineering functions associated with planning, management, and implementation activities for astromaterials curation, current and future, at the Johnson Space Center in accordance with applicable documents defined below (controlled via ARES Configuration Control Process). The contractor shall process and allocate astromaterials identified by the plans developed by the Headquarters chartered Curation Analysis and Planning Team for Extraterrestrial Materials (CAPTEM) and Meteorite Working Group (MWG). The contractor shall create and maintain laboratory records, procedures, reports, reference materials, databases, web pages, and other prime data on samples and curation activities. The contractor shall provide Facility Engineering services for major curation system design and modifications. Work shall be done in accordance with the applicable documents below.

Travel to the White Sands Test Facility Remote Lunar Storage Facility are required to verify operational status.

Travel for Educational outreach, scientific conferences, meetings and training, and exploration support.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 3	JSC Lessons Learned Process	10-02
JPD 2800.4 Added Rev 3	JSC Information Technology (IT) Program Management	03-01
JPG 2800.3 Added Rev 3	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
MIL-STD-882 Added Rev 3	Standard Practice for System Safety	Rev D 02-02
JPR 1700.1 Added Rev 3	JSC Safety & Health Handbook	Current
JPR 1710.13 Added Rev 3	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	current
JPR 2810.1 Added Rev 3	JSC Information Technology Security Handbook	current
JSC 03225	JSC Plan for Safeguarding Lunar Samples	current
JSC 26014	JSC Operational Plan for Curator's Display in Space Center Houston	current
KA-WI-001 Added Rev 1	ARES Master Work Instruction	current
KA-WI-002 Added Rev 1	ARES Configuration Management	current
KA-WI-003 Added Rev 1	ARES Management of Research Proposals	current
KR-001 Added Rev 1	Office of Astromaterials Research Configuration Management Process	current
KT-WI-001 Added Rev 1	Process for Astromaterials Curation	current
LOP 36	Entry and Exit of Personnel for the Genesis Laboratory	current
LOP 54	Approved Materials and Items: PSLV, RSLV, and RPL	current
LOP 58	Approved Materials and Items: MPL	current
LOP 60	Approved Materials and Items: Genesis Laboratory	current
LOP 65 Added Rev 2	Stardust Lab: Sample Handling, Security, Access, and Contamination Control	current
LOP 73 Added Rev 2	SEH Lab Entry, Exit, Housekeeping, Maintenance and Acceptable Materials	current
MP 11	Facility Description:PSLV	current
MP 13	Facility Description: Sample Control and Sample Information Center	current
MP 14	Facility Description: TSL	current
MP 16	Facility Description Genesis Laboratory	current

MP 2	Hurricane Plan for the Planetary Materials Facility	current
MP 5	Emergency Action Plan for Response to Oxygen Alarm in the Curatorial Laboratories	current
MP 6	General Operating Procedure for the Genesis Laboratory	current
MP 90A	Index of Curatorial Procedures	current
NPD 7100.10E Added Rev 3	Curation of Extraterrestial Materials	current
SCDP 11 Added Rev 2	RSF Records Procedure for Maintenance/Removing Sample from Inventory	current
TPS 82 Added Rev 3	Remote Storage Facility: Routine Maintenance Operations	current
TSP 64 Added Rev 3	Genesis Lab: Protocols and Schedules for Housekeeping and Contamination Control Monitoring	current

c. **Required DRDs**

5.1.1 Astromaterials Collections, Processing, Allocation, Documentation, Data and Sample Control, and Information Dissemination

DRD #	DRD Title	Quantity/Frequency
Updated Rev 3	No Requirement	DRD 25 for reporting requirements

d. **Products**

5.1.1 Astromaterials Collections, Processing, Allocation, Documentation, Data and Sample Control, and Information Dissemination

Product(s)	Quantity	Delivery Date
Lunar, Meteorite, Cosmic Dust, Genesis, Stardust, Space Exposed Hardware (SEH), Thin Section Curation Functionality Updated Rev 3	24/7	yearly
Ultra Pure Water (UPW), LN2/GN2, and Preclean/Final Clean Functionality Updated Rev3	24/7	yearly
Lunar, Meteorite, Genesis, Stardust, and Cosmic Dust Sample Allocation Plan Packages from twice yearly CAPTEM and MWG Meetings Updated Rev 3	2	yearly
Astromaterials Databases and Updates Updated Rev 3	2	yearly
Sample Data Packs Updated Rev 3	1/sample	yearly
Website and updates Updated Rev 3	1	yearly
Tours Updated Rev 3	as limited by Curator/indefinite quantity	yearly
Sample shipping and receiving Updated Rev 3	1/sample request	yearly
Metrics report Updated Rev 2	12	yearly
Delivery/Acceptance Report (per DRD 25) Updated Rev 3	1/month	15th of the month following the period of performance (or next business day if 15th is on a weekend or holiday).
Facility Engineering Report Added Rev 3	1	Yearly

e. **Product Verification**

5.1.1 Astromaterials Collections, Processing, Allocation, Documentation, Data and Sample Control, and Information Dissemination

i. Lunar, Meteorite, Cosmic Dust, Genesis, Stardust, Space Exposed Hardware (SEH), Thin Section Curation Functionality

- KT Office review/acceptance of Lunar, Meteorite, Cosmic Dust, Genesis, Stardust, SEH, Thin Section Curation functionality at weekly Astromaterials Curation Status meeting. Acceptance/closure by TM will be documented through the TMR/Alternate

ii. Ultra Pure Water (UPW), LN2/GN2, and Preclean/Final Clean Functionality

- KY Office review/acceptance of UPW, LN2/GN2, and Preclean/Final Clean functionality at weekly Astromaterials Curation Status meeting. Acceptance/closure by TM will be documented through the TMR/Alternate

iii. Lunar, Meteorite, Genesis, Stardust, and Cosmic Dust Sample Allocation Plan Packages from twice yearly CAPTEM and MWG Meetings
- Final approval and closeout of curatorial orders. Acceptance/closure by TM will be documented through the TMR/Alternate
iv. Astromaterials Databases and Updates
- Final approval and closeout of curatorial orders. Acceptance/closure by TM will be documented through the TMR/Alternate
v. Sample Data Packs
- Final approval and signature of Curator. Acceptance/closure by TM will be documented through the TMR/Alternate
vi. Website and updates
- Final approval by Curator. Acceptance/closure by TM will be documented through the TMR/Alternate
vii. Tours
- Final approval of personnel waiver by Curator. Acceptance/closure by TM will be documented through the TMR/Alternate
viii. Sample shipping and receiving
- Final approval and signature of Curator. Acceptance/closure by TM will be documented through the TMR/Alternate
ix. Metrics report Updated Rev 2
- Final approval of ARES Monthly Metrics Report. Acceptance/closure by TM will be documented through the TMR/Alternate Updated Rev 2
x. Delivery/Acceptance Report (per DRD 25)
- NASA approval in DDMS of Delivery/Acceptance Report
xi. Facility Engineering Report
- Acceptance/closure by TM will be documented through the TMR/Alternate. Added Rev 3

6.0 Cost Summary and Revision History

DO 035 R3 Summary		Contract Year								
SLC		CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS1										
	Sum of Hrs									
	Sum of Dollars									
AS2										
	Sum of Hrs									
	Sum of Dollars									
BS1										
	Sum of Hrs									
	Sum of Dollars									
BS2										
	Sum of Hrs									
	Sum of Dollars									
BS3										
	Sum of Hrs									
	Sum of Dollars									
EN1										
	Sum of Hrs									
	Sum of Dollars									
EN2										
	Sum of Hrs									
	Sum of Dollars									
EN3										
	Sum of Hrs									
	Sum of Dollars									
EN4										
	Sum of Hrs									
	Sum of Dollars									
ET3										
	Sum of Hrs									
	Sum of Dollars									
IT1										
	Sum of Hrs									
	Sum of Dollars									
IT3										
	Sum of Hrs									
	Sum of Dollars									
SC1										
	Sum of Hrs									
	Sum of Dollars									
SC2										
	Sum of Hrs									
	Sum of Dollars									
SC3										
	Sum of Hrs									
	Sum of Dollars									
SC4										
	Sum of Hrs									

b4

	Sum of Dollars
SCS	
	Sum of Hrs
	Sum of Dollars
SQ2	
	Sum of Hrs
	Sum of Dollars
SV	
	Sum of Hrs
	Sum of Dollars
TN1	
	Sum of Hrs
	Sum of Dollars
TN2	
	Sum of Hrs
	Sum of Dollars
TN3	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Tota1	

17,281,512

Revision History:

Rev No.	Date	Summary
Rev 3	12/02/2009	Extend the period of performance to Jan 31, 2013 Add Facility Engineering services for major curation system and design modifications
Rev 2	06/18/2007	Revise for an increased level of Stardust Curation Activities, add future planning, management and implementation of astromaterials curation activities, add travel for Educational Outreach and add/delete applicable documents.
Rev 1	07/21/2005	To reflect period of performance to 1/31/2010 and incorporate Stardust curation activities.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ05HB84D- DO-36 R2	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Miyoshi Thompson

Tel. No.: (281) 244-1683 FAX: (281) 483-7890
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Sverdrup Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 04/08/05 - 01/31/13

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.

Name:

Signature: _____ Date: _____

10. Name: **J.R. Carpentier**

Signtature: J.R. Carpentier Date: **12/22/09**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ARES Orbital Debris					
DO	36 R2					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference.
However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$16,774,473

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ05HB84D-DO36 Rev 2

Originator: Susan Runco (KA) (281) 244-8848 **TMR:** Susan Runco (KA) (281) 244-8848

Revision Summary:

- Extend the period of performance to January 31, 2013
- Make a onetime plan adjustment to reflect decrease in analytical services
- Redefine tasks within the scope of work

1. Title of Effort: ARES Orbital Debris

2. Date of Request: 12/09/2009

3. Statement of Work Task Description

a. **2.1.6.2.3-Hypervelocity Impact**
The contractor shall perform research in the measurement and modeling of orbital debris for NASA Programs. The contractor shall define the orbital debris environment and assess its risks. The contractor shall maintain and verify orbital debris environmental models, which include long-term prediction models for evaluating debris mitigation practices. The contractor shall assess short and long term risks to orbiting spacecraft and provide spacecraft and reentry risk assessments for satellite breakups as needed 24/7. The contractor shall develop debris mitigation techniques and practices to limit the generation of debris.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 2

This delivery order period of performance starts 04/01/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Orbital Debris Research Updated Rev 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform orbital debris studies and provide related documents in accordance with the requirements stated in the ARES Orbital Debris Internal Task Plan and Schedule (KX-OD-001) and in accordance with applicable documents - controlled per ARES Configuration Control Process. Deliverable products are listed in the Specific Product Requirements section of KX-OD-001. No flight products are provided by this Delivery Order.

Updated Rev 1

5.1.1 Orbital Debris Research Products Updated Rev 1

Project Code:

Orbital debris products consist of:

Orbital Debris Analysis: The contractor shall develop, update, and document the Orbital Debris (OD) databases, websites, and other analysis products per KX-OD-001 and KX-001

Orbital Debris Modeling Products: The contractor shall develop OD models, use them to perform OD analyses, and document the results per KX-OD-001 and KX-001

Orbital Debris Optical Measurements Products : The contractor shall develop OD optical measurement procedures, perform and analyse OD optical measurements (using the procedures), and document the results per KX-OD-001 and KX-001

Orbital Debris Radar Measurements Products : The contractor shall develop OD radar measurement procedures, perform and analyse OD radar measurements (using the procedures), and document the results per KX-OD-001 and KX-001

Orbital Debris Safety Standard Products : The contractor shall develop and update OD safety standard products and tools, provide reentry analyses, and document the results per KX-OD-001 and KX-001

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added R1BP1	JSC Lessons Learned Process	10-02
JPD 2800.4 Added R1BP1	JSC Information Technology (IT) Program Management	03-01
JPG 2800.3 Added R1BP1	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
NPR 8621.1 Added R1BP1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
SPKA0004 Added R1BP1	Information Technology Security Plan Orbital Debris Analysis Facility Astromaterials Research and Exploration Science (ARES)	Current
JPR 1700.1 Added R1BP1	JSC Safety & Health Handbook	Rev. J, 04-2008
JPR 2810.1 Added R1BP1	JSC Information Technology Security Handbook	Rev. C, 10-2004
KA-WI-001 Added Rev 1	ARES Master Work Instruction	Current
KA-WI-002 Added Rev 1	ARES Configuration Management	Current
KA-WI-003 Added Rev 1	ARES Management of Research Proposals	Current
KX-001 Added Rev 1	Office for Human Exploration Science Configuration Management Process	Current
KX-OD-001	ARES Orbital Debris Deliverable Control Board Internal Task Plan and Schedule	current
KX-OD-002	ARES Orbital Debris Project Surveillance Plan	current

c. **Required DRDs**

5.1.1 Orbital Debris Research Products		
DRD #	**DRD Title**	**Quantity/Frequency**
Updated Rev 2	No Requirement	DRD25 for reporting requirements

d. **Products**

5.1.1 Orbital Debris Research Products		
Product(s)	**Quantity**	**Delivery Date**
Orbital Debris Analysis development and update product metrics and reports Updated Rev 2	per KX-OD-001	per KX-OD-001
Model development and analysis product metrics and reports Updated Rev 2	per KX-OD-001	per KX-OD-001
Optical measurement procedure, experiment, and analysis product metrics and reports Updated Rev 2	per KX-OD-001	per KX-OD-001
Radar measurement procedure, experiment, and analysis product metrics and reports Updated Rev 2	per KX-OD-001	per KX-OD-001
Safety standard product and analysis product metrics and reports Updated Rev 2	per KX-OD-001	per KX-OD-001
Delivery/Acceptance Report (per DRD 25) Added Rev 1	1/quarter	quarterly

e. **Product Verification**

5.1.1 Orbital Debris Research Products
i. Orbital Debris Analysis development and update product metrics and reports
- Technical content monitoring and review per KX-OD-002 procedures. Deliverables will be provided to the TM for acceptance and official closure through the TMR/Alternate.
ii. Model development and analysis product metrics and reports
- Technical content monitoring and review per KX-OD-002 procedures. Deliverables will be provided to the TM for acceptance and official closure through the TMR/Alternate.
iii. Optical measurement procedure, experiment, and analysis product metrics and reports
- Technical content monitoring and review per KX-OD-002 procedures. Deliverables will be provided to the TM for acceptance and official closure through the TMR/Alternate.
iv. Radar measurement procedure, experiment, and analysis product metrics and reports
- Technical content monitoring and review per KX-OD-002 procedures. Deliverables will be provided to the TM for acceptance and official closure through the TMR/Alternate.
v. Safety standard product and analysis product metrics and reports
- Technical content monitoring and review per KX-OD-002 procedures. Deliverables will be provided to the TM for acceptance and official closure through the TMR/Alternate.
vi. Delivery/Acceptance Report (per DRD 25)
- NASA approval in DDMS of Delivery/Acceptance Report Added Rev 1

6.0 Cost Summary and Revision History

DO 036 R2 Summary		Contract Year								Grand Total
SLC		CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	
AS2	Sum of Hrs									
	Sum of Dollars									
AS3	Sum of Hrs									
	Sum of Dollars									
EN1	Sum of Hrs									
	Sum of Dollars									
EN2	Sum of Hrs									
	Sum of Dollars									
EN3	Sum of Hrs									
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EN4	Sum of Hrs									
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IT1	Sum of Hrs									
	Sum of Dollars									
IT3	Sum of Hrs									
	Sum of Dollars									
MGR	Sum of Hrs									
	Sum of Dollars									
SC1	Sum of Hrs									
	Sum of Dollars									
SC2	Sum of Hrs									
	Sum of Dollars									
SC3	Sum of Hrs									
	Sum of Dollars									
SC4										

Sum of Hrs Sum of Dollars	
SCS	
Sum of Hrs Sum of Dollars	
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	1

64

16,774,473

Revision History:

Rev No.	Date	Summary
R2	10/20/2009	- Extend the period of performance to January 31, 2013 - Make a one time plan adjustment to reflect decrease in analytical services - Redefine tasks within the scope of work
R1	08/11/2005	Applicable documents updated to incorporate new ARES Work Instructions. New product added: "Delivery/Acceptance Report" per new DRD 25. Note: Applicable documents and DRD 25 were reviewed by ARES ESC DTM as part of ARES CM process and found to have no impacts. This change should have no scope, schedule, or cost impacts.
Original		

National Aeronautics and Space Administration Lyndon B. Johnson Space Center Houston, TX 77058	**ORDER FOR SUPPLIES OR SERVICES**	Page 1 of 8

1. Order No.	**2. Date Of Order**	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ05HB85D DO 37 R6	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 04/08/2005 – 01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: **Ray DeVall**

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: 07/12/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**ARES Astromaterials Research**					
DO	**37 R6**	64				
	Est. Labor Costs					
	Materials/Subcontracts				64	
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However, the order's requirements take precedence over the contractor's proposal.					

12. For JSC Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$21,814,868.26

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ05HB85D-DO37 REV 6

Originator: Susan Runco (KA) (281) 244-8848 **TMR:** Susan Runco (KA) (281) 244-8848

Revision Summary:

To descope work in the areas of Astrobiology, Noble Gas Analysis, and Materials Processing & Properties and the associated labor, materials, & travel. This revision will increase labor, materials, and travel associated with ARES Education & Outreach to include DRATS and Student Space Mentoring.

Materials used for completion of research as identified in KR-ESC-02 shall be authorized by KA Project Directives approved by the KA TMR and concurred upon by the cognizant Contracting Officer.

1. Title of Effort: ARES Astromaterials Research

2. Date of Request: 05/09/2011

3. Statement of Work Task Description

a. **2.1.6 Astromaterials Research and Exploration Science**
The contractor shall conduct scientific research and peer reviews in space related scientific fields such as astromaterials, astrobiology and Earth science. The contractor shall provide assessments of geological and planetary science projects in these and other related fields. Assessments shall include but not be limited to curation of samples, acquisition of analytical data, evaluation of findings, and providing technical data for abstracts, presentations, peer-review publications, and research proposals.

b. **2.5 Education, Commercialization, and Technology Outreach**
The contractor shall plan and implement educational, commercialization, and technology outreach activities including special projects, curriculum development, demonstrations, displays, seminars, and presentations.

The contractor shall develop outreach materials including brochures, multi-media products, exhibit materials, and newsletters. These materials shall be disseminated through activities including web based and educational forums, and other public events.

c. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 5

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 04/01/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Astromaterials Research Updated REV 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Perform the research outlined in KR-ESC-02, ARES Astromaterials Research Action Plan, and in accordance with referenced documents, controlled per ARES Configuration Control Process. The contractor shall provide services and invitational travel for visiting scientists and researchers when so requested by ARES. No flight products will be required. Materials used for completion of research as identified in KR-ESC-02 shall be authorized by KA Project Directives approved by the KA TM and concurred upon by the cognizant Contracting Officer. Updated REV 6

5.1.1 Astromaterials Research Initiatives Updated REV 6

Project Code:

Perform the research outlined in the research plans listed in document KR-ESC-02

Exobiology, Astrobiology, and Evolutionary Biology - Section 3.1

Experimental Petrology - Section 3.2

Experimental Impact Research - Section 3.3

Mars Mineralogy Exploration Program Research- Section 3.4

Isotopes and Geochemistry - Section 3.5

Interplanetary Dust, Stardust, and Primitive Materials - Section 3.6

Lunar Research - Section 3.7

Astromaterials Projects - Section 3.8

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 4	JSC Lessons Learned Process	10-02
JPD 2800.4 Added Rev 4	JSC Information Technology (IT) Program Management	03-01
JPG 2800.3 Added Rev 4	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
MIL-STD-882 Added Rev 4	Standard Practice for System Safety	Rev D 02-02
JPR 1700.1 Added Rev 4	JSC Safety & Health Handbook	Rev J, 04-2008
JPR 1710.13 Added Rev 4	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev C, 08-2004
JPR 2810.1 Added Rev 4	JSC Information Technology Security Handbook	Rev C, 10-2004
KA-WI-001 Added Rev 1	ARES Master Work Instruction	Current
KA-WI-002 Added Rev 1	ARES Configuration Management	Current
KA-WI-003 Added Rev 1	ARES Management of Research Proposals	Current
KR-001 Added Rev 1	Office of Astromaterials research Configuration Management Process	Current
KR-ESC-02 Added Rev 2	ARES Astromaterials Research Action Plan	Current
SPKA0006 Added Rev 4	Astromaterials Research and Curation (AR&C) Facility	Current

c. **Required DRDs**

5.1.1 Astromaterials Research Initiatives

DRD #	DRD Title	Quantity/Frequency
Updated Rev 5	No Requirement	DRD25-1/quarter

d. **Products**

5.1.1 Astromaterials Research Initiatives		
Product(s)	**Quantity**	**Delivery Date**
Data, abstracts, and presentation materials per Research Plans outlined in Document KR-ESC-02 Updated REV 6	8/year	per KR-ESC-02
Delivery/Acceptance Report (per DRD 25) Updated REV 6	1/quarter	quarterly

e. **Product Verification**

5.1.1 Astromaterials Research Initiatives
i. Data, abstracts, and presentation materials per Research Plans outlined in Document KR-ESC-02
- NASA Principal Investigator for each product, as outlined in Document KR-ESC-02 sections, will review/accept data, abstracts, publications, and presentation materials. Acceptance by TM will be documented through TMR/Alternate. Updated REV 6
ii. Delivery/Acceptance Report (per DRD 25)
- NASA approval of Delivery/Acceptance Report Updated REV 6

5.2 ARES Education and Outreach Updated Rev 4

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall prepare and present materials for education and public outreach in astrobiology, astromaterials, and exploration research in accordance with KR-ESC-02 ARES Astromaterials Research Action Plan, and other referenced documents; controlled per ARES Configuration Control Process. No flight products will be required. Updated Rev 4

5.2.1 Education/Outreach Updated Rev 6
Project Code:

Prepare and present materials for education and public outreach in astrobiology, astromaterials, exploration research, and other KA/ARES related subjects in accordance with KR-ESC-02 ARES Astromaterials Research Action Plan,

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 4	JSC Lessons Learned Process	10-02
JPD 2800.4 Added Rev 5	JSC Information Technology (IT) Program Management	03-01
JPG 2800.3 Added Rev 5	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
MIL-STD-882 Added Rev 5	Standard Practice for System Safety	Rev D 02-02
JPR 1700.1 Added Rev 5	JSC Safety & Health Handbook	Current
JPR 2810.1 Added Rev 5	JSC Information Technology Security Handbook	Current
KA-WI-001 Added Rev 1	ARES Master Work Instruction	Current
KA-WI-002 Added Rev 1	ARES Configuration Management	Current
KA-WI-003 Added Rev 1	ARES Management of Research Proposals	Current
KR-001 Added Rev 5	Office of Astromaterials Research Configuration Management	Current
KR-ESC-02 Added Rev 2	ARES Research Action Plan	Current
SPKA0006 Added Rev 5	Astromaterials Research and Curation (AR&C) Facility	Current

c. **Required DRDs**

5.2.1 Education/Outreach		
DRD #	**DRD Title**	**Quantity/Frequency**
Updated Rev 5	No Requirement	DRD 25- 1/quarter

d. **Products**

5.2.1 Education/Outreach		
Product(s)	**Quantity**	**Delivery Date**
Education/Outreach Materials Updated Rev 6	20/year	per KR-ESC-02

Education/Outreach Metrics Report Deleted Rev 5	12/year	monthly
Delivery/Acceptance Report (per DRD 25), combined with Astromaterials Research Delivery Report Updated Rev 6	1/quarter	quarterly

e. **Product Verification**

5.2.1 Education/Outreach
i. Education/Outreach Materials
- The NASA DO Technical Monitor will review/accept the Education/Outreach materials for compliance with venue request and schedule. Deliverables will be accepted by TM and official closure through the TMR/Alternate
ii. Education/Outreach Metrics Report Deleted Rev 5
- The Education/Outreach metrics report will be reviewed/accepted at the bi-monthly ARES Technical Cost and Performance Review. Deleted Rev 5
iii. Delivery/Acceptance Report (per DRD 25), combined with Astromaterials Research Delivery Report
- NASA approval of Delivery/Acceptance Report Updated Rev 6

6.0 Cost Summary and Revision History

DO 037 R6 Summary		ContractYear								
SLC		CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS1										
	Sum of Hrs									
	Sum of Dollars									
AS3										
	Sum of Hrs									
	Sum of Dollars									
EN1										
	Sum of Hrs									
	Sum of Dollars									
EN2										
	Sum of Hrs									
	Sum of Dollars									
EN3										
	Sum of Hrs									
	Sum of Dollars									
EN4										
	Sum of Hrs									
	Sum of Dollars									
ESS										
	Sum of Hrs									
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ET1										
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ET3										
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IT1										
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IT3										
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QA1										
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SC1										
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SC2										
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SC3										
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	Sum of Dollars									
SC4										
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	Sum of Dollars									
SCS										
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TN1										
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TN2										

Sum of Hrs	
Sum of Dollars	
TN3	
Sum of Hrs	
Sum of Dollars	
AS2	
Sum of Hrs	
Sum of Dollars	
BS2	
Sum of Hrs	
Sum of Dollars	
BS3	
Sum of Hrs	
Sum of Dollars	
IT2	
Sum of Hrs	
Sum of Dollars	
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**$21,814,868.26**

b4

DO 37 revision history	Total cost	Reason for revision
Original	$9,772,661	
Revision 1	$9,772,661	Applicable documents updated to incorporate new ARES work instruction. New product added "Delivery Acceptance Report" per DRD 25.
Revision 2	$10,545,823	Modified requirements to reflect reduction in Astrobiology & Astronomy, along with increases in Primitive Materials, Experimental Impact, & Organics research. June adjustment due to Astrobiology and Astronomy research de-scope by 1.3 FTEs in CY02. This results in a one time decrease in plan of $226,042.
Revision 3	$10,096,937	The one time Rev 2 adjustment of $226,042 that should have resulted in a decrease ended up as an increase of that amount. This Rev is to correct the data entry error (i.e., sign) and is a one-time $448,885 decrease in the overall D0 cost. There are no changes to the scope of work as a result of this revision.
Revision 4	$11,900,373	Addition of lunar research and alignment of research areas based on currently active grants from Research Opportunities in Space and Earth Science (ROSES). Increase scope for research in two new research laboratories (Inductively-Coupled Mass Spectrometer and Focused Ion-Beam Facility). Increase in scope of the Education and Outreach program for the addition of the Lunar and Meteorite Sample Education Disk Program and the Expedition Earth & Beyond Program. June plan includes $762K realization of labor and STO labor for growth in quantity of research and education within scope and ahead of plan due to science grants and mission funding.

Revision 5	$22,902,853	To extend period of performance to January 31, 2013 and to increase labor, materials, and travel associated with ARES Education and Outreach.
Revision 6	$21,814,199	To descope work in the areas of Astrobiology, Noble Gas Analysis, and Materials Processing and Properties and the associated labor, materials, and travel. This revision will increase labor, materials, and travel associated with ARES Education and Outreach to include Desert Research and Technology Studies (RATS) and Student Space Mentoring.

National Aeronautics and Space Administration Lyndon B. Johnson Space Center Houston, TX 77058	**ORDER FOR SUPPLIES OR SERVICES**	Page 1 of 10

1. Order No.	**2. Date Of Order**	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ05HB86D DO 38 R3	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Alan C. Jackson

Tel. No.: (281) 283-4164 FAX: (281) 483-7890
E-Mail: alan.c.jackson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 04/08/05 – 01/31/13

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.

Name:

Signature: _____ Date: _____

10. Name: **Jessica Corley**

Signtature: **Jessica Corley** Date: **11/02/09**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ARES Hypervelocity Impact					
DO	**38 R3**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference.
However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$14,954,355

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ05HB86D DO38 R3

Originator: Susan Runco (KA) (281) 244-8848 **TMR:** Susan Runco (KA) (281) 244-8848

Revision Summary:

Extend the period of performance to January 31, 2013.
Increased reporting frequency of HITF Web site maintenance and upgrades status.
Increased reporting frequency of Hypervelocity impact database development and maintenance status.
Reduced task to deliver Shuttle Hypervelocity impact test/analysis reports.
Reduced task to deliver Shuttle MMOD risk assessments for Cargo Integration Review and Flight Readiness Review
Reduced task to deliver Shuttle MMOD risk assessments for MMOD risk mitigation and BUMPER verification
Reduced task to deliver BUMPER-Shuttle configuration control documentation
Reduced task to deliver Shuttle Post-flight MMOD damage assessment report
Reduced task to deliver Shuttle test sample construction, shipping, and documentation
Reduced task to deliver Shuttle EVA MMOD risk assessments
Reduced task to deliver Piezoelectric Impact Detection System hardware and software development and testing
Deleted task to deliver 3-Dimensional Test Sample Surface Geometry scanning and data management system
Added task to deliver ISS MMOD Uncertainty analyses and documentation
Added task to deliver Orion Lunar and/or Asteroid Mission Uncertainty analyses and documentation
Added task to deliver BUMPER upgrades to include ISS catastrophic failure modes
Added task to deliver BUMPER-Constellation configuration control and documentation
Deleted task to deliver Shuttle Operational and Anomaly Investigation low-velocity testing and documentation
Increased time period to deliver Shuttle low-velocity impact hydrocode simulations

1. Title of Effort: ARES Hypervelocity Impact

2. Date of Request: 09/11/2009

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

d. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

e. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated R2BP1

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 04/01/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Hypervelocity Impact Research Updated R2BP1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform hypervelocity impact studies and provide related documents in accordance with the requirements stated in the ARES Hypervelocity Impact Research Facility (HITF) Internal Task Plan and Schedule (HITF-KX-001) and in accordance with applicable documents - controlled per ARES Configuration Control Process. Deliverable products are listed in the Specific Product Requirements section. No flight products are provided by this Delivery Order.

Effective with approval of Revision 3, HITF-KX-001 replaces KX-HITF-001. Updated R2BP1

5.1.1 Hypervelocity Impact Research Products Updated R2BP1 **Project Code:**

Hypervelocity Products consist of:

Hypervelocity Impact Administrative Products: The contractor shall develop and maintain HITF impact database and web sites, and provide HITF status reports per HITF-KX-001 and KX-001.

Shuttle Micrometeoroid Orbital Debris (MMOD) Risk Assessment Products: The contactor shall provide Shuttle MMOD risk assessments and test/analysis reports per HITF-KX-001 and KX-001.

ISS Micrometeoroid Orbital Debris (MMOD) Risk Assessment Products: The contractor shall provide ISS MMOD risk assessments and test/analysis reports per HITF-KX-001 and KX-001.

Orion Micrometeoroid Orbital Debris (MMOD) Risk Assessment Products: The contractor shall provide Orion MMOD risk assessments and test/analysis reports per HITF-KX-001 and KX-001.

Constellation (non-Orion) Micrometeoroid Orbital Debris (MMOD) Risk Assessment Products: The contractor shall provide MMOD risk assessments and test/analysis reports per HITF-KX-001 and KX-001.

Other Spacecraft Micrometeoroid Orbital Debris (MMOD) Risk Assessment Products: The contractor shall provide MMOD risk assessments and test/analysis reports, conduct shielding research, and provide additional hypervelocity impact products for other spacecraft per HITF-KX-001 and KX-001.

5.1.2 Shuttle Low-Velocity Testing Products Updated R2BP1 **Project Code:**

The contractor shall provide low-velocity testing services for Shuttle return-to-flight, operations, and anomaly investigations per HITF-KX-001 and KX-001.

b. **Applicable Documents**

Document Number	Document Name	Rev.
HITF-KX-001 (replaces KX-HITF-001) Added R2BP1	ARES Hypervelocity Impact Technology Facility (HITF) Internal Task Plan and Schedule	Current
HITF-KX-002 Added R2BP1	ARES BUMPER Configuration Management Plan Hypervelocity Impact Technology Facility (HITF)	Current
HITF-KX-003 (replaces SN3-WI-	ARES BUMPER Micro-Meteoroid and Orbital Debris (MMOD) Risk Assessment	Current

003) Added R2BP1	Process Hypervelocity Impact Technology Facility (HITF)	
KA-WI-001 Added Rev 1	ARES Master Work Instruction	Current
KA-WI-002 Added Rev 1	ARES Configuration Management	Current
KA-WI-003 Added Rev 1	ARES Management of Research Proposals	Current
KX-001 Added Rev 1	Office for Human Exploration Science Configuration Management Process	Current
KX-HITF-001	ARES Hypervelocity Impact Technology Facility (HITF) Internal Task Plan and Schedule	Current

c. **Required DRDs**

5.1.1 Hypervelocity Impact Research Products

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
Updated R2BP1	No Requirement	DRD 25 for reporting req.

5.1.2 Shuttle Low-Velocity Testing Products

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
Updated R2BP1	No Requirement	DRD 25 for reporting req.

d. **Products**

5.1.1 Hypervelocity Impact Research Products

Product(s)	Quantity	Delivery Date
Hypervelocity test status report Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Cost, schedule, technical status report Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
HITF Web site maintenance and upgrade progress report Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Hypervelocity impact database development and maintenance report Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Hypervelocity test priority weekly report Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Maintain facility readiness and personnel training certifications for BUMPER and launcher operators Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Shuttle Hypervelocity impact test/analysis reports Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001 (ends July 2010)
Shuttle MMOD risk assessments for Cargo Integration Review (CIR) and Flight Readiness Review (FRR) Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001(ends at last Shuttle mission)
Shuttle MMOD risk assessments for MMOD risk mitigation and BUMPER verification Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001(ends at last Shuttle mission)
BUMPER-Shuttle configuration control documentation per KX-HITF-001, KX-HITF-002 and SN3-WI-003 Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001(ends 3 months after last Shuttle mission)
Shuttle Post-flight MMOD damage assessment report Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001(ends 3 months after last Shuttle mission lands)
Shuttle Test sample construction, shipping, and documentation Updated R2BP1	Per KX-HITF-001	Per KX-HITF-001(ends April 2010)
ISS Hypervelocity impact test/analysis reports Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
ISS integrated MMOD threat analysis (ITA) report Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
ISS MMOD risk assessments for elements and ISS overall Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
BUMPER-ISS configuration control documentation per KX-HITF-001, KX-HITF-002 and SN3-WI-003 Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001

ISS Mini-Pressurized Logistics Module (MPLM) MMOD damage report Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
ISS On-orbit MMOD damage assessments to ISS radiators & other hardware Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
ISS Test sample construction, shipping, and documentation Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
ISS MMOD/BUMPER technical interchange meeting (TIM) protocols Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Extravehicular Activity (EVA) hypervelocity test, analysis and MMOD risk assessment reports Deleted Rev 2	2	2 in FY 2005
EVA/Other Vehicle Shielding technology development test and analysis reports Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
EVA/Other Vehicle Test sample construction, shipping, and documentation Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Delivery/Acceptance Report (per DRD 25) Updated R2BP1	1/quarter	quarterly
EVA MMOD risk assessments for Shuttle FRR Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Piezoelectric Impact Detection System hardware and software development and testing Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
3-Dimensional Test Sample Surface Geometry scanning and data management system Deleted R2BP1	Quarterly status report and operational system by end of FY08	Quarterly
High-velocity impact hydrocode simulations Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
ISS MMOD Uncertainty Analyses and documentation Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Orion Lunar and/or Asteroid Mission Uncertainty Analyses and documentation Updated R2BP1	Per KX-HITF-001	Per KX-HITF-001
BUMPER upgrades to include ISS catastrophic failure modes Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
BUMPER-Constellation configuration control documentation per KX-HITF-001, KX-HITF-002 and SN3-WI-003 Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
3-Dimensional Test Sample Surface Geometry scanning and data management system Added R2BP1	Quarterly status report and operational system by end of FY08	Quarterly through FY08
Extravehicular Activity (EVA) hypervelocity test, analysis and MMOD risk assessment reports Added R2BP1	2	2 in FY05

5.1.2 Shuttle Low-Velocity Testing Products		
Product(s)	**Quantity**	**Delivery Date**
RTF Low-velocity test coordination, data documentation, and reports Deleted Rev 2	daily as required by KX-HITF-001	daily through FY05
Operational and Anomaly Investigation low-velocity testing and documentation Deleted R2BP1	daily as required by KX-HITF-001	STS-114 and subsequent missions. Testing portion through April 30, 2010
Delivery/Acceptance Report (per DRD 25) Updated R2BP1	1/quarter	quarterly
Low-velocity impact hydrocode simulations Updated R2BP1	Per HITF-KX-001	Per HITF-KX-001
Operational and Anomaly Investigation low-velocity testing and documentation Added R2BP1	Per HITF-KS-001	STS-114 and subsequent missions. Testing portion through Sep 2009.
RTF Low-velocity test coordination, data documentation, and reports Added R2BP1	daily as required by KX-HITF-001	Daily through FY05.

e. **Product Verification**

5.1.1 Hypervelocity Impact Research Products
i. Hypervelocity test status report
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.
ii. Cost, schedule, technical status report

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

iii. HITF Web site maintenance and upgrade progress report

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

iv. Hypervelocity impact database development and maintenance report

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

v. Hypervelocity test priority weekly report

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

vi. Maintain facility readiness and personnel training certifications for BUMPER and launcher operators

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

vii. Shuttle Hypervelocity impact test/analysis reports

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

viii. Shuttle MMOD risk assessments for Cargo Integration Review (CIR) and Flight Readiness Review (FRR)

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

ix. Shuttle MMOD risk assessments for MMOD risk mitigation and BUMPER verification

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

x. BUMPER-Shuttle configuration control documentation per KX-HITF-001, KX-HITF-002 and SN3-WI-003

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xi. Shuttle Post-flight MMOD damage assessment report

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xii. Shuttle Test sample construction, shipping, and documentation

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xiii. ISS Hypervelocity impact test/analysis reports

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xiv. ISS integrated MMOD threat analysis (ITA) report

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xv. ISS MMOD risk assessments for elements and ISS overall

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xvi. BUMPER-ISS configuration control documentation per KX-HITF-001, KX-HITF-002 and SN3-WI-003

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xvii. ISS Mini-Pressurized Logistics Module (MPLM) MMOD damage report

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xviii. ISS On-orbit MMOD damage assessments to ISS radiators & other hardware

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xix. ISS Test sample construction, shipping, and documentation

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xx. ISS MMOD/BUMPER technical interchange meeting (TIM) protocols

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xxi. Extravehicular Activity (EVA) hypervelocity test, analysis and MMOD risk assessment reports Deleted Rev 2

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate. Deleted Rev 2

xxii. EVA/Other Vehicle Shielding technology development test and analysis reports

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xxiii. EVA/Other Vehicle Test sample construction, shipping, and documentation

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate.

xxiv. Delivery/Acceptance Report (per DRD 25)

- - NASA approval in DDMS of Delivery/Acceptance Report

xxv. EVA MMOD risk assessments for Shuttle FRR

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate

xxvi. Piezoelectric Impact Detection System hardware and software development and testing

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate

xxvii. 3-Dimensional Test Sample Surface Geometry scanning and data management system Deleted R2BP1

- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate Deleted R2BP1

xxviii. High-velocity impact hydrocode simulations
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate
xxix. ISS MMOD Uncertainty Analyses and documentation
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate
xxx. Orion Lunar and/or Asteroid Mission Uncertainty Analyses and documentation
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate
xxxi. BUMPER upgrades to include ISS catastrophic failure modes
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate
xxxii. BUMPER-Constellation configuration control documentation per KX-HITF-001, KX-HITF-002 and SN3-WI-003
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate
xxxiii. 3-Dimensional Test Sample Surface Geometry scanning and data management system
- No product verification given for 3-Dimensional Test Sample Surface Geometry scanning and data management system
xxxiv. Extravehicular Activity (EVA) hypervelocity test, analysis and MMOD risk assessment reports
- No product verification given for Extravehicular Activity (EVA) hypervelocity test, analysis and MMOD risk assessment reports

5.1.2 Shuttle Low-Velocity Testing Products
i. RTF Low-velocity test coordination, data documentation, and reports Deleted Rev 2
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate. Deleted Rev 2
ii. Operational and Anomaly Investigation low-velocity testing and documentation Deleted R2BP1
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate. Deleted R2BP1
iii. Delivery/Acceptance Report (per DRD 25)
- - NASA approval in DDMS of Delivery/Acceptance Report
iv. Low-velocity impact hydrocode simulations
- Reviewed/accepted by NASA Technical Monitor (TM) for official closure through TMR/Alternate
v. Operational and Anomaly Investigation low-velocity testing and documentation
- No product verification given for Operational and Anomaly Investigation low-velocity testing and documentation
vi. RTF Low-velocity test coordination, data documentation, and reports
- No product verification given for RTF Low-velocity test coordination, data documentation, and reports

6.0 Cost Summary & Revision History

DO 038 R3 Summary		Contract Year								Grand Total
SLC		CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	
AS1										
	Sum of Hrs									
	Sum of Dollars									
AS2										
	Sum of Hrs									
	Sum of Dollars									
AS3										
	Sum of Hrs									
	Sum of Dollars									
EN1										
	Sum of Hrs									
	Sum of Dollars									
EN2										
	Sum of Hrs									
	Sum of									

64

	Dollars
EN3	
	Sum of Hrs
	Sum of Dollars
EN4	
	Sum of Hrs
	Sum of Dollars
ESS	
	Sum of Hrs
	Sum of Dollars
ET2	
	Sum of Hrs
	Sum of Dollars
ET3	
	Sum of Hrs
	Sum of Dollars
IT1	
	Sum of Hrs
	Sum of Dollars
IT4	
	Sum of Hrs
	Sum of Dollars
PC2	
	Sum of Hrs
	Sum of Dollars
QA1	
	Sum of Hrs
	Sum of Dollars
SC2	
	Sum of Hrs
	Sum of Dollars
SC3	
	Sum of Hrs
	Sum of Dollars
SC4	
	Sum of Hrs
	Sum of Dollars
TN1	
	Sum of Hrs
	Sum of Dollars
TN2	
	Sum of Hrs
	Sum of Dollars
TN3	
	Sum of Hrs
	Sum of Dollars
SV	

b4

1

Sum of Hrs Sum of Dollars	
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**14,954,355**

b4

Revision History:

Rev No.	Date	Summary
R2BP1	11/02/2009	Extend the period of performance to January 31, 2013. Increased reporting frequency of HITF Web site maintenance and upgrades status. Increased reporting frequency of Hypervelocity impact database development and maintenance status. Reduced task to deliver Shuttle Hypervelocity impact test/analysis reports. Reduced task to deliver Shuttle MMOD risk assessments for Cargo Integration Review and Flight Readiness Review Reduced task to deliver Shuttle MMOD risk assessments for MMOD risk mitigation and BUMPER verification Reduced task to deliver BUMPER-Shuttle configuration control documentation Reduced task to deliver Shuttle Post-flight MMOD damage assessment report Reduced task to deliver Shuttle test sample construction, shipping, and documentation Reduced task to deliver Shuttle EVA MMOD risk assessments Reduced task to deliver Piezoelectric Impact Detection System hardware and software development and testing Deleted task to deliver 3-Dimensional Test Sample Surface Geometry scanning and data management system Added task to deliver ISS MMOD Uncertainty analyses and documentation Added task to deliver Orion Lunar and/or Asteroid Mission Uncertainty analyses and documentation Added task to deliver BUMPER upgrades to include ISS catastrophic failure modes Added task to deliver BUMPER-Constellation configuration control and documentation Deleted task to deliver Shuttle Operational and Anomaly Investigation low-velocity testing and documentation Increased time period to deliver Shuttle low-velocity impact hydrocode simulations
R1R2	08/31/2007	The following is a list of revisions submitted with this update: Increased minimum number of ISS Hypervelocity impact test/analysis reports Increased minimum number of Shuttle Hypervelocity impact test/analysis reports Added task to deliver Extravehicular Activity (EVA) spacewalk risk assessments Added task to deliver Piezoelectric Impact Detection System hardware and software. Added task to deliver 3-Dimensional Test Sample Surface Geometry scanning and data management system.

		Added task to deliver high-velocity impact hydrocode analyses Added task to deliver low-velocity impact hydrocode analyses Reduced task to deliver low-velocity impact testing in FY08 Deleted task to deliver low-velocity impact testing in FY09 and FY10
R1	07/25/2005	Applicable documents updated to incorporate new ARES Work Instructions. New product added: "Delivery/Acceptance Report" per new DRD 25. Note: Applicable documents and DRD 25 were reviewed by ARES ESC DTM as part of ARES CM process and found to have no impacts. This change should have no scope, schedule, or cost impacts.
Original		

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ05HC27D DO 49 R6	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/ Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 483-7890
E-Mail miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
2224 Bay Area Boulevard, Suite 200
Houston, Texas 77058

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 07/02/05 – 01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111,C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **J.R. Carpentier**

Signature: **J.R. Carpentier** Date: **12/28/2009**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**EC Systems Test Branch Operations**					
DO	**49 R6**	64			64	
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For JSC Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$35,317,038

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ05HC27D-DO49 Rev 6

Originator: Jennifer Villarreal (EC) (281) 483-7306 **TMR:** Bruce Sauser (EC) (281) 483-2030

Revision Summary:
This revision extends the period of performance through January 2013. The revision adds b4 including b4 n materials for facility and laboratory equipment maintenance, upgrades, and consumables.

1. Title of Effort: Systems Test Branch (STB) Operations

2. Date of Request: 11/03/2009

3. Statement of Work Task Description

a. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

b. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and SA facilities. The contractor shall transition facility operational readiness conditions for EA and SA facilities.

c. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 6

This delivery order period of performance starts 07/02/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Building 33 Testing Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide test data and quick look reports for the 172 test equivalents performed in the Building 33 Special Chambers Complex. Contractor provide testing products as indicated below, and detailed in CTSD-DOP-004 Rev E - STB Laboratory Operations Task Plan managed by EC4 and contractor. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 5

5.1.1 Building 33 Testing

Project Code:

The contractor shall perform testing in the Building 33 Special Chambers Complex, and deliver the environmental tests as listed in the 5.1.1 Product Table and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP_004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Baseline
STB-E-493 Added Rev 5	CTSD STB Training and Certification Plan	G, 08-06
STB-E-554 Added Rev 5	STB Test Operations Guidelines	E, 09-06
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06
STB-F-616 Added Rev 5	Reduction of Test Data	I, 03-08

c. **Required DRDs**

5.1.1 Building 33 Testing

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per test completed

d. **Products**

5.1.1 Building 33 Testing

Product(s)	Quantity	Delivery Date
Environmental tests Updated Rev 6	251 test equivalents	1/31/2013

e. **Product Verification**

5.1.1 Building 33 Testing

i. Environmental tests

- NASA EC4 branch management will sign the test quicklook to indicate acceptance of test completion.

5.2 Crew Training Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide test data and quick look reports for the crew training events performed in the SSATA. The contractor shall provide testing products as indicated below, and detailed in the CTSD-DOP-004 Rev F - STB Laboratory Operations Task Plan managed by EC4 and contractor. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004 Updated Rev 6

5.2.1 Crew Training

Project Code:

The contractor shall deliver crew training runs in the Space Station Airlock Test Article (SSATA), and deliver runs as listed in the 5.2.1 Product Table and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Baseline
STB-E-493 Added Rev 5	CTSD STB Training and Certification Plan	G, 08-06
STB-E-554 Added Rev 5	STB Test Operations Guidelines	E, 09-06
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06
STB-F-616 Added Rev 5	Reduction of Test Data	I, 03-08
STB-M-181 Added Rev 5	SSATA Emergency Procedures for Manned EMU Operation	F, 01-09
STB-M-183	SSATA Emergency Procedure for Manned EMU and Orlan Joint Operations	Baseline

c. **Required DRDs**

5.2.1 Crew Training

DRD #	DRD Title	Quantity/Frequency
107 Updated Rev 5	Test Report	1 per Test completed

d. **Products**

5.2.1 Crew Training

Product(s)	Quantity	Delivery Date
Crew Training Runs Updated Rev 6	87 crew training equivalents	1/31/2013

e. **Product Verification**

5.2.1 Crew Training

i. Crew Training Runs

- NASA EC4 branch management will sign the test quick-look report to indicate acceptance of the deliverable. Updated Rev 6

5.3 Facility Projects

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall develop and implement facility modifications to CTSD facilities. Project schedules are in accordance with the CTSD Division Schedule located at "C:\Program Files\Microsoft Office\Office11\MSACCESS.EXE" "C:\Program Files\Engineering Labs Database\Engineering Labs Database.mdb".

5.3.1 Facility Projects

Project Code:

The contractor shall add the required capabilities to existing CTSD facilities, and deliver the facility modifications listed in the 5.3.1 Product Table and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.

CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Baseline
STB-E-557	STB Facility and Major Test Buildup Procedure	C
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06

c. **Required DRDs**

5.3.1 Facility Projects

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per project completed

d. **Products**

5.3.1 Facility Projects

Product(s)	Quantity	Delivery Date
Facility Modifications Updated Rev 6	176	1/31/2013
Updated NASA facility drawings Updated Rev 6	1 set	1/31/2013

e. **Product Verification**

5.3.1 Facility Projects

i. Facility Modifications

- Successful completion of project acceptance test.

ii. Updated NASA facility drawings

- Systems Test Branch Chief (or designee) approval of modified facility drawings.

5.4 Advanced Data Acquisition, Recording and Control System Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall add the required capabilities to existing facilities and provide testing products as specified below, and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan managed by EC4 and contractor. Drawings will be provided in an AutoCAD format as allowed by JPG 8500.4. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 6

5.4.1 Advanced Data Acquisition, Recording and Control System
Project Code:

The contractor shall develop and implement modifications and upgrades of the CTSD Data Acquisition, Recording and Controls (DARAC) system, and deliver the upgrades listed in the 5.4.1 Product Table and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024	General Operating Procedure Manual for EA Testing Facilities	Baseline
STB-E-557	STB Facility and Major Test Buildup Procedure	C
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06

c. **Required DRDs**

5.4.1 Advanced Data Acquisition, Recording and Control System

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per project completed

d. **Products**

5.4.1 Advanced Data Acquisition, Recording and Control System

Product(s)	Quantity	Delivery Date
Facility Modifications Updated Rev 6	67 project equivalents	1/31/2013
Updated NASA facility drawings Updated Rev 6	1 set	1/31/2013

e. **Product Verification**

5.4.1 Advanced Data Acquisition, Recording and Control System

i. Facility Modifications

- NASA EC4 branch management will sign URR acceptance form to indicate acceptance of project completion.

ii. Updated NASA facility drawings

- Systems Test Branch Chief (or designee) approval of updated facility drawings.

5.5 ISS Thermal Test Article Building 360 Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform testing in Building 360, and provide interim test data and quick look report for the test performed in Building 360. The contractor will provide testing products as indicated below, and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan managed by EC4 and contractor. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 6

5.5.1 ISS Thermal Test Article Building 360
Project Code:

The contractor shall perform testing in Building 360, and deliver the tests listed in the 5.5.1 Product Table and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024	General Operating Procedure Manual for EA Testing Facilities	Baseline
STB-E-493 Added Rev 5	CTSD STB Training and Certification Plan	G, 08-06
STB-E-554 Added Rev 5	STB Test Operations Guidelines	E, 09-06
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06
STB-F-616 Added Rev 5	Reduction of Test Data	I, 03-08

c. **Required DRDs**

5.5.1 ISS Thermal Test Article Building 360

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per test completed

d. **Products**

5.5.1 ISS Thermal Test Article Building 360

Product(s)	Quantity	Delivery Date
ISS Thermal Test Article life test Updated Rev 6	1	1/31/2013

e. **Product Verification**

5.5.1 ISS Thermal Test Article Building 360

i. ISS Thermal Test Article life test

- NASA EC4 branch management will sign the test quick look to indicate acceptance of test completion.

5.6 8-Foot / 11-Foot PLSS Testing Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide test data and quick look reports for the PLSS tests in the 8-foot chamber and the 11-foot chamber. The contractor will provide testing products as indicated below, and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan managed by EC4 and contractor. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 6

5.6.1 8-Foot / 11-Foot PLSS Testing Updated Rev 6

Project Code:

The contractor shall provide Portable Life Support System (PLSS) Certification Testing in the 8-Foot (three runs each) and 11-Foot chambers of Building 7, and deliver the tests listed in the 5.6.1 Product Table and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024	General Operating Procedure Manual for EA Testing Facilities	Baseline
STB-E-493 Added Rev 5	CTSD STB Training and Certification Plan	G, 08-06
STB-E-554 Added Rev 5	STB Test Operations Guidelines	E, 09-06
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06

c. **Required DRDs**

5.6.1 8-Foot / 11-Foot PLSS Testing

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per test completed

d. **Products**

5.6.1 8-Foot / 11-Foot PLSS Testing

Product(s)	Quantity	Delivery Date
PLSS tests Updated Rev 6	11	1/31/2013

e. **Product Verification**

5.6.1 8-Foot / 11-Foot PLSS Testing

i. PLSS tests

- NASA EC4 branch management will sign the test quick look to indicate acceptance of test completion.

5.7 Diversified Testing Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform test operations and provide test data and quick look reports for diversified test equivalents. The contractor will provide testing products as indicated below, and detailed in the CTSD-DOP-004 Rev E ? STB Laboratory Operations Task Plan managed by EC4 and contractor. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 6

5.7.1 Diversified Testing
Project Code:

The contractor shall perform diversified test operations, and deliver the tests listed in the 5.7.1 Product Table and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024	General Operating Procedure Manual for EA Testing Facilities	Baseline
STB-E-493 Added Rev 5	CTSD STB Training and Certification Plan	G, 08-06
STB-E-554 Added Rev 5	STB Test Operations Guidelines	E, 09-06
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06
STB-F-616	Reduction of Test Data	E

c. **Required DRDs**

5.7.1 Diversified Testing

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per test completed

d. **Products**

5.7.1 Diversified Testing

Product(s)	Quantity	Delivery Date
Environmental tests Updated Rev 6	111 environmental test equivalents	1/31/2013

e. **Product Verification**

5.7.1 Diversified Testing

i. Environmental tests

- NASA EC4 branch management will sign the test quick look to indicate acceptance of test completion.

5.8 Return to Flight Activities Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide test data and quick look reports for two (2) Return to Flight tests. The contractor will provide testing products as indicated below, and detailed in the CTSD-DOP-004 ? STB Laboratory Operations Task Plan managed by EC4 and contractor. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 6

5.8.1 Return to Flight Activities
Project Code:

The contractor shall perform return to flight test operations in Chamber B, the Building 7 Dual Glove Box, and/or the Building 33 Special Test Chambers Complex, and provide the tests listed in the 5.8.1 Product Table and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	Baseline
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Baseline
STB-E-493 Added Rev 5	CTSD STB Training and Certification Plan	G, 08-06
STB-E-554 Added Rev 5	STB Test Operations Guidelines	E, 09-06
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06
STB-F-616 Added Rev 5	Reduction of Test Data	I, 03-08

c. **Required DRDs**

5.8.1 Return to Flight Activities

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per test completed

d. **Products**

5.8.1 Return to Flight Activities

Product(s)	Quantity	Delivery Date
Return to Flight tests Updated Rev 6	2 tests	9/30/2006

e. **Product Verification**

5.8.1 Return to Flight Activities

i. Return to Flight tests

- EC4 branch management will sign the test quick look to indicate acceptance of test completion.

5.9 Water and Gas Analysis Updated Rev 6

a. **Requirement** - In compliance with the above identified SOW(s) the contractor will provide 2491 water analyses and 234 gas analyses. The contractor will provide testing products as indicated below, and detailed in the CTSD-DOP-004 Rev E - STB Laboratory Operations Task Plan managed by EC4 and contractor. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 6

5.9.1 Water and Gas Analysis Updated Rev 6

Project Code:

The contractor shall provide testing products as indicated below, and detailed in the CTSD-DOP-004 Rev E- STB Laboratory Operations Task Plan managed by EC4 and contractor. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024 Added Rev 5	General Operating Procedures Manual for EA Testing Facilities	Baseline
STB-E-493 Added Rev 5	CTSD STB Training and Certification Plan	G, 08-06
STB-E-554 Added Rev 5	STB Test Operations Guidelines	E, 09-06
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06
STB-F-616 Added Rev 5	Reduction of Test Data	I, 03-08

c. **Required DRDs**

5.9.1 Water and Gas Analysis

DRD #	DRD Title	Quantity/Frequency
107 Added Rev 5	Test Report	1 per test completed

d. **Products**

5.9.1 Water and Gas Analysis

Product(s)	Quantity	Delivery Date
Water Analyses Updated Rev 6	2491 analysis equivalents	1/31/2013
Gas Analyses Updated Rev 6	234 analysis equivalents	9/30/08

e. **Product Verification**

5.9.1 Water and Gas Analysis

i. Water Analyses

- NASA EC4 branch management will sign the test quick look to indicate acceptance of test completion.

ii. Gas Analyses

- NASA EC4 branch management will sign the test quick look to indicate acceptance of test completion.

5.10 Shared Capabilities Assets Program (SCAP) Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall add the required capabilities to existing facilities, and provide testing products as specified below and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan managed by EC4 and contractor. Drawings will be provided in an AutoCAD format as allowed by JPR 8500.4. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 6

5.10.1 Shared Capabilities Assets Program (SCAP) Updated Rev 6

Project Code:

The contractor shall add the required capabilities to existing facilities, and provide testing products as specified below and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan managed by EC4 and contractor. Drawings will be provided in an AutoCAD format as allowed by JPR 8500.4. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024 Added Rev 5	General Operating Procedures Manual for EA Testing Facilities	Baseline, 11-06
STB-E-557 Added Rev 5	STB Facility and Major Test Buildup Procedure	C, 04-03
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06

c. **Required DRDs**

5.10.1 Shared Capabilities Assets Program (SCAP)

DRD #	DRD Title	Quantity/Frequency
107 Added Rev 5	Test Report	1 per test completed

d. **Products**

5.10.1 Shared Capabilities Assets Program (SCAP)		
Product(s)	**Quantity**	**Delivery Date**
Facility Modifications Updated Rev 6	16 each	1/31/2013
Updated NASA Facility Drawings Updated Rev 6	1 set	1/31/2013

e. **Product Verification**

5.10.1 Shared Capabilities Assets Program (SCAP)
i. Facility Modifications
- NASA EC4 branch management will sign URR acceptance form to indicate acceptance of project completion..
ii. Updated NASA Facility Drawings
- NASA EC4 branch management (or designee) approval of updated facility drawings Updated Rev 6

5.11 EVA Facilities Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall add the required capabilities to existing facilities, and provide testing products as specified below, and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan managed by EC4 and contractor. Drawings will be provided in an AutoCAD format as allowed by JPR 8500.4. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004. Updated Rev 6

5.11.1 EVA Facilities Updated Rev 6
Project Code:

The contractor shall add the required capabilities to existing facilities, and provide testing products as specified below, and detailed in the CTSD-DOP-004 - STB Laboratory Operations Task Plan managed by EC4 and contractor. Drawings will be provided in an AutoCAD format as allowed by JPR 8500.4. The current version is posted at \\JFC-IFS-02\data\EA\EC_SHR\ESCG\EC4\CTSD-DOP-004.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024 Added Rev 5	General Operating Procedures Manual for EA Testing Facilities	Baseline, 11-06
STB-E-557 Added Rev 5	STB Facility and Major Test Buildup Procedure	C, 04-03
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06

c. **Required DRDs**

5.11.1 EVA Facilities

DRD #	DRD Title	Quantity/Frequency
107 Added Rev 5	Test Report	1 per test completed

d. **Products**

5.11.1 EVA Facilities

Product(s)	Quantity	Delivery Date
Facility Modifications Updated Rev 6	1	1/31/2013
Updated NASA Facility Drawings Updated Rev 6	1 set	1/31/2013

e. **Product Verification**

5.11.1 EVA Facilities
i. Facility Modifications
- NASA EC4 branch management will sign URR acceptance form to indicate acceptance of project completion.
ii. Updated NASA Facility Drawings
- Systems Test Branch Chief (or designee) approval of updated facility drawings.

5.12 Quality Services Added Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide quality engineering and quality assurance services to meet the test and facility modifications requirements in this DO. Added Rev 5

5.12.1 Quality Services Updated Rev 6
Project Code:

The contractor shall provide quality engineering and quality assurance services to meet the test and facility modifications requirements in this DO

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD=DOP-004 Added Rev 6	STB Laboratory Operations Task Plan	F
EA-WI-024 Added Rev 5	General Operating Procedures Manual for EA Testing Facilities	Baseline, 11-06
STB-E-557 Added Rev 5	STB Facility and Major Test Buildup Procedure	C, 04-03
STB-F-001 Added Rev 5	CTSD STB General Operating Procedures Manual	M, 09-06

c. **Required DRDs**

5.12.1 Quality Services		
DRD #	DRD Title	Quantity/Frequency
Added Rev 5	No Requirement	

d. **Products**

5.12.1 Quality Services		
Product(s)	Quantity	Delivery Date
Perform Quality Assurance Review of Work Authorizing Documents, etc. Updated Rev 6	1 per test or facility upgrade as minimum	Per Test or Facility Upgrade Schedule

e. **Product Verification**

5.12.1 Quality Services
i. Perform Quality Assurance Review of Work Authorizing Documents, etc.
- Accurate WADs Updated Rev 6

6.0 Cost Summary and Revision History

DO 049 R6 Summary		Contract Year								Grand Total
SLC		CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	
EN1	Sum of Hrs									
	Sum of Dollars									
EN2	Sum of Hrs									
	Sum of Dollars									
EN3	Sum of Hrs									
	Sum of Dollars									
EN4	Sum of Hrs									
	Sum of Dollars									
MGR	Sum of Hrs									
	Sum of Dollars									
SV	Sum of Hrs									
	Sum of Dollars									
TN1	Sum of Hrs									
	Sum of Dollars									
TN2	Sum of Hrs									
	Sum of Dollars									
TN3	Sum of Hrs									
	Sum of Dollars									
BS1	Sum of Hrs									
	Sum of Dollars									
IT1	Sum of Hrs									
	Sum of Dollars									
QA1	Sum of Hrs									
	Sum of Dollars									
SC1	Sum of Hrs									

	Sum of Dollars
SC2	
	Sum of Hrs
	Sum of Dollars
SC3	
	Sum of Hrs
	Sum of Dollars
QA2	
	Sum of Hrs
	Sum of Dollars
QE1	
	Sum of Hrs
	Sum of Dollars
QE2	
	Sum of Hrs
	Sum of Dollars
QE3	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**35,317,038**

b4

Revision History:

Rev No.	Date	Summary
Rev 6	10/26/2009	This revision extends the period of performance through January 2013. The revision adds b4 including $ b4 in materials for facility and laboratory equipment maintenance, upgrades, and consumables.
Rev 5	02/26/2009	**This Revision reflects DO49 Systems Test Branch (STB) Operations changes as result of implementation for Rev E of the CTSD-DOP-004 STB Laboratory Operations Task Plan. The scope for WBS 12 Quality Services, was added. Adjustments were made to the remaining WBS numbers to reflect the current scope of work.**

Rev 4	08/01/2008	**No change to RFP. Revision created in order to submit an Unsolicited Proposal. This unsolicited proposal to DO49 Systems Test Branch (STB) Operations is in response to Rev D of CTSD-DOP-004 STB Laboratory Operations Task Plan. The differences between this proposal and the original version RFP are identified in the table in section 9.3.1 of this proposal. The period of performance is being extended with the additional scope for each WBS to the end of the contract. The scope for two new WBS numbers, WBS 10 Shared Capabilities Assets Program and WBS 11 EVA Facility Modifications, was also added. The FY08 authorization was reduced to reflect the current scope of work.**
Rev 3	08/21/2007	**No change to RFP. Revision created in order to submit an Unsolicited Proposal. If accepted we anticipate that this will be DO49 Rev 3.**
Rev 2	06/12/2007	**No change to RFP. Revision created in order to submit an Unsolicited Proposal.**
Rev 1	05/23/2006	**No change to RFP. Revision created in order to submit a Value Change Proposal (VCP).**
Original		

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ05HC11D–DO 55 R8

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/Christian C. Gaspard
Tel. No.: (281) 792-7522 FAX: (281) 333-0501
E-Mail: christian.c.gaspard @nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 05/14/2005 – 01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Chuck Murgia

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: Ronald Johnson Date: 9/22/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**EC2 Engineering Analysis and Development of Cold Stowage and Thermal Control Systems**					
DO	**55 R8**					
	Est. Labor Costs					
	Materials/Subcontracts/NLR Misc					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: ☐COMP ☐PART
PPC: BC
Reissue To:

13. Total
$25,624,535.50

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ05HC11D-DO55 R8

Originator: Frederick Smith (EC2) (281) 483-9232 **TMR:** Jennifer Villarreal (EC) (281) 483-7306

Revision Summary:
Extension through January 2013. Added scope for FY11,12,13.

1. FROM Title of Effort: EC2 Engineering Analysis and Development of Cold Stowage and Thermal Control Systems Updated REV 8
1. Title of Effort: EC2 Engineering Analysis and Development of Thermal Control Systems

2. Date of Request: 08/20/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

e. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

f. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of

results.

g. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

h. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

i. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

j. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

k. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 8

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 05/14/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Analysis Tools Maintenance and Development Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide analytical tools and evaluations in areas of ECLSS, ATCS, and EVA systems. Note: FY11, FY12 and FY13 work will be in accordance with the most up to date Engineering Analysis Plan. Updated REV 8

5.1.1 ECLSS, ATCS, and EVA Tool Enhancements and Analytical Studies Updated Rev 7

Project Code:

The contractor shall add the required capabilities to the existing ECLSS, ATCS and EVAS analysis tools and perform the engineering analyses and studies listed in the 5.1.1 Product Table and detailed in the current applicable Engineering Analysis Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-001	EC2 FY05 Engineering Analysis Plan	Current
CTSD-DOP-005 Added Rev 1	EC2 FY06 Engineering Analysis Plan	Current
CTSD-DOP-010 Added Rev 7	EC2 FY07 Engineering Analysis Plan	Current
CTSD-DOP-012 Added Rev 7	EC2 FY08 Engineering Analysis Plan	Current
CTSD-DOP-014 Added Rev 7	EC2 FY09 Engineering Analysis Plan	Current
JSC-28918	EVA Design Requirements and Considerations	Baseline
JSC-47804	Advanced Life Support Baseline Values and Assumptions Document	Rev. A
JSC-65527 Added Rev 7	Advanced Life Support Requirements Document	Current

c. **Required DRDs**

5.1.1 ECLSS, ATCS, and EVA Tool Enhancements and Analytical Studies

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
218 Updated Rev 7	Engineering Analysis	A/R

d. **Products**

5.1.1 ECLSS, ATCS, and EVA Tool Enhancements and Analytical Studies

Product(s)	Quantity	Delivery Date
ECLSS/ATCS/EVA Analysis Tool Upgrade Packages	2	9/30/2005
ECLSS/ATCS/EVA Analytical Study Reports	5	9/30/2005
ECLSS/ATCS/EVA Analysis Tool Upgrade Packages Added Rev 1	4	9/30/2006
ECLSS/ATCS/EVA Analytical Study Reports Added Rev 1	4	9/30/2006
ECLSS/ATCS/EVA Analysis Tool Upgrade Packages	1	9/30/2007
ECLSS/ATCS/EVA Analytical Study Reports Added Rev 3	14	9/30/2007
ECLSS/ATCS/EVA Analysis Tool Upgrade Packages Added Rev 7	1	9/30/2008
ECLSS/ATCS/EVA Analysis Tool Upgrade Packages Added Rev 7	1	9/30/2009
ECLSS/ATCS/EVA Analytical Study Reports Added Rev 7	9	9/30/2008
ECLSS/ATCS/EVA Analysis Tool Upgrade Packages Added Rev 7	1	9/30/2010
ECLSS/ATCS/EVA Analytical Study Reports Added Rev 7	8	9/30/2009

ECLSS/ATCS/EVA Analytical Study Reports Added Rev 7	8	9/30/2010
ECLSS/ATCS/EVA Analytical Study Reports Added REV 8	8	9/30/2011
ECLSS/ATCS/EVA Analysis Tool Upgrade Packages Added REV 8	1	9/30/2011
ECLSS/ATCS/EVA Analytical Study Reports Added REV 8	8	9/30/2012
ECLSS/ATCS/EVA Analysis Tool Upgrade Packages Added REV 8	1	9/30/2012
ECLSS/ATCS/EVA Analytical Study Reports Added REV 8	3	01/31/2013

e. **Product Verification**

5.1.1 ECLSS, ATCS, and EVA Tool Enhancements and Analytical Studies

i. ECLSS/ATCS/EVA Analysis Tool Upgrade Packages

- EC2 Branch review of deliverable

ii. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable

iii. ECLSS/ATCS/EVA Analysis Tool Upgrade Packages

- EC2 Branch review of deliverable Added Rev 1

iv. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable Added Rev 1

v. ECLSS/ATCS/EVA Analysis Tool Upgrade Packages

- EC2 Branch review of deliverable

vi. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable Added Rev 3

vii. ECLSS/ATCS/EVA Analysis Tool Upgrade Packages

- EC2 Branch review of deliverable Added Rev 7

viii. ECLSS/ATCS/EVA Analysis Tool Upgrade Packages

- EC2 Branch review of deliverable Added Rev 7

ix. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable Added Rev 7

x. ECLSS/ATCS/EVA Analysis Tool Upgrade Packages

- EC2 Branch review of deliverable Added Rev 7

xi. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable Added Rev 7

xii. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable Added Rev 7

xiii. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable Added REV 8

xiv. ECLSS/ATCS/EVA Analysis Tool Upgrade Packages

- EC2 Branch review of deliverable Added REV 8

xv. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable Added REV 8

xvi. ECLSS/ATCS/EVA Analysis Tool Upgrade Packages

- EC2 Branch review of deliverable Added REV 8

xvii. ECLSS/ATCS/EVA Analytical Study Reports

- EC2 Branch review of deliverable Added REV 8

5.2 ISS EVA Thermal Analysis Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform assembly and stage EVA thermal analyses and general thermal evaluations of EVA hardware. Note: FY11, FY12 and FY13 work will be in accordance with the most up to date Engineering Analysis Plan. Updated REV 8

5.2.1 ISS EVA Pre-flight and EVA requirements evaluations Updated Rev 7

Project Code:

The contractor shall perform assembly and stage EVA thermal analyses and general touch temperature and thermal evaluations of EVA hardware listed in the 5.2.1 Product Table and detailed in the the current Engineering Analysis Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-001	EC2 FY05 Engineering Analysis Plan	Current
CTSD-DOP-005 Added Rev 1	EC2 FY06 Engineering Analysis Plan	Current
CTSD-DOP-010 Added Rev 7	EC2 FY07 Engineering Analysis Plan	Current
CTSD-DOP-012 Added Rev 7	EC2 FY08 Engineering Analysis Plan	Current
CTSD-DOP-014 Added Rev 7	EC2 FY09 Engineering Analysis Plan	Current
HS MEMO EMUM1-01906	ISS EMU Thermal Certification for Flights STS-88 (2A) and Subsequent	Original
JSC 39117	EMU ISS EVA Thermal Environment Requirements for Certification	Rev. D
JSC-26557	On-Orbit Assembly, Modeling, and Mass Properties Handbook, International Space Station Program	REV. E, DCN-4
JSC-28918	EVA Design Requirements and Considerations	BASELINE

c. **Required DRDs**

5.2.1 ISS EVA Pre-flight and EVA requirements evaluations

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
218 Updated Rev 7	Engineering Analysis	A/R

d. **Products**

5.2.1 ISS EVA Pre-flight and EVA requirements evaluations

Product(s)	Quantity	Delivery Date
Assembly EVA Flight Plan Analysis Reports Updated REV 8	A/R	2 Days Prior to Launch
Stage EVA Flight Plan Analysis Reports Updated REV 8	A/R	2 Days Prior to EVA
Slidewire and OIH Handrail Thermal Analysis Report Updated REV 8	1	9/30/2005
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report Updated REV 8	1	9/30/2005
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report Updated REV 8	1	9/30/2006
Detailed EVA Hardware Thermal Analysis Report Updated REV 8	1	9/30/2006
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report Added Rev 3	1	9/30/2007
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report Added Rev 7	1	9/30/2008
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report` Added Rev 7	1	9/30/2009
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report Added Rev 7	1	9/30/2010
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report Added REV 8	1	9/30/2011
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report Added REV 8	1	9/30/2012
EVA Hardware Thermal and Touch Temperature Evaluation Summary Report Added REV 8	1	1/31/2013

e. **Product Verification**

5.2.1 ISS EVA Pre-flight and EVA requirements evaluations

i. Assembly EVA Flight Plan Analysis Reports

- - EC2 Branch review of deliverable

ii. Stage EVA Flight Plan Analysis Reports

- - EC2 Branch review of deliverable

iii. Slidewire and OIH Handrail Thermal Analysis Report
- - EC2 Branch review of deliverable
iv. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- - EC2 Branch review of deliverable
v. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- - EC2 Branch review of deliverable
vi. Detailed EVA Hardware Thermal Analysis Report
- - EC2 Branch review of deliverable
vii. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- EC2 Branch review of deliverable Added Rev 3
viii. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- EC2 Branch review of deliverable Added Rev 7
ix. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- EC2 Branch review of deliverable Added Rev 7
x. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- EC2 Branch review of deliverable Added Rev 7
xi. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- EC2 Branch review of deliverable Added REV 8
xii. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- EC2 Branch review of deliverable Added REV 8
xiii. EVA Hardware Thermal and Touch Temperature Evaluation Summary Report
- EC2 Branch review of deliverable Added REV 8

5.3 Systems Integration, Modeling, and Analysis (SIMA) Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering analysis and evaluation products for the ELS SIMA project. Note: FY11, FY12 and FY13 work will be in accordance with the most up to date Engineering Analysis Plan. Updated REV 8

5.3.1 ELS SIMA Engineering Evaluations Updated REV 8

Project Code:

The contractor shall provide evaluations of Life Support (LS) technology development progress, LS requirements and baseline values and assumptions for LS studies. The contractor shall also conduct computer modeling and simulations of LS fluid processing and solids handling systems and components to evaluate developments in the LS technologies. The Contractor shall also provide trade-off studies and develop LS design database. The engineering analysis and evaluation products are listed in the 5.3.1 Product Table and detailed in the applicable Engineering Analysis Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-001	EC2 FY05 Engineering Analysis Plan	Current
CTSD-DOP-005 Added Rev 1	EC2 FY06 Engineering Analysis Plan	Current
CTSD-DOP-010 Added Rev 7	EC2 FY07 Engineering Analysis Plan	Current
CTSD-DOP-012 Added Rev 7	EC2 FY08 Engineering Analysis Plan	current
CTSD-DOP-014 Added Rev 7	EC2 FY09 Engineering Analysis Plan	current
JSC 39502	ALS Systems Integration, Modeling, and Analysis Reference Missions Document	A
JSC 47804	Advanced Life Support Baseline Values and Assumptions Document	A
JSC-65527 Added Rev 7	Advanced Life Support Requirements Document	current

c. **Required DRDs**

5.3.1 ELS SIMA Engineering Evaluations

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
218 Updated Rev 7	Engineering Analysis	A/R

d. **Products**

5.3.1 ELS SIMA Engineering Evaluations

Product(s)	Quantity	Delivery Date
ALS SIMA Engineering Analysis Reports	14	9/30/2005
ALS SIMA Engineering Analysis Reports Added Rev 1	12	9/30/2006
ELS SIMA Engineering Analysis Reports Added Rev 3	14	9/30/2007
ELS SIMA Engineering Analysis Reports Added Rev 7	9	9/30/2008
ELS SIMA Engineering Analysis Reports Added Rev 7	9	9/30/2009
ELS SIMA Engineering Analysis Reports Added Rev 7	8	9/30/2010
SIMA Engineering Analysis Reports Added REV 8	5	9/30/2011
SIMA Engineering Analysis Reports Added REV 8	5	9/30/2012
SIMA Engineering Analysis Reports Added REV 8	2	1/31/2013

e. **Product Verification**

5.3.1 ELS SIMA Engineering Evaluations

i. ALS SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable

ii. ALS SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 1

iii. ELS SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 3

iv. ELS SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 7

v. ELS SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 7

vi. ELS SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 7

vii. SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable Added REV 8

viii. SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable Added REV 8

ix. SIMA Engineering Analysis Reports
- EC2 Branch review of deliverable Added REV 8

5.4 Advanced Life Support (ALS) Thermal Control Systems (TCS) Hardware Development

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide hardware development products for ALS TCS.

5.4.1 Hardware Development Projects for ALS TCS Updated Rev 1
Project Code:

The contractor shall conceptualize, design, develop and test development hardware for the ALS Thermal Control

System (TCS) and provide the development hardware products listed in the 5.4.1 Product Table and detailed in the "EC2 FY05 Thermal Control System Hardware Development Plan" (CTSD-DOP-002). This task ends at the end of FY05, there are no tasks associated with this task in FY06.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-ADV-532	Porous Media Condensing Heat Exchanger Test Requirements /Test Plan Document	Original
CTSD-DOP-002	EC2 FY05 Thermal Control System Hardware Development Plan	Current
MSAD-02-0508-A	LPTPA User's Manual	A
MSAD-03-0012-A	LPTPA Test Requirements and Test Plan Document	A

c. **Required DRDs**

5.4.1 Hardware Development Projects for ALS TCS

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.4.1 Hardware Development Projects for ALS TCS

Product(s)	Quantity	Delivery Date
Porous Media Condensing Heat Exchanger Performance Testing	1	9/30/2005
Low Power Two Phase Active Thermal Control System (LPTPA) Performance Testing	1	9/30/2005

e. **Product Verification**

5.4.1 Hardware Development Projects for ALS TCS

i. Porous Media Condensing Heat Exchanger Performance Testing

- EC2 Branch review of deliverable

ii. Low Power Two Phase Active Thermal Control System (LPTPA) Performance Testing

- EC2 Branch review of deliverable

5.5 Heat Rejection and Advanced Thermal Control Systems Hardware Development Updated Rev 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide hardware development products for Heat Rejection and Advanced Thermal Control Systems.

Updated Rev 1

5.5.1 Development Hardware Advanced Thermal Control Systems Products Updated Rev 2

Project Code:

The contractor shall conceptualize, design, develop and test development hardware for Heat Rejection and Advanced Thermal Control Systems (ATCS) and provide the development hardware products listed in the 5.5.1 Product Table and detailed in the "EC2 FY05 Thermal Control System Hardware Development Plan" and the "EC2 FY06 Thermal Control System Hardware Development Plan".

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-002	EC2 FY05 Thermal Control System Hardware Development Plan	Current
CTSD-DOP-006 Added Rev 1	EC2 FY06 Thermal Control System Hardware Development Plan	Current
JPR 8500.4 Added Rev 1	Engineering Drawing System Manual	Rev. J
JSC-62274	Ground Heat Pump Test Requirements/Test Plan Document	Original

c. **Required DRDs**

5.5.1 Development Hardware Advanced Thermal Control Systems Products		
DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
102 Added Rev 1	Engineering Drawings and Model Files	1
107 Added Rev 1	Test Report	1
218 Updated Rev 2	Engineering Analysis	3

d. **Products**

5.5.1 Development Hardware Advanced Thermal Control Systems Products		
Product(s)	Quantity	Delivery Date
Light - Weight Radiator Test Coupon	1	9/30/2005
Vapor Compression Heat Pump Performance Testing	1	9/30/2005
Contamination Insensitive Sublimator Design Evaluation Report	1	9/30/2005
Report on use of propylene glycol and water mixture in the ISS and in exploration vehicles Added Rev 1	1	9/30/2006
Concept design review of sublimator engineering development unit	1	9/30/2006
Performance data for small scale porous media heat exchanger test article Deleted Rev 2	1	9/30/2006
Post test Report for automated feedback control testing of LPTPA Deleted Rev 2	1	9/30/2006
Vacuum chamber test facility trade memo Added Rev 2	1	9/30/2006
TCS Fluids System Test Bed Added Rev 2	1	9/30/2006
Vapor Compression Heat Pump thermal analysis report Added Rev 2	1	9/30/2006
Radiator Fluid Manifolds Added Rev 2	2	9/30/2006
Radiator SINDA thermal model Added Rev 2	1	9/30/2006
Porous Media Condensing Heat Exchanger Engineering Development Unit	2	9/30/2006

e. **Product Verification**

5.5.1 Development Hardware Advanced Thermal Control Systems Products

i. Light - Weight Radiator Test Coupon

- EC2 Branch review of deliverable

ii. Vapor Compression Heat Pump Performance Testing

- EC2 Branch review of deliverable

iii. Contamination Insensitive Sublimator Design Evaluation Report

- EC2 Branch review of deliverable

iv. Report on use of propylene glycol and water mixture in the ISS and in exploration vehicles

- EC2 Branch review of deliverable Added Rev 1

v. Concept design review of sublimator engineering development unit

- EC2 Branch review of deliverable

vi. Performance data for small scale porous media heat exchanger test article Deleted Rev 2

- EC2 Branch review of deliverable Deleted Rev 2

vii. Post test Report for automated feedback control testing of LPTPA Deleted Rev 2

- EC2 Branch review of deliverable Deleted Rev 2

viii. Vacuum chamber test facility trade memo

- EC2 Branch review of deliverable Added Rev 2

ix. TCS Fluids System Test Bed

- EC2 Branch review of deliverable Added Rev 2

x. Vapor Compression Heat Pump thermal analysis report

- EC2 Branch review of deliverable Added Rev 2

xi. Radiator Fluid Manifolds

- EC2 Branch review of deliverable Added Rev 2

xii. Radiator SINDA thermal model

- EC2 Branch review of deliverable Added Rev 2

xiii. Porous Media Condensing Heat Exchanger Engineering Development Unit

- EC2 Branch review of deliverable

5.6 Cold Stowage Equipment Development and Certification

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide flight hardware development and certification products for ISS payload cold stowage.

5.6.1 Phase Change Materials Packs (Icepac) Updated Rev 1

Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall design, fabricate, and certify Icepac capsules, provide pre and post flight processing activities, conduct crew training, performance testing, and sustaining engineering. The contractor shall also investigate new Phase Change Materials and design and certify a second generation of Icepac. The flight hardware development products are listed in the 5.6.1 Product Table and detailed in the "EC2 FY05 Cold Stowage Development and Certification Plan" and the "EC2 FY06 Cold Stowage Development and Certification Plan".

5.6.2 MELFI Improved Tray Updated Rev 1

Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall design and develop new MELFI trays in accordance with the specified MELFI requirements. This task includes design and fabricating prototype trays, and performing functional tests. The hardware development products are listed in the 5.6.2 Product Table and detailed in the "EC2 FY05 Cold Stowage Development and Certification Plan" (CTSD-DOP-003). This task ends at the end of FY 05, there are no tasks associated with this task in FY 06.

5.6.3 Coldbag Updated Rev 2

Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall provide development, certification and sustaining engineering for the Coldbags. This task includes fabricating and certifying Single and Double Coldbags, providing pre and post-launch processing activities, conducting crew training and performance testing. This task also includes design and fabrication of an improved performance Coldbag(s). The flight hardware development products are listed in the 5.6.3 Product Table and detailed in the "EC2 FY05 Cold Stowage Development and Certification Plan" and the "EC2 FY06 Cold Stowage Development and Certification Plan".

5.6.4 Glacier Added Rev 1

Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall provide certification processing activities for Glacier. This task includes review and processing of Glacier certification products and activities including safety and design packages. The Glacier products are listed in the 5.6.4 Product Table and detailed in the "EC2 FY06 Cold Stowage Development and Certification Plan".

5.6.5 Small Payloads Updated Rev 2

Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall maintain a flight ready inventory of GN2 Cryodewars. The Contractor shall also provide pre and post flight processing activities, conduct crew training, performance testing, and sustaining engineering. The contractor shall propose and begin the certification process for common biological sample holders to be used in conjunction with Coldbag, Icepac, and MELFI. The flight hardware development products are listed in the 5.6.5 Product Table and detailed in the "EC2 FY06 Cold Stowage Development and Certification Plan".

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
CTSD-DOP-003	EC2 FY05 Cold Stowage Development and Certification Plan	Current
CTSD-DOP-007 Added Rev 1	EC2 FY06 Cold Stowage Development and Certification Plan	Current
JPR 8500.4 Added Rev 1	Engineering Drawing System Manual	Rev. J
JSC 21937 Added Rev 1	Verification Matrix for the Cellular Biotechnology Cryodewar	
JSC 28970 Added Rev 1	ARM for the Cellular Biotechnology Cryodewar	Rev C
JSC 47982	Statement of Work for CTSD Cold Stowage and GFE Hardware Development and Operations	Rev Baseline
JSC 60361	Icepac Applicable Requirements Matrix (ARM)	Rev A
JSC 62040	ARM for the Cold Stowage Insulated Sample Bag	Rev A
JSC 62108	Coldbag to Payload Interface Definition Document	Rev Baseline
JSC 62149	MIT Applicable Requirements Matrix	(upon baseline release)
JSC 62196	Icepac Verification Matrix	Rev A
JSC 62268	Verification Matrix for the Cold Stowage Insulated Sample Bag	Rev Baseline
JSC 65119 Added Rev 2	Cold Stowage Sustaining Engineering Plan	Rev Basic
MELFI-DWG-03201-002-LIN	MELFI Dewar Internal View	
MELFI-DWG-03201-003-LIN	MELFI Dewar Sections	
SSP 57908	MELFI System Requirements Document	
SSP57932	Payload Integration Agreement for Icepacs	

c. **Required DRDs**

5.6.1 Phase Change Materials Packs (Icepac)

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 1	Engineering Drawings and Model Files	3
107 Added Rev 1	Test Report	5
230 Updated Rev 2	Acceptance Data Package	10
233 Added Rev 1	Government Certification Approval Request (GCAR)	1
235 Added Rev 1	Space Station Payload Safety Data Package	1

5.6.2 MELFI Improved Tray

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 1	Engineering Drawings and Model Files	3
107 Deleted Rev 1	Test Report	1
218 Added Rev 3	Engineering Analysis	1

5.6.3 Coldbag

DRD #	DRD Title	Quantity/Frequency

102 Added Rev 1	Engineering Drawings and Model Files	3
107 Added Rev 1	Test Report	10
230 Updated Rev 2	Acceptance Data Package	5
233 Updated Rev 2	Government Certification Approval Request (GCAR)	2
235 Updated Rev 2	Space Station Payload Safety Data Package	1

5.6.4 Glacier

DRD #	DRD Title	Quantity/Frequency
Added Rev 1	No Requirement	

5.6.5 Small Payloads

DRD #	DRD Title	Quantity/Frequency
107 Added Rev 1	Test Report	1
235 Added Rev 1	Space Station Payload Safety Data Package	1

d. **Products**

5.6.1 Phase Change Materials Packs (Icepac)

Product(s)	Quantity	Delivery Date
Icepac Hardware Product	650	9/30/2005
Acceptance Data Package	6	9/30/2005
Sustaining Engineering Plan	1	12/31/2005
Redesign Icepac Hardware Product	1500	9/30/2006
Acceptance Data Package	4	9/30/2006

5.6.2 MELFI Improved Tray

Product(s)	Quantity	Delivery Date
MELFI Improved Tray Product	4	9/30/2005
MELFI Improved Tray Thermal Analysis Report	1	9/30/2006

5.6.3 Coldbag

Product(s)	Quantity	Delivery Date
Coldbag Hardware Product	10	9/30/2005
Improved Performance Double Coldbag Product	1	9/30/2006
Engineering Analysis (Thermal) Updated Rev 3	3	8/30/2006
Coldbag Acceptance Data Package	5	9/30/2006
Single Coldbag Product	6	9/30/2006

5.6.4 Glacier

Product(s)	Quantity	Delivery Date
Phase II SDP Submittal to PSRP	1	9/30/2006
Action Item Log	12	1 per month (FY06)

5.6.5 Small Payloads

Product(s)	Quantity	Delivery Date
Series Reflight Assessment Approval	1	9/30/2006

e. **Product Verification**

5.6.1 Phase Change Materials Packs (Icepac)

i. Icepac Hardware Product

- Per JSC 62196, Icepac Verification Matrix, and EC2 Branch review of deliverable

ii. Acceptance Data Package

- Per JSC 62196, Icepac Verification Matrix, and EC2 Branch review of deliverable

iii. Sustaining Engineering Plan

- Per JSC 62196, Icepac Verification Matrix, and EC2 Branch review of deliverable

iv. Redesign Icepac Hardware Product

- Per JSC 62196, Icepac Verification Matrix, and EC2 Branch review of deliverable

v. Acceptance Data Package

- Per JSC 62196, Icepac Verification Matrix, and EC2 Branch review of deliverable

5.6.2 MELFI Improved Tray

i. MELFI Improved Tray Product

- EC2 Branch review of deliverable

ii. MELFI Improved Tray Thermal Analysis Report

- EC2 Branch review of deliverable

5.6.3 Coldbag

i. Coldbag Hardware Product

- Per JSC 62268, Verification Matrix for the Cold Stowage Insulated Sample Bag, and EC2 Branch review of deliverable

ii. Improved Performance Double Coldbag Product

- Per JSC 62268, Verification Matrix for the Cold Stowage Insulated Sample Bag, and EC2 Branch review of deliverable

iii. Engineering Analysis (Thermal) Updated Rev 3

- EC2 Project Manager review of deliverable Updated Rev 3

iv. Coldbag Acceptance Data Package

- Per JSC 62268, Verification Matrix for the Cold Stowage Insulated Sample Bag, and EC2 Branch review of deliverable

v. Single Coldbag Product

- Per JSC 62268, Verification Matrix for the Cold Stowage Insulated Sample Bag, and EC2 Branch review of deliverable

5.6.4 Glacier

i. Phase II SDP Submittal to PSRP

- Per signed Phase II Safety Assessment

ii. Action Item Log

- EC2 Project Manager review of deliverable

5.6.5 Small Payloads

i. Series Reflight Assessment Approval

- Per signed Reflight Assessment Form

5.7 AIM - HSRT Evaluations and Advanced EVA Analysis

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide analyses and evaluations for AIM, HSRT and Advanced EVA development projects.

5.7.1 AIM and HSRT Evaluations Updated Rev 1

Project Code:

The contractor shall provide AIM and HSRT engineering analysis and evaluation products. The contractor shall provide AIM Technology Integration Assessments to evaluate Life Support and Habitability technologies and characteristics. The engineering analysis and evaluation products are listed in the 5.7.1 Product Table and detailed in the "EC2 FY05 Engineering Analysis Plan" and the "EC2 FY06 Engineering Analysis Plan".

5.7.2 Advanced EVA Analysis Updated Rev 1

Project Code:

The contractor shall provide Advanced EVA engineering analysis and evaluation products. These products shall evaluate Advanced EVA technologies and characteristics including new conceptual EVA suit designs, pressure considerations, landing location impacts on EVA, and EVA contingency/emergency requirements. The engineering analysis and evaluation products are listed in the 5.7.2 Product Table and detailed in the "EC2 FY05 Engineering Analysis Plan" and the "EC2 FY06 Engineering Analysis Plan".

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-001	EC2 FY05 Engineering Analysis Plan	Current
CTSD-DOP-005 Added Rev 1	EC2 FY06 Engineering Analysis Plan	Current
JSC-28918	EVA Design Requirements and Considerations	Baseline
JSC-38571C	Advanced Life Support Requirements Document	Rev. C
JSC-47804	Advanced Life Support Baseline Values and Assumptions Document	Rev. A

c. **Required DRDs**

5.7.1 AIM and HSRT Evaluations

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
218 Updated Rev 2	Engineering Analysis	4

5.7.2 Advanced EVA Analysis

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
218 Updated Rev 2	Engineering Analysis	8

d. **Products**

5.7.1 AIM and HSRT Evaluations

Product(s)	Quantity	Delivery Date
Technology Integration Assessment Reports	4	9/30/2005
Technology Integration Assessment Reports - (Deleted) Deleted Rev 2	0	9/30/2006

5.7.2 Advanced EVA Analysis

Product(s)	Quantity	Delivery Date
Advanced EVA Evaluation Reports	4	9/30/2005
Advanced EVA Evaluation Reports	4	9/30/2006

e. **Product Verification**

5.7.1 AIM and HSRT Evaluations
i. Technology Integration Assessment Reports
- EC2 Branch review of deliverable
ii. Technology Integration Assessment Reports - (Deleted) Deleted Rev 2
- EC2 Branch review of deliverable Deleted Rev 2

5.7.2 Advanced EVA Analysis
i. Advanced EVA Evaluation Reports
- EC2 Branch review of deliverable
ii. Advanced EVA Evaluation Reports
- EC2 Branch review of deliverable

5.8 Vehicle ECLSS Analysis and Advanced LCVG Studies Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide analyses and evaluations of Vehicle ECLSS processes and hardware. Also, the contractor shall provide analytical analyses and evaluations Advanced LCVG technologies including the use of flexible fabrics with high thermal conductivity. Updated REV 8

5.8.1 Vehicle ECLSS Analysis and Advanced LCVG Evaluations Updated REV 8

Project Code:

The contractor shall perform the Vehicle ECLSS and Advanced LCVG engineering analysis and evaluation products listed in the 5.8.1 Product Table and detailed in the applicable Engineering Analysis Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-001	EC2 FY05 Engineering Analysis Plan	Current
CTSD-DOP-005 Added Rev 1	EC2 FY06 Engineering Analysis Plan	Current
CTSD-DOP-010 Added Rev 7	EC2 FY07 Engineering Analysis Plan	current
CTSD-DOP-012 Added Rev 7	EC2 FY08 Engineering Analysis Plan	Current
CTSD-DOP-014 Added Rev 7	EC2 FY09 Engineering Analysis Plan	current
JSC 47804 Added Rev 3	Advanced Life Support Baseline Values and Assumptions Document	A
JSC 65527 Added Rev 7	Replaces JSC38571C	Current
JSC-28918	EVA Design Requirements and Considerations	Baseline
JSC-38571C Added Rev 3	Advanced Life Support Requirements Document	C

c. **Required DRDs**

5.8.1 Vehicle ECLSS Analysis and Advanced LCVG Evaluations

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
218 Updated Rev 7	Engineering Analysis	A/R

d. **Products**

5.8.1 Vehicle ECLSS Analysis and Advanced LCVG Evaluations

Product(s)	Quantity	Delivery Date
Flexible Fabric Application Analysis Reports	2	9/30/2005
Flexible Fabric Application Analysis Reports	1	9/30/2006
Constellation ECLSS Engineering Analysis Reports Added Rev 3	8	9/30/2007
Constellation ECLSS Engineering Analysis Reports Added Rev 7	8	9/30/2008
Constellation ECLSS Engineering Analysis Reports Added Rev 7	7	9/30/2009
Constellation ECLSS Engineering Analysis Reports Added Rev 7	7	9/30/2010
Vehicle ECLSS Engineering Analysis Reports Added REV 8	2	9/30/2011
Vehicle ECLSS Engineering Analysis Reports Added REV 8	2	9/30/2012
Vehicle ECLSS Engineering Analysis Reports Added REV 8	1	1/31/2013

e. **Product Verification**

5.8.1 Vehicle ECLSS Analysis and Advanced LCVG Evaluations
i. Flexible Fabric Application Analysis Reports
- EC2 Branch review of deliverable
ii. Flexible Fabric Application Analysis Reports
- EC2 Branch review of deliverable
iii. Constellation ECLSS Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 3
iv. Constellation ECLSS Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 7
v. Constellation ECLSS Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 7
vi. Constellation ECLSS Engineering Analysis Reports
- EC2 Branch review of deliverable Added Rev 7
vii. Vehicle ECLSS Engineering Analysis Reports
- EC2 Branch review of deliverable Added REV 8
viii. Vehicle ECLSS Engineering Analysis Reports
- EC2 Branch review of deliverable Added REV 8
ix. Vehicle ECLSS Engineering Analysis Reports
- EC2 Branch review of deliverable Added REV 8

5.9 Vehicle Active Thermal Control Analysis Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide analytical analyses and evaluations of vehicle thermal control approach and thermal hardware. Updated REV 8

5.9.1 Vehicle Thermal Control and Hardware Thermal Evaluations Updated REV 8

Project Code:

The contractor shall perform the engineering analyses and studies listed in the 5.9.1 Product Table and detailed in the applicable EC2 FY Engineering Analysis Plan. Note: FY11, FY12, and FY13 work will be in accordance with the most up to date Engineering Analysis Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CTSD-DOP-005 Added Rev 2	EC2 FY06 Engineering Analysis Plan	Current
CTSD-DOP-010 Added Rev 7	EC2 FY07 Engineering Analysis Plan	current
CTSD-DOP-012 Added Rev 7	EC2 FY08 Engineering Analysis Plan	current
CTSD-DOP-014 Added Rev 7	EC2 FY09 Engineering Analysis Plan	current

MSAD-04-0333 Added Rev 2	Radiator Sink Temperature for Simplified Lunar Mission Spacecraft Configurations in Low Earth Orbit, Lunar Transit, and Low Lunar Orbit Current

c. **Required DRDs**

5.9.1 Vehicle Thermal Control and Hardware Thermal Evaluations

DRD #	DRD Title	Quantity/Frequency
218 Updated Rev 7	Engineering Analysis	A/R

d. **Products**

5.9.1 Vehicle Thermal Control and Hardware Thermal Evaluations

Product(s)	Quantity	Delivery Date
CEV Hardware Engineering Analysis Report Added Rev 2	1	9/30/2006
CEV Hardware Engineering Analysis Reports	11	9/30/2007
Envision Analysis Report Added Rev 7	1	9/30/2007
CEV Hardware Engineering Analysis Reports Added Rev 7	4	9/30/2008
CEV Hardware Engineering Analysis Reports Added Rev 7	4	9/30/2009
CEV Hardware Engineering Analysis Reports Added Rev 7	4	9/30/2010
Vehicle Thermal and Hardware Engineering Analysis Reports Added REV 8	4	9/30/2011
Vehicle Thermal and Hardware Engineering Analysis Reports Added REV 8	4	9/30/2012
Vehicle Thermal and Hardware Engineering Analysis Reports Added REV 8	1	1/31/2013

e. **Product Verification**

5.9.1 Vehicle Thermal Control and Hardware Thermal Evaluations

i. CEV Hardware Engineering Analysis Report

- EC2 Branch review of deliverable Added Rev 2

ii. CEV Hardware Engineering Analysis Reports

- EC2 Branch review of deliverable

iii. Envision Analysis Report

- EC2 Branch review of deliverable Added Rev 7

iv. CEV Hardware Engineering Analysis Reports

- EC2 Branch review of deliverable Added Rev 7

v. CEV Hardware Engineering Analysis Reports

- EC2 Branch review of deliverable Added Rev 7

vi. CEV Hardware Engineering Analysis Reports

- EC2 Branch review of deliverable Added Rev 7

vii. Vehicle Thermal and Hardware Engineering Analysis Reports

- TM and EC2 Branch review of deliverable Added REV 8

viii. Vehicle Thermal and Hardware Engineering Analysis Reports

- TM and EC2 Branch review of deliverable Added REV 8

ix. Vehicle Thermal and Hardware Engineering Analysis Reports

- TM and EC2 Branch review of deliverable Added REV 8

5.10 MELFI Added Rev 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide integration and operations of flight hardware development and certification for the Minus Eighty Laboratory Freezer for ISS (MELFI).
Added Rev 2

5.10.1 MELFI Integration and Operations Added Rev 2

Project Code:

The contractor shall provide the hardware definition and detailed design activities required for the European Space Agency (ESA)'s development and flight qualification of the Minus Eighty Laboratory Freezer for ISS (MELFI) (Flight Units 1, 2, 3) assigned to the Thermal Systems and Engineering Support Branch (EC2). The contractor shall provide support in project management, training, verification tracking, acceptance testing, system design analysis, analytical integration, definition and implementation of operational requirements, operations and logistics, and users function in integration and de-integration of cold stowage.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 2	Project Management of GFE Flight Projects	Rev D 02-04
NT-CWI-001 Added Rev 2	Task Performance Sheet (TPS)	Rev A 03-01
CTSD-DOP-0XX Added Rev 2	EC2 FY06 MELFI Project Plan	Current
SSP 52000-PDS Added Rev 2	Payload Data Sets Blank Book	Current
SSP 52054 Added Rev 2	ISSP Payloads Certification of Flight Readiness Implementation Plan	Current
SSP 57000 Added Rev 2	Pressurized Payload Interface Requirements Document	Current
SSP 57011 Added Rev 2	Payload Verification Program Plan	Current
SSP 57020 Added Rev 2	Pressurized Payloads Accommodation Handbook	Current
SSP 57059 Added Rev 2	Standard Payload Integration Agreement for Pressurized Payloads	Current
SSP 57070 Added Rev 2	Cold Stowage Interface Requirements Document	Current

c. **Required DRDs**

5.10.1 MELFI Integration and Operations

DRD #	DRD Title	Quantity/Frequency
218 Added Rev 2	Engineering Analysis	1
219 Added Rev 2	Flight Product User's Guide	1
232 Deleted Rev 3	System Safety Program Plan	1 per payload
235 Added Rev 3	Space Station Payload Safety Data Package	1 per payload

d. **Products**

5.10.1 MELFI Integration and Operations

Product(s)	Quantity	Delivery Date
Integrated Safety Assessment Added Rev 2	1	09/30/2006
MELFI Analysis Report Added Rev 2	1	09/30/2006
MELFI Console Handbook Added Rev 2	1	09/30/2006

e. **Product Verification**

5.10.1 MELFI Integration and Operations

i. Integrated Safety Assessment

- EC2 Branch review of deliverable Added Rev 2

ii. MELFI Analysis Report

- EC2 Branch review of deliverable Added Rev 2

iii. MELFI Console Handbook

- EC2 Branch review of deliverable Added Rev 2

5.11 Materials and Softgoods Laboratory Added Rev 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide materials engineering and analysis services for the CTSD Materials Development Laboratory and shall provide design services to develop softgoods items in the CTSD Softgoods Laboratory. Added Rev 2

5.11.1 Materials and Softgoods Laboratory Added Rev 2

Project Code:

The contractor shall provide materials engineering and analysis services for the CTSD Materials Development Laboratory to perform materials investigation tests, evaluate softgoods and non-metallic materials requirements, and provide recommendations for materials to be used in the ISS. The contractor shall provide design services to develop preliminary softgoods designs and prototypes in the CTSD Softgoods Laboratory.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NT-CWI-001 Added Rev 2	Task Performance Sheet (TPS)	Rev A 03-01
CSD - 533 Added Rev 2	Inspection and Acceptance Criteria for Stitches& Seams	Current
CTSD #SH-1192 Added Rev 2	Softgoods Laboratory Equipment Operating Procedures	Current
JPG 5322.1 Added Rev 2	Contamination Control Requirements Manual	Current
JPR 8500.4 Added Rev 2	Engineering Drawing System Manual	Current
JSC 26626 Added Rev 2	EVA Hardware Generic Design Requirement Document	Current
JSC 27301 Added Rev 2	Materials Control Plan for JSC Flight Hardware	Rev B
JSC SLP 4.4 Added Rev 2	Design Control JSC System Level Procedure	Current
PRC-9002 Added Rev 2	Process Specifications for Part Marking	Current
SSP 57000 Added Rev 2	Instructions for Labels & Decals	Current
WI-EC-4.4-1-3 Added Rev 2	Design and Fabrication of Flight Softgoods	Current

c. **Required DRDs**

5.11.1 Materials and Softgoods Laboratory

DRD #	DRD Title	Quantity/Frequency
107 Updated Rev 7	Test Report	A/R

d. **Products**

5.11.1 Materials and Softgoods Laboratory

Product(s)	Quantity	Delivery Date
Materials Lab Test Reports Added Rev 2	3	9/30/2006
Quarterly Report Summarizing the Set of Preliminary Softgoods Designs and Prototypes Produced	1	9/30/2006
Quarterly Reports Summarizing the Set of Preliminary Softgoods Designs and Prototypes Produced Added Rev 3	4	End of ea. Quarter in FY07
Materials Lab Test Reports Added Rev 3	4	9/30/2007
Quarterly Reports Summarizing the Set of Preliminary Softgoods Designs and Prototypes Produced Added Rev 7	A/R	Quarterly
Materials Lab Test Reports Added Rev 7	A/R	Quarterly

e. **Product Verification**

5.11.1 Materials and Softgoods Laboratory

i. Materials Lab Test Reports

- EC2 Branch review of deliverable Added Rev 2

ii. Quarterly Report Summarizing the Set of Preliminary Softgoods Designs and Prototypes Produced

- EC2 Branch review of deliverable

iii. Quarterly Reports Summarizing the Set of Preliminary Softgoods Designs and Prototypes Produced

- EC2 Branch review of deliverable Added Rev 3

iv. Materials Lab Test Reports

- EC2 Branch review of deliverable Added Rev 3

v. Quarterly Reports Summarizing the Set of Preliminary Softgoods Designs and Prototypes Produced

- EC2 Branch review of deliverable Added Rev 7

vi. Materials Lab Test Reports

- EC2 Branch review of deliverable Added Rev 7

5.12 Mechanical System Design Added Rev 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services for the development of preliminary designs to meet the objectives and requirements of the Crew and Thermal Systems Division (CTSD) projects. Added Rev 2

5.12.1 Mechanical System Design Added Rev 2

Project Code:

The contractor shall provide preliminary conceptual and detailed designs supporting CTSD projects. The design work to be performed under this task shall be mainly mechanical design but may also include some electrical design. The specific tasks can vary from simple ground support hardware, test fixtures, and mockups to highly complex flight hardware systems.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 8500.4 Added Rev 7	Engineering Drawing System Manual	Rev H 11-01
JSC-SLP-4.4 Added Rev 2	Design Control	Current
WI-EC-4.4-1-1 Added Rev 2	Hardware Design	Current

c. **Required DRDs**

5.12.1 Mechanical System Design

DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

d. **Products**

5.12.1 Mechanical System Design

Product(s)	Quantity	Delivery Date
Quarterly Report Summarizing the Set of Pre-release Conceptual and Detailed Designs Produced	1	9/30/2006
Quarterly Reports Summarizing the Set of Pre-release Conceptual and Detailed Designs Produced Added Rev 3	4	End of ea. Quarter in FY07
Quarterly Reports Summarizing the Set of Pre-release Conceptual and Detailed Designs Produced Added Rev 7	A/R	Quarterly

e. **Product Verification**

5.12.1 Mechanical System Design

i. Quarterly Report Summarizing the Set of Pre-release Conceptual and Detailed Designs Produced

- EC2 Branch review of deliverable

ii. Quarterly Reports Summarizing the Set of Pre-release Conceptual and Detailed Designs Produced

- EC2 Branch review of deliverable Added Rev 3

iii. Quarterly Reports Summarizing the Set of Pre-release Conceptual and Detailed Designs Produced

- EC2 Branch review of deliverable Added Rev 7

5.13 Advanced Thermal Control Systems Hardware Development Products Added Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall shall provide hardware development products for Heat Rejection and Advanced Thermal Control Systems. Added Rev 3

5.13.1 Development Hardware for Advanced Thermal Control Systems Updated REV 8

Project Code: 00039 ATCS

The contractor shall conceptualize, design, develop, integrate and test development hardware for Advanced Thermal Control Systems (ATCS) and provide the development hardware products listed in the 5.13.1 Product Table and detailed in the applicable EC FY Thermal Control System Hardware Development Plan. Note: FY11, FY12, and FY13 work will be in accordance with the most up to date Thermal Control System Hardware Development Plan.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 8500.4 Added Rev 7	Engineering Drawing System Manual	Rev H 11-01
CTSD-DOP-011 Added Rev 7	EC2 FY07 Thermal Control System Hardware Development Plan	Current
CTSD-DOP-013 Added Rev 7	EC2 FY08 Thermal Control System Hardware Development Plan	current
CTSD-DOP-015 Added Rev 7	EC2 FY09 Thermal Control System Hardware Development Plan	current

c. **Required DRDs**

5.13.1 Development Hardware for Advanced Thermal Control Systems

DRD #	DRD Title	Quantity/Frequency
107 Updated Rev 7	Test Report	A/R
218 Updated Rev 7	Engineering Analysis	A/R

d. **Products**

5.13.1 Development Hardware for Advanced Thermal Control Systems

Product(s)	Quantity	Delivery Date
Vapor Compression Heat Pump System Architecture Analysis Updated REV 8	1	9/28/2007
Contamination Insensitive Sublimator EDU Test Report Updated REV 8	1	9/28/2007
Contamination Insensitive Sublimator Stress Analysis Updated REV 8	1	9/28/2007
Contamination Insensitive Sublimator Prototype Hardware Updated REV 8	1	9/28/2007
Post Test Report for TCS Fluids Updated REV 8	1	9/28/2007
TRR for integrated Testing of Heat Rejection Hardware Updated REV 8	1	9/28/2007
Integrated Test Report for Heat Rejection Hardware Updated REV 8	1	9/28/2007
Quicklook Report on Fluid Sampling Added Rev 7	1	9/30/2008
Sublimator Driven Cold Plate EDUs fabricated Added Rev 7	3	9/30/2008
Test data file for Sublimator Driven Cold Plate Testing Added Rev 7	1	9/30/2008

Design TIM for Water Phase Change Material Added Rev 7	1	9/30/2008
End-of-Year Status Report for Life Testing of Energy Storage Heat Exchanger Added Rev 7	1	9/30/2008
Lunar Lander Radiator Trade Memo Added Rev 7	1	9/30/2008
Lunar Lander Heat Pump Trade Memo Added Rev 7	1	9/30/2008
Lunar Lander ATCS Loop Trade Memo Added Rev 7	1	9/30/2008
Lunar Lander ATCS Loop Trade Memo Added Rev 7	1	9/30/2008
Propylene Glycol Water Life Test Quarterly Reports Added Rev 7	4	9/30/2009
Sublimator Driven Coldplate test data file Added Rev 7	1	9/30/2009
MicroChannel Heat Exchanger test data file Added Rev 7	1	9/30/2009
Transient Sublimator Final Test Report Added Rev 7	1	9/30/2009
Electrochromic Radiator Coupon test data file Added Rev 7	1	9/30/2009
Freezable Radiator Test Coupon Added Rev 7	1	9/30/2009
Freezable Radiator Final Test Report Added Rev 7	1	9/30/2009
Modified ATCS Platform Added Rev 7	1	9/30/2009
Replicative Ice PCM Final Test Report Added Rev 7	1	9/30/2009
Rover EDU test data file Added Rev 7	1	9/30/2009
Phase Change Material Life Interim Test Reports Added Rev 7	2	9/30/2009
Propylene Glycol Water Life Test Stand Design Review Added Rev 7	1	9/30/2010
Sublimator Driven Coldplate Task Objective Document Added Rev 7	1	9/30/2010
MicroChannel Heat Exchanger Life Test Stand Design Review Added Rev 7	1	9/30/2010
Transient Sublimator Task Objective Document Added Rev 7	1	9/30/2010
Variable Heat Rejection Radiators Task Objective Document Added Rev 7	1	9/30/2010
Second Generation Ice PCM Pressure System Design Review Added Rev 7	1	9/30/2010
Rover Heat Sink Interstitial Material Study Task Objective Document Added Rev 7	1	9/30/2010
Heat Acquisition Report Added REV 8	Quarterly	through period of performance
Heat Transport Report Added REV 8	Biannually	through period of performance including 1 in January 2013
Heat Rejection Report Added REV 8	8	9/30/2011
Heat Rejection Report Added REV 8	8	9/30/2012
Heat Rejection Report Added REV 8	2	1/31/2013

e. **Product Verification**

5.13.1 Development Hardware for Advanced Thermal Control Systems

i. Vapor Compression Heat Pump System Architecture Analysis

- EC2 Branch review of deliverable

ii. Contamination Insensitive Sublimator EDU Test Report

- EC2 Branch review of deliverable

iii. Contamination Insensitive Sublimator Stress Analysis

- EC2 Branch review of deliverable

iv. Contamination Insensitive Sublimator Prototype Hardware

- EC2 Branch review of deliverable

v. Post Test Report for TCS Fluids

- EC2 Branch review of deliverable

vi. TRR for integrated Testing of Heat Rejection Hardware

- EC2 Branch review of deliverable

vii. Integrated Test Report for Heat Rejection Hardware

- EC2 Branch review of deliverable

viii. Quicklook Report on Fluid Sampling

- TM review of deliverable Added Rev 7

ix. Sublimator Driven Cold Plate EDUs fabricated

- TM review of deliverable Added Rev 7

x. Test data file for Sublimator Driven Cold Plate Testing
- TM review of deliverable Added Rev 7

xi. Design TIM for Water Phase Change Material
- TM review of deliverable Added Rev 7

xii. End-of-Year Status Report for Life Testing of Energy Storage Heat Exchanger
- TM review of deliverable Added Rev 7

xiii. Lunar Lander Radiator Trade Memo
- TM review of deliverable Added Rev 7

xiv. Lunar Lander Heat Pump Trade Memo
- TM review of deliverable Added Rev 7

xv. Lunar Lander ATCS Loop Trade Memo
- TM review of deliverable Added Rev 7

xvi. Lunar Lander ATCS Loop Trade Memo
- TM review of deliverable Added Rev 7

xvii. Propylene Glycol Water Life Test Quarterly Reports
- TM review of deliverable Added Rev 7

xviii. Sublimator Driven Coldplate test data file
- TM review of deliverable Added Rev 7

xix. MicroChannel Heat Exchanger test data file
- TM review of deliverable Added Rev 7

xx. Transient Sublimator Final Test Report
- TM review of deliverable Added Rev 7

xxi. Electrochromic Radiator Coupon test data file
- TM review of deliverable Added Rev 7

xxii. Freezable Radiator Test Coupon
- TM review of deliverable Added Rev 7

xxiii. Freezable Radiator Final Test Report
- TM review of deliverable Added Rev 7

xxiv. Modified ATCS Platform
- TM review of deliverable Added Rev 7

xxv. Replicative Ice PCM Final Test Report
- TM review of deliverable Added Rev 7

xxvi. Rover EDU test data file
- TM review of deliverable Added Rev 7

xxvii. Phase Change Material Life Interim Test Reports
- TM review of deliverable Added Rev 7

xxviii. Propylene Glycol Water Life Test Stand Design Review
- TM review of deliverable Added Rev 7

xxix. Sublimator Driven Coldplate Task Objective Document
- TM review of deliverable Added Rev 7

xxx. MicroChannel Heat Exchanger Life Test Stand Design Review
- TM review of deliverable Added Rev 7

xxxi. Transient Sublimator Task Objective Document
- TM review of deliverable Added Rev 7

xxxii. Variable Heat Rejection Radiators Task Objective Document
- TM review of deliverable Added Rev 7

xxxiii. Second Generation Ice PCM Pressure System Design Review
- TM review of deliverable Added Rev 7

xxxiv. Rover Heat Sink Interstitial Material Study Task Objective Document
- TM review of deliverable Added Rev 7

xxxv. Heat Acquisition Report
- TM review of deliverable Added REV 8

xxxvi. Heat Transport Report

- TM review of deliverable Added REV 8

xxxvii. Heat Rejection Report

- TM review of deliverable Added REV 8

xxxviii. Heat Rejection Report

- TM review of deliverable Added REV 8

xxxix. Heat Rejection Report

- TM review of deliverable Added REV 8

DO 055 R8 Summary

DO 055 R8 Summary		ContractYear								
SLC		CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	Grand Total
EN1										
	Sum of Hrs									
	Sum of Dollars									
EN2										
	Sum of Hrs									
	Sum of Dollars									
EN3										
	Sum of Hrs									
	Sum of Dollars									
EN4										
	Sum of Hrs									
	Sum of Dollars									
ESS										
	Sum of Hrs									
	Sum of Dollars									
MGR										
	Sum of Hrs									
	Sum of Dollars									
SC1										
	Sum of Hrs									
	Sum of Dollars									
SC3										
	Sum of Hrs									
	Sum of Dollars									
SV										
	Sum of Hrs									
	Sum of Dollars									
ZP0										
	Sum of Hrs									
	Sum of Dollars									
ZP1										
	Sum of Hrs									
	Sum of Dollars									
BS2										
	Sum of Hrs									
	Sum of Dollars									
TN1										
	Sum of Hrs									
	Sum of Dollars									
TN2										
	Sum of Hrs									
	Sum of Dollars									
TN3										
	Sum of Hrs									

	Sum of Dollars
AS3	
	Sum of Hrs
	Sum of Dollars
SC2	
	Sum of Hrs
	Sum of Dollars
SE	
	Sum of Hrs
	Sum of Dollars
AS2	
	Sum of Hrs
	Sum of Dollars
IT2	
	Sum of Hrs
	Sum of Dollars
BS1	
	Sum of Hrs
	Sum of Dollars
ET3	
	Sum of Hrs
	Sum of Dollars
PC1	
	Sum of Hrs
	Sum of Dollars
QA2	
	Sum of Hrs
	Sum of Dollars
BS3	
	Sum of Hrs
	Sum of Dollars
QA1	
	Sum of Hrs
	Sum of Dollars
QE2	
	Sum of Hrs
	Sum of Dollars
PM	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	

Fee (100% of Pool) Total	25,624,535

64

DO Revision Change History

DO 55 Revision History:	Total Cost	Reason for Revision
Original	$1,423,685	N/A
Revision 1	$4,460,169	Adds FY06 Authorizations
Revision 2	$5,229,724	Increases FY06 Authorizations and moved Task Order work (Softgoods & Materials, Design, and MELFI tasks) into Delivery Order 55.
Revision 3	$8,751,764	This revision adds FY07 scope to: 5.1 "Analysis Tools Maintenance and Development" 5.2 "ISS EVA Thermal Analysis" 5.3 "Advanced Life Support (ALS) Systems Integrations, Modeling and Analysis (SIMA)" 5.8 "Constellation ECLSS Analysis and Advanced LCVG Studies" 5.9 "Constellation Active Thermal Control Analysis" 5.11 "Materials and Softgoods Laboratory" 5.12 "Mechanical System Design" This revision adds the following new FY07 WBS: 5.13 "Advanced Thermal Control Systems Hardware Development Products" This revision includes minor changes to the following FY06 WBS products: 5.5 "Heat Rejection and Advanced Thermal Control Systems Hardware Development" 5.6 "Cold Stowage Equipment Development and Certification" This revision marks the end of activities in the following: 5.5 "Heat Rejection and Advanced Thermal Control Systems Hardware Development" (FY07 work is being transferred to WBS 5.13 within DO55) 5.6 "Cold Stowage Equipment Development and Certification" (FY07 work is being transferred to the new DO191) 5.7 "Advanced Integration Matrix (AIM) - Human Systems Research & Technology (HSRT) Assessments and Advanced EVA Analysis" (No FY07 tasks planned for this WBS) 5.10 "MELFI" (FY07 work is being transferred to the new DO191)
Revision 4	$8,328,372	This revision adds FY07 scope to: 5.9 "Constellation Active Thermal Control Analysis"

DO 55 Revision History:	Total Cost	Reason for Revision
		5.11 "Materials and Softgoods Laboratory" This revision reduces FY07 authorization/scope for: 5.3 "Advanced Life Support (ALS) Systems Integrations, Modeling and Analysis (SIMA)" 5.5 "Heat Rejection and Advanced Thermal Control Systems Hardware Development" 5.12 "Mechanical System Design"
Revision 5	11,619,351	This revision adds FY08 scope to: 5.1 "Analysis Tools Maintenance and Development" 5.2 "ISS EVA Thermal Analysis" 5.3 "Advanced Life Support (ALS) Systems Integrations, Modeling and Analysis (SIMA)" 5.8 "Constellation ECLSS Analysis and Advanced LCVG Studies" 5.9 "Constellation Active Thermal Control Analysis" 5.11 "Materials and Softgoods Laboratory" 5.12 "Mechanical System Design" 5.13 "Advanced Thermal Control Systems Hardware Development Products"
Revision 6	15,344,854	This revision adds FY09 scope to: 5.1 "Analysis Tools Maintenance and Development" 5.2 "ISS EVA Thermal Analysis" 5.3 "Advanced Life Support (ALS) Systems Integrations, Modeling and Analysis (SIMA)" 5.8 "Constellation ECLSS Analysis and Advanced LCVG Studies" 5.9 "Constellation Active Thermal Control Analysis" 5.11 "Materials and Softgoods Laboratory" 5.12 "Mechanical System Design" 5.13 "Advanced Thermal Control Systems Hardware Development Products"
Revision 7	$18,815,824	This revision changes FY09 scope and adds FY10 scope to: 5.1 "Analysis Tools Maintenance and Development" 5.2 "ISS EVA Thermal Analysis" 5.3 "Advanced Life Support (ALS) Systems Integrations, Modeling and Analysis (SIMA)" 5.8 "Constellation ECLSS Analysis and Advanced LCVG Studies" 5.9 "Constellation Active Thermal Control Analysis" 5.11 "Materials and Softgoods Laboratory" 5.12 "Mechanical System Design" 5.13 "Advanced Thermal Control Systems Hardware Development Products"
Revision 8	$25,624,532	This revision adds scope for FY11-13 to 5.1 "Analysis Tools Maintenance and Development" 5.2 "ISS EVA Thermal Analysis" 5.3 "Systems Integrations, Modeling and Analysis (SIMA)" 5.8 "Vehicle ECLSS Analysis and Advanced LCVG Studies" 5.9 "Vehicle Active Thermal Control Analysis" 5.11 "Materials and Softgoods Laboratory"

DO 55 Revision History:	Total Cost	Reason for Revision
		5.12 "Mechanical System Design" 5.13 "Advanced Thermal Control Systems Hardware Development Products"

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ05HC13D DO 61 Rev 8

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 05/27/05 – 10/14/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall
Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**
Signtature: **Adrian D. Clayton** Date: **11/07/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	EV Electromagnetic Compatibility Test and Analysis					
DO	61 R8					
	Est. Labor Costs	64				
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				64	
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$5,277,047.40

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ05HC13D-DO61 REV 8

Originator: DENISE ROMERO (EV511) (281) .48-8056 **TMR:** Cordelia Foster (EV) (281) 483-5265

Revision Summary:
Completes DO through 10/14/11, stop work issued by CO on 10/14/2011.

1. FROM Title of Effort: EV Electromagnetic Compatibility Test and Analysis Updated Rev 7
1. Title of Effort: Specialty Engineering Services

2. Date of Request: 10/06/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

e. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

f. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

g. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 8
The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 05/27/2005 and ends 10/14/2011.

5. Product Requirements

5.1 Space Shuttle Electromagnetic Compatibility Test and Analysis Updated Rev 7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall plan and perform EMI tests on GFE hardware and provide analysis for the Space Shuttle Program.

Planning shall include preparation for Test Readiness Reviews and evaluation of EMI test procedures, operate the facility to facilitate measurements, perform data reduction and storage, and assemble test data packages. One trip is planned each year for testing at KSC.

The contractor shall provide Electromagnetic Environmental Effects (E3) systems engineering and analysis for the Space Shuttle Program. Analysis shall include EMI-related design/development review activities and EMI analysis of designs and modified designs. The quantities per program are interchangeable and managed by the EMC/EMI CCB. The contractor shall prepare reports in memorandum form and include a description of the hardware design reviewed, a description of the analyses performed, and detailed explanation of design recommendations made with discussion of likely consequences if the recommendations are not implemented.

The contractor shall evaluate change requests and/or change request evaluation reports and EMI test evaluation reports.

The contractor shall plan and perform EMI tests of GFE hardware for the Space Shuttle Program.

The contractor shall prepare recommended changes or updates to the Space Shuttle requirements document SL-E-0002.

The contractor shall present or brief engineering assessment or analyses at Technical Interchange Meetings (TIM), and shall observe or perform testing at other Facilities.

Support to this CLIN will end on June 30, 2011 as the Space Shuttle retires.
Updated Rev 7

5.1.1 E3 Test Data Package
Project Code:

For each test, the contractor shall supply a Test Data Package containing at minimum:

1. Copies of data obtained during the test
    a. Comparison of data to specification requirements in graph and table format
    b. Laboratory ambient measurement data if required
    c. Pass/fail results
    d. Time line of test
2. List of equipment with calibration due dates for equipment utilized in the test
3. Photographs of test setup
4. Remarks

5.1.2 Engineering Analysis Updated Rev 2
Project Code:

For each analysis, the contractor shall supply a report consisting of:

1. Description of the hardware design reviewed
2. Description of the analyses performed
3. Detailed explanation of design recommendations made with discussion of likely consequences if the recommendations are not implemented

4. Remarks

b. Applicable Documents

Document Number	Document Name	Rev.
EV-021	Procedures for Client Use of Avionic Systems Division Laboratories	07/15/2003
JPR 1700.1 Added Rev 4	JSC Safety & Health Handbook	Rev. J, 04-2008
JSC-27743	EMC Test Methods for Shuttle Orbiter Equipment/Experiments	02/01/1997
JSC-27773	Avionic Systems Division General Operating Procedures	01/01/1999
JSC-62581 Added Rev 3	ASD Lab Policy	11/2003
NT-CWI-001 Added Rev 4	Task Performance Sheet (TPS)	Rev C, 07-2008
NT-CWI-003 Added Rev 4	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev. C, 11-2006
RE3-82-14110	Operator Certification Procedure for Hewlett Packard Model 8582A Automatic Spectrum	01/01/1998
SL-E-0002	Space Shuttle Specification, Electromagnetic Interference Characteristics, Requirements for Equipment	08/10/2001

c. Required DRDs

5.1.1 E3 Test Data Package

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 7	Regular Status Report/Summary Review	1 per month (TCSR Status)
107 Updated Rev 2	Test Report	1 report per test

5.1.2 Engineering Analysis

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 7	Regular Status Report/Summary Review	1 per month (TCSR Status)
202 Deleted Rev 6	Flight Products Systems Requirements Review (SRR) Data Package	1 report per month
218 Updated Rev 2	Engineering Analysis	1 per analysis

d. Products

5.1.1 E3 Test Data Package

Product(s)	Quantity	Delivery Date
E3 Test Data Package	25 per year	within 5 days of test completion
Status Report and Summaries	1 per month	monthly ending 6/30/2011

5.1.2 Engineering Analysis

Product(s)	Quantity	Delivery Date
Engineering Analysis Report	1 per analysis	6 per year
Flight Products System Requirements Review Report Deleted Rev 2	57	1/month
Status Report and Summaries Added Rev 7	1 per month	monthly ending 6/30/2011

e. Product Verification

5.1.1 E3 Test Data Package

i. E3 Test Data Package

- Test Data Package will be reviewed and approved by the TMR

ii. Status Report and Summaries

- All Status Reports and Summaries are delivered to and verified by the EV5 Branch Chief.

5.1.2 Engineering Analysis

i. Engineering Analysis Report

- Engineering Analysis Report will be reviewed and approved by the TMR

ii. Flight Products System Requirements Review Report Deleted Rev 2

- Flight Products System Requirements Report will be reviewed and approved by the TMR Deleted Rev 2

iii. Status Report and Summaries

- All Status Reports and Summaries are delivered to and verified by the EV5 Branch Chief. Added Rev 7

5.2 Space Station Electromagnetic Compatibility Test and Analysis Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide planning, management, and implementation activities to assure the electromagnetic compatibility for the Space Station Program and Government Furnished Equipment (GFE) hardware by test and analysis. The contractor shall provide support to the Electromagnetic Effects Control Board (EMC/EMI) in evaluation of GFE Tailoring Interpretation Agreements (TIA) against USA EMC requirements and Russian EMC requirements. The quantities per program are interchangeable and managed by the EMC/EMI CCB.

Planning shall include preparation for Test Readiness Reviews and evaluation of EMI test procedures.

The contractor shall provide Electromagnetic Environmental Effects (E3) systems engineering and analysis for the Space Station Program and elements. Analysis shall include EMI-related design/development review activities and EMI analysis of designs and modified designs. The contractor shall prepare reports in memorandum form and include a description of the hardware design reviewed, a description of the analyses performed, and detailed explanation of design recommendations made with discussion of likely consequences if the recommendations are not implemented.

The contractor shall evaluate change requests and/or change request evaluation reports and EMI test evaluation reports.

The contractor shall plan and perform EMI tests of GFE hardware for the Space Station Program.

The contractor shall prepare recommended changes or updates to Space Station requirements documents SSP-30237, SSP-30238, and SSP-50094.

Contractor shall provide briefings at technical interchange meetings and observe testing at International Partner Facilities. One trip each to Tokyo, Japan and Moscow, Russia is planned for each year of the delivery order. Updated Rev 6

5.2.1 E3 Test Data Package Updated REV 8

Project Code:

For each test, the contractor shall supply a Test Data Package containing at minimum:

1. Copies of data obtained during the test
    a. Comparison of data to specification requirements in graph and table format
    b. Laboratory ambient measurement data if required
    c. Pass/fail results
    d. Time line of test
2. List of equipment with calibration due dates for equipment utilized in the test
3. Photographs of test setup
4. Remarks

5.2.2 Engineering Analysis Updated REV 8
Project Code:

For each analysis, the contractor shall supply a report consisting of:

1. Description of the hardware design reviewed

2. Description of the analyses performed

3. Detailed explanation of design recommendations made with discussion of likely consequences if the recommendations are not implemented

4. Remarks

b. **Applicable Documents**

Document Number	Document Name	Rev.
EV-021	Procedures for Client Use of Avionic Systems Division Laboratories	07/15/2003
JPR 1700.1 Added Rev 4	JSC Safety & Health Handbook	Rev. J, 04-2008
JSC-27773	Avionic Systems Division General Operating Procedures	01/01/1999
JSC-62581 Added Rev 3	ASD Lab Policy	11/2003
NT-CWI-001 Added Rev 4	Task Performance Sheet (TPS)	Rev C, 07-2008
NT-CWI-003 Added Rev 4	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev C, 11-2006
RE3-82-14110	Operator Certification Procedure for Hewlett Packard Model 8582A Automatic Spectrum Analyzer System	01/01/1998
SSP-30237	Space Station Electromagnetic Emission and Susceptibility Requirements	11/2003
SSP-30238	Space Station Electromagnetic Techniques	12/22/1998
SSP-50094	NASA/RSA Joint Specification Standards Document for the ISS Russian Segment	03/10/2000

c. **Required DRDs**

5.2.1 E3 Test Data Package

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 7	Regular Status Report/Summary Review	1 per month (TCSR Status)
107 Updated Rev 2	Test Report	1 report per test

5.2.2 Engineering Analysis

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 7	Regular Status Report/Summary Review	1 per month (TCSR Status)
202 Deleted Rev 6	Flight Products Systems Requirements Review (SRR) Data Package	1 report per month
218 Updated Rev 2	Engineering Analysis	1 per analysis

d. **Products**

5.2.1 E3 Test Data Package

Product(s)	Quantity	Delivery Date
E3 Test Data Package Updated REV 8	25 per year	within 5 days of test completion
Status Reports and Summaries Updated REV 8	1 per month	monthly ending 10/06/2011

5.2.2 Engineering Analysis		
Product(s)	**Quantity**	**Delivery Date**
Engineering Analysis Report Updated REV 8	1 per analysis	6 per year
Flight Products System Requirements Report Deleted Rev 2	1 per analysis	1 report per month
Status Reports and Summaries Updated REV 8	1 per month	monthly ending 10/06/2011

e. **Product Verification**

5.2.1 E3 Test Data Package
i. E3 Test Data Package
- Test Data Package will be reviewed and approved by the TMR
ii. Status Reports and Summaries
- All Status Reports and Summaries are delivered to and verified by the EV5 Branch Chief.

5.2.2 Engineering Analysis
i. Engineering Analysis Report
- Engineering Analysis Report will be reviewed and approved by the TMR
ii. Flight Products System Requirements Report Deleted Rev 2
- Flight Products System Requirements Report will be reviewed and approved by the TMR Deleted Rev 2
iii. Status Reports and Summaries
- All Status Reports and Summaries are delivered to and verified by the EV5 Branch Chief.

5.3 Constellation and Crew Exploration Vehicle Electromagnetic Compatibility Test and Analysis Updated Rev 7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall plan and perform EMI tests on hardware and provide analysis for the Constellation Program and the Crew Exploration Vehicle project.

Planning shall include preparation for Test Readiness Reviews and evaluation of EMI test procedures.

The contractor shall provide Electromagnetic Environmental Effects (E3) systems engineering and analysis for the Constellation Program and the Crew Exploration Vehicle project. Analysis shall include EMI-related design/development review activities and EMI analysis of designs and modified designs. The quantities per program are interchangeable and managed by the EMC/EMI CCB. The contractor shall prepare reports in memorandum form and include a description of the hardware design reviewed, a description of the analyses performed, and detailed explanation of design recommendations made with discussion of likely consequences if the recommendations are not implemented.

The contractor shall evaluate change requests and/or change request evaluation reports and EMI test evaluation reports.

The contractor shall plan and perform EMI tests of hardware for the Constellation Program and the Crew Exploration Vehicle project. The quantities per program are interchangeable and managed by the EMC/EMI CCB.

The contractor shall prepare recommended changes or updates to Constellation Program and the Crew Exploration Vehicle project EMI and EMC documents.

The contractor shall present or brief engineering assessment or analyses at Technical Interchange Meetings (TIM), and shall observe or perform testing at other Facilities. This travel is required for contractor to perform Orion specification development and hardware design at vendor facilities. Currently there are three known trips. Six additional trips (average of three per year) to similar facilities may be required.

The EMC/EMI Configuration Control Board (CCB) approves project requests.

Support to this CLIN will end on September 30, 2010.

Updated Rev 7

5.3.1 E3 Test Data Package
Project Code:

For each test, the contractor shall supply a Test Data Package containing at minimum:

1. Copies of data obtained during the test

    a. Comparison of data to specification requirements in graph and table format

    b. Laboratory ambient measurement data if required

    c. Pass/fail results

    d. Time line of test

2. List of equipment with calibration due dates for equipment utilized in the test

3. Photographs of test setup

4. Remarks

5.3.2 Engineering Analysis
Project Code:

For each analysis, the contractor shall supply a report consisting of:

1. Description of the hardware design reviewed

2. Description of the analyses performed

3. Detailed explanation of design recommendations made with discussion of likely consequences if the recommendations are not implemented

4. Remarks

b. **Applicable Documents**

Document Number	Document Name	Rev.
CEV-T-025000	Project Orion CEV Electromagnetic Compatibility Control and Verification Document	11/01/2007
CxP 70080	Constellation Program Electromagnetic Environmental Effects (E3) Requirements	08/30/2007
CxP 70141	Constellation Program Electromagnetic Environmental Effects (E3) Control Plan	08/23/2007
EV-021	Procedures for Client Use of Avionic Systems Division Laboratories	07/15/2003
JPR 1700.1	JSC Safety & Health Handbook	Rev J, 04-2008
JSC-27743	EMC Test Methods for Shuttle Orbiter Equipment/Experiments	02/01/1997
JSC-27773	Avionic Systems Division General Operating Procedures	01/01/1999
Mil-STD-461E	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment	08/20/1999
Mil-STD-461F	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment	12/10/2007
NT-CWI-001	Task Performance Sheet (TPS)	Rev C, 07-2008
NT-CWI-003	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev C, 11-2006
RE3-82-14110	Operator Certification Procedure for Hewlett Packard Model 8528A Automatic Spectrum	01/01/1998

c. **Required DRDs**

5.3.1 E3 Test Data Package

DRD #	DRD Title	Quantity/Frequency

107	Test Report	1 report per test

5.3.2 Engineering Analysis		
DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	1 per analysis

d. **Products**

5.3.1 E3 Test Data Package		
Product(s)	Quantity	Delivery Date
E3 Test Data Package	80	within 5 days of test completion

5.3.2 Engineering Analysis		
Product(s)	Quantity	Delivery Date
Engineering Analysis Report	20	per Master Schedule iaw EMC/EMI CCB.

e. **Product Verification**

5.3.1 E3 Test Data Package

i. E3 Test Data Package

- Test Data Package will be reviewed and approved by the TMR

5.3.2 Engineering Analysis

i. Engineering Analysis Report

- Engineering Analysis Report will be reviewed and apporved by the TMR

5.4 Low Impact Docking System (LIDS) Electromagnetic Compatibility Test and Analysis Updated Rev 7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide Electromagnetic Environmental Effects (E3) evaluation and analysis, and plan and perform EMI tests, on LIDS avionic and electrical equipment.

The contractor shall provide E3 design & development evaluation and analysis support activities for hardware certification, electrical bonding application compliance, magnetic field scanning, completion of a vehicle electrostatic charging study for on-orbit operations, and determination of appropriate composition and review of LIDS flowdown E3 requirements.

The contractor shall plan and perform E3 tests of LIDS hardware, and shall provide data results of such tests as are performed for evlauation or analysis as required.

The quantities per program are interchangeable and managed by the EMC/EMI CCB.

Support to this CLIN will end on September 30, 2010. Updated Rev 7

5.4.1 Engineering Evaluation and Analysis
Project Code:

For each evaulation and/or analysis, the contractor shall provide a report consisting of:

1. Details of the subject of the evaulation and/or analysis.

2. Details of the evaulation and/or analysis performed.

3. Details of any recommendations made as a result of the evaulation and/or analysis, with discussion of likely ramifications of implementation of the recommnedations or the lack thereof.

4. Pertinent remarks

5.4.2 E3 Test Data Package
Project Code:

For each test, the contractor shall provide a Test Data Package containing at minimum

1. Copies of data obtained during the subject testing, including

    A. comparison of the the data to project specification requirements in graphical and numerical format

    B. measurement of the laboratory ambient electromagnetic environment in accordance with specification requirements

    C. test results with regard to pass/fail, if applicable

2. A list of test equipment, and its calibration status, utilized for the test

3. Photographs of all test setups utilized during the subject testing

4. Pertinent remarks

b. **Applicable Documents**

Document Number	Document Name	Rev.
CEV-T-025	Project Orion CEV Electromagnetic Compatibility Control and Verification Document	R2_07_09
CxP 70080	Constellation Program Electromagnetic Environmental Effects (E3) Requirements	Rev. A, Chg 1
CxP 70141	Constellation Program Electromagnetic Environmental Effects (E3) Control Plan	Rev. A
EV-021	Procedures for Client Use of Avionic Systems Division Laboratories	Rev. H
JPR 1700.1	JSC Safety & Health Handbook	Rev J, 04-2008
JSC-27773	Avionic Systems Division General Operating Procedures for Laboratories and Facilities	Rev. G
Mil-STD-461	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment	Rev. E
Mil-STD-461	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment	Rev. F
NT-CWI-001	Task Performance Sheet (TPS)	Rev C, 07-2008
NT-CWI-003	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev C, 11-2006

c. **Required DRDs**

5.4.1 Engineering Evaluation and Analysis

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per test

5.4.2 E3 Test Data Package

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	1 per analysis

d. **Products**

5.4.1 Engineering Evaluation and Analysis

Product(s)	Quantity	Delivery Date
E3 evaluation of LIDS avionic and electronic equipment	1 per project request	Per project request iaw EMC/EMI CCB
Review LIDS design drawings for electrical bonding application compliance	1 per drawing	Per project request iaw EMC/EMI CCB
Perform a LIDS spacecraft charging study, and determine expected potential difference between visiting vehicle LIDS and Station-mounted LIDS	1	12/31/09

5.4.2 E3 Test Data Package

Product(s)	Quantity	Delivery Date
EMI certification of LIDS avionic and electronic equipment	1 certification test per each	As required by project request iaw

	equipment	EMC/EMI CCB
Perform a LIDS magnetic field scan	1	As required by project request iaw EMC/EMI CCB

e. **Product Verification**

5.4.1 Engineering Evaluation and Analysis
i. E3 evaluation of LIDS avionic and electronic equipment
- Evaluations to be reviewed and approved by TMR
ii. Review LIDS design drawings for electrical bonding application compliance
- Reviews to be spot-checked and approved by TMR
iii. Perform a LIDS spacecraft charging study, and determine expected potential difference between visiting vehicle LIDS and Station-mounted LIDS
- Study results to be reviewed and approved by TMR

5.4.2 E3 Test Data Package
i. EMI certification of LIDS avionic and electronic equipment
- Test data packages to be reviewed and approved by TMR
ii. Perform a LIDS magnetic field scan
- Scan results to be reviewed and approved by TMR

5.5 EEE Parts and Radiation Added Rev 7

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide EEE Parts analysis and engineering services for flight hardware development in accordance with EEE Parts CCB procedures and includes radiation test planning and test execution. The quantities per program are interchangeable and managed by the EEE Parts CCB. Ten EEE parts reports total shall be delivered per FY irregardless of the program.

The contractor shall provide engineering services to perform the following tasks:
* Develop and implement JSC EEE parts processes and procedures.
* Prepare and present materials for PDR, CDR and FCA/PCA as required.
* Prepare memorandums or reports for EEE parts risk/screening/test/inspection recommendations.
* Perform MTBF prediction and radiation susceptibility assessments.
* Technical consultation for on site activities including Center EEE Parts, Working Group, NEPAG/NEPP, data reviews, and weekly CCB reviews.
* Coordinate audits of connector manufacturers.
* Participate on committees which review and revise connector specifications.
* Travel in support of radiation testing, project technical interchange meetings and audits. Added Rev 7

5.5.1 EEE Parts - Payloads Updated REV 8
Project Code:

The contractor shall provide EEE parts engineering services (including radiation) associated with the development of JSC payloads in accordance with the Applicable Documents listing.

5.5.2 EEE Parts - Space Shuttle Updated REV 8
Project Code:

The contractor shall provide EEE parts engineering services (including radiation) associated with the development of Space Shuttle hardware in accordance with the Applicable Documents listing.

Support to this section will end on June 30, 2011 as the Space Shuttle retires.

5.5.3 EEE Parts - Crew Exploration Vehicle (CEV) Updated REV 8
Project Code:

The contractor shall provide EEE parts engineering services (including radiation) associated with the development of Crew Exploration Vehicle hardware in accordance with the Applicable Documents listing, the Baseline versions of the Constellation

Program EEE Parts Plan and the Crew Exploration Vehicle EEE Parts Plan.

5.5.4 EEE Parts - International Space Station Updated REV 8
Project Code:

The contractor shall provide EEE parts engineering services (including radiation) associated with the development of International Space Station hardware in accordance with the Applicable Documents listing.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JSC 61360 Added Rev 7	Engineering Directorate Certified Parts Approval Process	Revi A
MF0004-400 Added Rev 7	Electrical, Electronic and Electromechanical Orbiter Project Parts Requirements (OPPR)	Rev F
SSP 30312 Added Rev 7	Electrical, Electronic and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program	Rev F 11-95
CxP-70133 Added Rev 7	Constellation Program Electrical, Electronics, and Electromechanical (EEE) Parts Plan	Baseline
JSC 49697 Added Rev 7	Constellation Program Electrical, Electronics, and Electromechanical (EEE) Parts Plan	A
JSC 61365 Added Rev 7	Component Engineers Handbook	NR
MIL-HDBK-217 Added Rev 7	Reliability Prediction of Electronic Equipment	F
NSTS-5300.4 (ID-2) Added Rev 7	Safety, Reliability, Maintainability and Quality Provisions for the Space Shuttle Program	NR

c. **Required DRDs**

5.5.1 EEE Parts - Payloads

DRD #	DRD Title	Quantity/Frequency
103 Added Rev 7	Electrical, Electronic, and Electromechanical (EEE) Parts List and Analysis Report	10 total per FY
105 Added Rev 7	Regular Status Report/Summary Review	1 per month (TCSR Status)
107 Added Rev 7	Test Report	14 total per FY

5.5.2 EEE Parts - Space Shuttle

DRD #	DRD Title	Quantity/Frequency
103 Added Rev 7	Electrical, Electronic, and Electromechanical (EEE) Parts List and Analysis Report	10 total per FY
105 Added Rev 7	Regular Status Report/Summary Review	1 per month (TCSR Status)
107 Added Rev 7	Test Report	14 total per FY

5.5.3 EEE Parts - Crew Exploration Vehicle (CEV)

DRD #	DRD Title	Quantity/Frequency
103 Added Rev 7	Electrical, Electronic, and Electromechanical (EEE) Parts List and Analysis Report	10 total per FY
105 Added Rev 7	Regular Status Report/Summary Review	1 per month (TCSR Status)
107 Added Rev 7	Test Report	14 total per FY

5.5.4 EEE Parts - International Space Station

DRD #	DRD Title	Quantity/Frequency
103 Added Rev 7	Electrical, Electronic, and Electromechanical (EEE) Parts List and Analysis Report	10 total per FY
105 Added Rev	Regular Status Report/Summary Review	1 per month (TCSR

7		Status)
107 Added Rev 7	Test Report	14 total per FY

d. **Products**

5.5.1 EEE Parts - Payloads

Product(s)	Quantity	Delivery Date
EEE parts analysis and report Updated REV 8	10 total per FY	Prelim. Rpt due 4 weeks prior to Project PDR. Final Report due 4 weeks prior to Project CDR.
Radiation Test Report Updated REV 8	14 total per FY	2 weeks after completion of test
Status Reports and Summaries Updated REV 8	12 total per FY	monthly ending 10/06/2011

5.5.2 EEE Parts - Space Shuttle

Product(s)	Quantity	Delivery Date
EEE parts analysis and report Updated REV 8	10 total per FY	Prelim. Rpt due 4 weeks prior to Project PDR. Final Report due 4 weeks prior to Project CDR.
Radiation Test Report Updated REV 8	14 total per FY	2 weeks after completion of test
Status Reports and Summaries Updated REV 8	12 total per FY	monthly ending 6/30/2011

5.5.3 EEE Parts - Crew Exploration Vehicle (CEV)

Product(s)	Quantity	Delivery Date
EEE parts analysis and report Updated REV 8	10 total per FY	Prelim. Rpt due 4 weeks prior to Project PDR. Final Report due 4 weeks prior to Project CDR.
Radiation Test Report Updated REV 8	14 total per FY	2 weeks after completion of test
Status Reports and Summaries Updated REV 8	12 total per FY	monthly ending 10/06/2011

5.5.4 EEE Parts - International Space Station

Product(s)	Quantity	Delivery Date
EEE parts analysis and report Updated REV 8	10 total per FY	Prelim. Rpt due 4 weeks prior to Project PDR. Final Report due 4 weeks prior to Project CDR.
Radiation Test Report Updated REV 8	14 total per FY	2 weeks after completion of test
Status Reports and Summaries Updated REV 8	12 total per FY	monthly ending 10/06/2011

e. **Product Verification**

5.5.1 EEE Parts - Payloads

i. EEE parts analysis and report

- All EEE Parts products are delivered to and verified by the EEE Parts CCB or the EV5 Branch Chief. Updated REV 8

ii. Radiation Test Report

- All Radiation products are delivered to and verified by the EEE Parts CCB or the EV5 Branch Chief. Updated REV 8

iii. Status Reports and Summaries

- All Status Reports and summarys are delivered to and verified by the EEE Parts Lead or the EV5 Branch Chief Updated REV 8

5.5.2 EEE Parts - Space Shuttle

i. EEE parts analysis and report

- All EEE Parts products are delivered to and verified by the EEE Parts CCB or the EV5 Branch Chief. Updated REV 8

ii. Radiation Test Report

- All Radiation products are delivered to and verified by the EEE Parts CCB or the EV5 Branch Chief. Updated REV 8

iii. Status Reports and Summaries
- All Status Reports and summarys are delivered to and verified by the EEE Parts Lead or the EV5 Branch Chief Updated REV 8

5.5.3 EEE Parts - Crew Exploration Vehicle (CEV)
i. EEE parts analysis and report
- All EEE Parts products are delivered to and verified by the EEE Parts CCB or the EV5 Branch Chief. Updated REV 8
ii. Radiation Test Report
- All Radiation products are delivered to and verified by the EEE Parts CCB or the EV5 Branch Chief. Updated REV 8
iii. Status Reports and Summaries
- All Status Reports and summarys are delivered to and verified by the EEE Parts Lead or the EV5 Branch Chief Updated REV 8

5.5.4 EEE Parts - International Space Station
i. EEE parts analysis and report
- All EEE Parts products are delivered to and verified by the EEE Parts CCB or the EV5 Branch Chief. Updated REV 8
ii. Radiation Test Report
- All Radiation products are delivered to and verified by the EEE Parts CCB or the EV5 Branch Chief. Updated REV 8
iii. Status Reports and Summaries
- All Status Reports and summarys are delivered to and verified by the EEE Parts Lead or the EV5 Branch Chief Updated REV 8

5.6 Electronic Computer Aided Design (ECAD) Added Rev 7

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering services for ECAD tools used for flight hardware development by the Johnson Space Center Engineering Directorate. Added Rev 7

5.6.1 ECAD Added Rev 7

Project Code: The contractor shall provide ECAD tools engineering services associated with the development of electronic hardware in accordance with the Applicable Documents Listing

The contractor shall provide engineering services to perform the following tasks for all Space Programs supported at the Johnson Space Center:

* Coordinate purchasing of annual license renewals.
* Identify need for additional licenses.
* Identify ECAD tools no longer needed/used.
* Present tool licensing needs to EV5 management and NASA ECAD Lead
* Establish a database interface process to DDMS for finalized designs.
* Initiate and organize vendor supplied training for ECAD tools.
* Participate in ECAD tools team meetings.
* Assist members in ECAD tool usage

* Travel may be required to perform work for ECAD Tool Products currently used or planned for use at JSC. The purpose for travel would include tool training and ECAD related conferences.

b. **Applicable Documents**

Document Number	Document Name	Rev.
IPC 2221 Added Rev 7	Generic Standard on Printed Board Design	Rev A 05-03
IPC 2222 Added Rev 7	Sectional Design Standard for Rigid Organic Printed Boards	02-98
IPC-6011 Added Rev 7	Generic Performance Specification for Printed Boards	07-96
IPC-6012 Added Rev 7	Qualification and Performance Specification for Rigid Printed Boards	Rev A 07-00
JPR 8500.4 Added Rev 7	Engineering Drawing System Manual	K

c. **Required DRDs**

5.6.1 ECAD		
DRD #	DRD Title	Quantity/Frequency
101 Added Rev 7	Project Schedule	1 per Quarter
105 Added Rev 7	Regular Status Report/Summary Review	1 per month (TCSR Status)

d. **Products**

5.6.1 ECAD		
Product(s)	**Quantity**	**Delivery Date**
Status Reports and Summaries Added Rev 7	1	1 per month (TCSR Status)
License Renewal and Purchasing Plan Added Rev 7	1	Quarterly
Project Schedule Added Rev 7	1	Quarterly

e. **Product Verification**

5.6.1 ECAD
i. Status Reports and Summaries
- Delivered to and verified by the EV5 Branch Chief.. Added Rev 7
ii. License Renewal and Purchasing Plan
- Delivered to and verified by the EV5 Branch Chief. Added Rev 7
iii. Project Schedule
- Delivered to and verified by the NASA ECAD Lead. Added Rev 7

6.0 Cost Summary

SLC	Type	CY1	CY2	CY3	CY4	CY5	CY6	CY7	G Total
AS2	Sum of Hours								
	Sum of Dollars								
BS1	Sum of Hours								
	Sum of Dollars								
EN2	Sum of Hours								
	Sum of Dollars								
EN3	Sum of Hours								
	Sum of Dollars								
EN4	Sum of Hours								
	Sum of Dollars								
ESS	Sum of Hours								
	Sum of Dollars								
IT2	Sum of Hours								
	Sum of Dollars								
IT3	Sum of Hours								
	Sum of Dollars								
MGR	Sum of Hours								
	Sum of Dollars								
PC1	Sum of Hours								
	Sum of Dollars								
PC2	Sum of Hours								
	Sum of Dollars								
QA2	Sum of Hours								
	Sum of Dollars								
QE1	Sum of Hours								
	Sum of Dollars								
QE2	Sum of Hours								
	Sum of Dollars								
QE4	Sum of Hours								
	Sum of Dollars								
SC4	Sum of Hours								
	Sum of Dollars								
TN1	Sum of Hours								
	Sum of Dollars								
TN2	Sum of Hours								
	Sum of Dollars								
TN3	Sum of Hours								
	Sum of Dollars								
Total Direct Labor Hours									
Total Direct Labor Costs									
Travel Costs									
Subcontract									
NLR Misc									
Materials									
Burden on Non-Labor									
Total Non Labor									
Total Costs									
Fee									
Total									$5,277,047.40

64

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ06HA93D DO 87 R7	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 483-7890
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 02/23/2006 - 01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Chuck Murgia

Signature: _____ Date: _____

10. Name: **J.R. Carpentier**

Signtature: **J.R. Carpentier** Date: **12/22/2009**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**EC7 EVA GFE Tools & Eqpt Projects**					
DO	**87 R7**		b4		b4	
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However, the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$27,134,115

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ06HA93D-DO87 REV 7

Originator: Jennifer Villarreal (EC) (281) 483-7306 **TMR:** Jennifer Villarreal (EC) (281) 483-7306

Revision Summary:

Revision 7 extends the period of performance to January 2013. It also references specific Project Directives for applicable DRDs replacing CTSD 2987. It adds $b4 for quality activities and shifts FY10 scope into FY11-FY13. It includes $b4 for materials and $88k in travel to be controlled by Project Directives (PDs).

1. FROM Title of Effort: EC7 EVA GFE Tools & Equipment Projects Updated Rev 5

1. Title of Effort: EC7 EVA & IVA GFE Tools & Equipment Projects

2. Date of Request: 11/09/2009

3. Statement of Work Task Description

a. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

b. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

c. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

d. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

e. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

f. **2.3.1 Product Development**

The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

g. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

h. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 7

This delivery order period of performance starts 12/01/2005 and ends 01/31/2013.

5. Product Requirements

5.1 EVA GFE Tools and Equipment Engineering Projects Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform highly-specialized engineering and technical services to accomplish the programmatic objectives of the NASA/JSC Crew and Thermal Systems Division for Shuttle, ISS, and Advanced NASA Programs.

Project Directives will be used define deliverables including scope, milestones, changes to applicable documents or reference documents, process tailoring, etc. Project Directives (PDs) will be approved by the EC7 CCB chair. The contractor shall track and maintain all PD and report costs at the PD level.

Updated Rev 5

5.1.1 Tile Repair Cure-In-Place-Ablator (CIPA) Applicator Hardware Updated Rev 4

Project Code: 00026 Rev A.

Scope for work under this WBS has been moved to WBS 5.1.10 for FY07 in Rev. 1.

5.1.2 Tile Repair Hand Tools Hardware Development Updated Rev 4

Project Code: 00026 Rev A.

Contractor shall provide engineering, analysis, fabrication, assembly and test and delivery of tile repair hand tools. Contractor shall provide pre-flight processing, and post flight assessment and refurbishment of tile repair hand tools.

Contractor shall provide engineering analysis, manufacturing, assembly, logistics, integration and project management for the Tile Repair Hand Tools projects.

Contractor shall perform engineering projects in accordance with CTSD-2987 (Crew and Thermal Systems Division, EVA Tools and Equipment Branch, Technical Specifications Document) managed by the EC7 CCB.

Specifically, engineering projects shall include:

5.1.2.1 CIPA Discard Container, drawing number SED33117130

5.1.2.2 Durometer, drawing number, SED33116957

5.1.2.3 Gel Brushes

5.1.2.4 Foam Brushes, Drawing Number SED33117199

5.1.2.5 Netted Foam Brushes, Part Number SED3311XXXX

5.1.2.6 Removable Brush Handle, Drawing Number SED33116385

5.1.2.7 Gel Brush/Gel and Foam Brush Caddy, Drawing Number SED33116360

5.1.2.8 EWA Caddy, Drawing Number SED33116933

5.1.2.9 Emittance Wash Applicator (EWA), Drawing Number SED33116809, and Emittance Wash Applicator Caddy, Drawing Number SED33116933

5.1.2.10 Tile Repair Kit Hand Tool Stowage Bag, Drawing Number SED33117140

5.1.2.11 Mechanical Contour Gage (MCG), drawing number SED33117613

5.1.2.12 Stamps and Scrapers, Drawing Numbers SED33116364 (Angle Stamp), SED33116370 (Flat Stamp) and SED33117195 (3? Scraper)

5.1.2.13 EVA Wipes, Drawing number SED33116397

Note: Contractor is not submitting a proposal for the remainder of FY08 work (Rev 2) under this WBS.

5.1.3 Reinforced Carbon-Carbon (RCC) Repair Tools Development Updated Rev 5
Project Code: 00037

The contractor shall provide engineering, analysis, fabrication, assembly and test and delivery of RCC crack and plug repair tools and technologies in support of RCC repair. The contractor shall provide pre-flight processing, post flight processing/evaluation and hardware refurbishment.

5.1.4 Reinforced Carbon-Carbon (RCC) Repair Systems Updated Rev 5
Project Code: 00037

The contractor shall provide engineering, analysis, fabrication, assembly, test and delivery of RCC Repair technologies. The contractor shall perform the analysis of test samples, integration into test facilities, and provide real time test assessments.

5.1.5 ORU Temporary Stowage Device (OTSD) Development Updated Rev 5
Project Code: 00031

The contractor shall provide engineering, analysis, fabrication, assembly, test, certification and delivery of the ORU Temporary Stowage Device (OTSD) flight hardware and trainers.

5.1.6 EVA GFE Hardware Projects Updated Rev 5
Project Code: Multiple Project Codes Apply

The contractor shall provide engineering, design, analysis, fabrication, assembly, test and delivery of unique space flight hardware associated with EVA.

5.1.7 Worksite Stabilization Projects Updated Rev 5
Project Code: 00044

The contractor shall provide engineering design, analysis, project engineering, fabrication,

assembly, test and delivery of EVA worksite stabilization projects.

5.1.8 GFE Tile Overlay Repair Tools Updated Rev 5
Project Code: 00044

The contractor shall provide engineering, analysis, fabrication, assembly, test and delivery of unique tools and technologies in support of tile overlay repair. The contractor shall provide pre-flight processing, post flight processing/evaluation and hardware refurbishment.

5.1.9 GFE Tile Overlay Repair System Updated Rev 5
Project Code: 00044

The contractor shall provide engineering, analysis, fabrication, assembly, test and delivery of Tile Overlay Repair technologies. The contractor shall perform the analysis of test samples, integration into test facilities and provide real time test assessments.

5.1.10 Tile Repair Ablator Dispenser (T-RAD) Tool Updated Rev 5
Project Code: 00026 Rev A

The contractor shall provide engineering, analysis, fabrication, assembly and test of the T-RAD hardware and tools. The contractor shall provide pre and post flight processing of the T-RAD hardware for each STS flight. The contractor shall provide Detailed Test Objective (DTO) hardware development which may include new hardware builds, trainer hardware fabrication, tile sample integration, KSC vehicle integration and de-integration and post flight processing.

5.1.11 Tile Repair Ablator Dispenser (T-RAD) Repair Systems Updated Rev 5
Project Code: 00026 Rev A

The contractor shall provide engineering, analysis, fabrication, assembly, test and delivery of STA-54/T-RAD Orbiter Tile Repair System Technologies for Space Shuttle missions and DTO missions. The contractor shall perform the analysis of test samples, integration into test facilities, and provide real time test assessments.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
JSC 28035	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
CTSD-SS-2987	Crew and Thermal Systems Division EVA Tools and Equipment Branch (EC7) Technical Specifications Document	Current
JPR 8080.5 Added Rev 4	JSC Design and Procedural Standards	A
JPR-8500.4 Added Rev 4	Engineering Drawing System Manual	K
JSC-26626	EVA Generic Design Requirements Document	A
JSC-62460 Added Rev 4	ORU Temp Stow Project Technical Requirements Specification	Curent

NSTS-60514	System Requirements Document for the Orbiter Boom Sensor System	Change 3
NSTS-60526	System Requirements Document for the Orbiter On-Orbit Tile Repair Project (TRP)	A
NSTS-60536	System Requirements Document For The Orbiter On-Orbit Reinforced Carbon-Carbon (RCC) Repair Project	Baseline

c. **Required DRDs**

5.1.1 Tile Repair Cure-In-Place-Ablator (CIPA) Applicator Hardware

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 5	No Requirement	None
102 Updated Rev 1	Engineering Drawings and Model Files	1 set for certified hardware projects
107 Deleted Rev 1	Test Report	As defined by CTSD-SS-2987
218 Deleted Rev 1	Engineering Analysis	As defined by CTSD-SS-2987
221 Deleted Rev 1	Flight Products Acceptance Test Procedures	1 per Acceptance Test
230 Deleted Rev 1	Acceptance Data Package	1 per Unit
234 Deleted Rev 5	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	1 revision for STS 116,117 and 1 for STS 118 & subs
236 Deleted Rev 5	Certification and Acceptance Requirements Document (CARD)	1 per revision
237 Updated Rev 1	Certification Data Package	1 revision for STS 116,117 and 1 for STS 118 & subs
241 Updated Rev 1	Risk Assessment Executive Summary Report (RAESR)	1 revision for STS 116,117 and 1 for STS 118 & subs
242 Deleted Rev 5	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	1 revision for STS 116,117 and 1 for STS 118 & subs

5.1.2 Tile Repair Hand Tools Hardware Development

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 7	Engineering Drawings and Model Files	per PD
107 Updated Rev 7	Test Report	per PD
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev 7	Flight Products Acceptance Test Procedures	per PD
230 Updated Rev 7	Acceptance Data Package	per PD
234 Updated Rev 7	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	per PD
236 Updated Rev 7	Certification and Acceptance Requirements Document (CARD)	per PD
237 Updated Rev 7	Certification Data Package	per PD
241 Updated Rev 7	Risk Assessment Executive Summary Report (RAESR)	per PD
242 Updated Rev 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	per PD

5.1.3 Reinforced Carbon-Carbon (RCC) Repair Tools Development

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 7	Engineering Drawings and Model Files	per PD
107 Updated Rev 7	Test Report	per PD
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev 7	Flight Products Acceptance Test Procedures	per PD
230 Updated Rev 7	Acceptance Data Package	per PD
234 Updated Rev 7	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	per PD
236 Updated Rev 7	Certification and Acceptance Requirements Document (CARD)	per PD
237 Updated Rev 7	Certification Data Package	per PD
241 Updated REV 7	Risk Assessment Executive Summary Report (RAESR)	per PD
242 Updated REV 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	per PD

5.1.4 Reinforced Carbon-Carbon (RCC) Repair Systems

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 7	Engineering Drawings and Model Files	per PD
107 Updated Rev 7	Test Report	per PD
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev 7	Flight Products Acceptance Test Procedures	per PD
230 Updated Rev 7	Acceptance Data Package	per PD
234 Updated Rev 7	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	per PD
236 Updated Rev 7	Certification and Acceptance Requirements Document (CARD)	per PD
237 Updated Rev 7	Certification Data Package	per PD
241 Updated Rev 7	Risk Assessment Executive Summary Report (RAESR)	per PD
242 Updated Rev 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	per PD

5.1.5 ORU Temporary Stowage Device (OTSD) Development

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 4	Engineering Drawings and Model Files	As defined in CTSD 2987
107 Updated Rev 4	Test Report	As defined in CTSD 2987
213 Updated Rev 4	Flight Product Critical Design Review (CDR) Data Package	As defined in CTSD 2987
218 Updated Rev	Engineering Analysis	As defined in CTSD

4		2987
221 Updated Rev 4	Flight Products Acceptance Test Procedures	As defined in CTSD 2987
230 Updated Rev 4	Acceptance Data Package	As defined in CTSD 2987
234 Added Rev 4	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	As defined in CTSD 2987
236 Updated Rev 4	Certification and Acceptance Requirements Document (CARD)	As defined in CTSD 2987
237 Updated Rev 4	Certification Data Package	As defined in CTSD 2987
239 Updated Rev 4	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	As defined in CTSD 2987
240 Updated Rev 4	Space Station Hazard Reports (HR's)	As defined in CTSD 2987
241 Updated Rev 4	Risk Assessment Executive Summary Report (RAESR)	As defined in CTSD 2987
242 Added Rev 4	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	As defined in CTSD 2987

5.1.6 EVA GFE Hardware Projects

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 7	Engineering Drawings and Model Files	per PD
107 Updated Rev 7	Test Report	per PD
213 Updated Rev 7	Flight Product Critical Design Review (CDR) Data Package	per PD
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev7	Flight Products Acceptance Test Procedures	per PD
230 Updated Rev 7	Acceptance Data Package	per PD
234 Updated Rev 7	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	per PD
236 Updated Rev 7	Certification and Acceptance Requirements Document (CARD)	per PD
237 Updated Rev 7	Certification Data Package	per PD
239 Updated Rev 7	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	per PD
240 Updated Rev 7	Space Station Hazard Reports (HR's)	per PD
241 Updated Rev 7	Risk Assessment Executive Summary Report (RAESR)	per PD
242 Updated Rev 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	per PD

5.1.7 Worksite Stabilization Projects

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 4	Engineering Drawings and Model Files	As defined in CTSD 2987
107 Updated Rev 4	Test Report	As defined in CTSD 2987

213 Added Rev 4	Flight Product Critical Design Review (CDR) Data Package	As defined in CTSD 2987
218 Updated Rev 4	Engineering Analysis	As defined in CTSD 2987
221 Added Rev 4	Flight Products Acceptance Test Procedures	As defined in CTSD 2987
230 Added Rev 4	Acceptance Data Package	As defined in CTSD 2987
234 Added Rev 4	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	As defined in CTSD 2987
236 Added Rev 4	Certification and Acceptance Requirements Document (CARD)	As defined in CTSD 2987
237 Added Rev 4	Certification Data Package	As defined in CTSD 2987
239 Added Rev 4	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	As defined in CTSD 2987
240 Added Rev 4	Space Station Hazard Reports (HR's)	As defined in CTSD 2987
241 Added Rev 4	Risk Assessment Executive Summary Report (RAESR)	As defined in CTSD 2987
242 Added Rev 4	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	As defined in CTSD 2987

5.1.8 GFE Tile Overlay Repair Tools

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 7	Engineering Drawings and Model Files	per PD
107 Updated Rev 7	Test Report	per PD
213 Updated Rev 7	Flight Product Critical Design Review (CDR) Data Package	per PD
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev 7	Flight Products Acceptance Test Procedures	per PD
230 Updated Rev 7	Acceptance Data Package	per PD
234 Updated Rev 7	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	per PD
236 Updated Rev7	Certification and Acceptance Requirements Document (CARD)	per PD
237 Updated Rev 7	Certification Data Package	per PD
239 Updated Rev 7	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	per PD
240 Updated Rev 7	Space Station Hazard Reports (HR's)	per PD
241 Updated Rev 7	Risk Assessment Executive Summary Report (RAESR)	per PD
242 Updated Rev 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	per PD

5.1.9 GFE Tile Overlay Repair System

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 7	Engineering Drawings and Model Files	per PD

107 Updated Rev 7	Test Report	per PD
213 Updated Rev 7	Flight Product Critical Design Review (CDR) Data Package	per PD
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev 7	Flight Products Acceptance Test Procedures	per PD
230 Deleted Rev 5	Acceptance Data Package	As defined in CTSD 2987
230 Added Rev 5	Acceptance Data Package	N/A for Safe to Fly cert
234 Deleted Rev 5	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	As defined in CTSD 2987
236 Deleted Rev 5	Certification and Acceptance Requirements Document (CARD)	As defined in CTSD 2987
236 Added Rev 5	Certification and Acceptance Requirements Document (CARD)	N/A for Safe to Fly cert
237 Updated Rev 7	Certification Data Package	per PD
239 Updated Rev 7	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	per PD
240 Updated Rev 7	Space Station Hazard Reports (HR's)	per PD
241 Added Rev 5	Risk Assessment Executive Summary Report (RAESR)	N/A for Safe to Fly cert
241 Deleted Rev 5	Risk Assessment Executive Summary Report (RAESR)	As defined in CTSD 2987
242 Updated Rev 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	per PD

5.1.10 Tile Repair Ablator Dispenser (T-RAD) Tool

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 7	Engineering Drawings and Model Files	per PD
107 Updated Rev 7	Test Report	per PD
213 Updated Rev 7	Flight Product Critical Design Review (CDR) Data Package	per PD
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev 7	Flight Products Acceptance Test Procedures	per PD
230 Updated Rev 7	Acceptance Data Package	per PD
234 Updated Rev 7	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	per PD
236 Updated Rev 7	Certification and Acceptance Requirements Document (CARD)	per PD
237 Updated Rev 7	Certification Data Package	per PD
239 Updated Rev 7	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	per PD
240 Updated Rev 7	Space Station Hazard Reports (HR's)	per PD
241 Updated Rev 7	Risk Assessment Executive Summary Report (RAESR)	per PD
242 Updated Rev 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	per PD

Rev 5		01
JSC 28035 Added Rev 5	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JPR-8080.5 Added Rev 5	JSC Design and Procedural Standards	A

c. **Required DRDs**

5.9.1 Life Support Technology Products		
DRD #	**DRD Title**	**Quantity/Frequency**
102 Updated Rev 7	Engineering Drawings and Model Files	per PD
107 Updated Rev 7	Test Report	per PD
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev 7	Flight Products Acceptance Test Procedures	per PD
230 Updated Rev 7	Acceptance Data Package	per PD
236 Added Rev 5	Certification and Acceptance Requirements Document (CARD)	per PD
237 Updated Rev 7	Certification Data Package	per PD
241 Updated Rev7	Risk Assessment Executive Summary Report (RAESR)	per PD

d. **Products**

5.9.1 Life Support Technology Products		
Product(s)	**Quantity**	**Delivery Date**
Products as defined by Project Directive(s) Updated Rev 7	as defined in PD	per PD

e. **Product Verification**

5.9.1 Life Support Technology Products
i. Products as defined by Project Directive(s)
- Project Directives will be closed by CCB chair, TMR, or designee upon receipt of deliverables.

6.0 Cost Summary and Revision History

DO 087 R7 Summary								
SLC		CY2	CY3	CY4	CY5	CY6	CY7	CY8
AS3								
	Sum of Hrs							
	Sum of Dollars							
EN2								
	Sum of Hrs							
	Sum of Dollars							
EN3								
	Sum of Hrs							
	Sum of Dollars							
EN4								
	Sum of Hrs							
	Sum of Dollars							
ESS								
	Sum of Hrs							
	Sum of Dollars							
MGR								
	Sum of Hrs							
	Sum of Dollars							
PC2								
	Sum of Hrs							
	Sum of Dollars							
QA2								
	Sum of Hrs							
	Sum of Dollars							
QE2								
	Sum of Hrs							
	Sum of Dollars							
SRE								
	Sum of Hrs							
	Sum of Dollars							
TN3								
	Sum of Hrs							
	Sum of Dollars							
EN1								
	Sum of Hrs							
	Sum of Dollars							
AS2								
	Sum of Hrs							
	Sum of Dollars							
IT2								
	Sum of Hrs							
	Sum of Dollars							
SV								
	Sum of Hrs							
	Sum of Dollars							
BS2								

	Sum of Hrs	
	Sum of Dollars	
IT3		
	Sum of Hrs	
	Sum of Dollars	
AS1		
	Sum of Hrs	
	Sum of Dollars	
QA1		
	Sum of Hrs	
	Sum of Dollars	
QE1		
	Sum of Hrs	
	Sum of Dollars	
SE		
	Sum of Hrs	
	Sum of Dollars	
TN2		
	Sum of Hrs	
	Sum of Dollars	
SQ1		
	Sum of Hrs	
	Sum of Dollars	
TN1		
	Sum of Hrs	
	Sum of Dollars	
Total Direct Labor Hrs		
Total Direct Labor Cost		
Subcontract		
Material		
Travel		
NLR Misc		
Burden on Non-Labor		
Total Non-Labor		
Total Costs		
Fee (100% of Pool)		
Total		**27,134,1**

Revision History:

Rev No.	Date	Summary
R7	11/09/2009	Revision 7 extends the period of performance to January 2013. It also references specific Project Directives for applicable DRDs replacing CTSD 2987. It adds $ b4 for quality activities and shifts FY10 scope into FY11-FY13. It includes $ b4 for materials and $ b4 in travel to be controlled by Project Directives (PDs).
R6	09/24/2009	Revision 6 exercises the Option in Revision 5 for the FY10 portion of the Contractor's proposal dated June 12, 2009 an increase of $2,996,675.
R5	05/15/2009	Revision 5 updates the deliverables for FY 09 and FY10 and extends the period of performance to the end of the contract. Revision 5 only authorizes the FY09 portion of the Contractor's proposal dated June 12, 2009 (increase of $ 5,499,433). The Government reserves the option to unilaterally authorize the FY10 portion (increase of $ 2,996,675) of the Contractor's proposal.
R4	02/27/2009	**Revision created for changes to DO87 EC7 EVA GFE Tools and Equipment Projects. This revision covers IVA GFE Flight Crew Equipment to add scope and authorization for new GFE Hardware projects including EVA Window Bag and SARJ Recovery Tools. It also removes scope for all IVA/FCE activity after February 2009.**
R3	09/25/2008	**No change to RFP. Revision created in order to submit an Unsolicited Proposal. This unsolicited proposal to DO87 EC7 EVA GFE Tools and Equipment Projects, and IVA GFE Flight Crew Equipment to add scope and authorization for new GFE Hardware projects including OBSS Cover, EVA Window Bag, SARJ Recovery Tools, and T-RAD Crit 1 certification. The RCC Repair System, Large Area Repair and IVA Sustaining Engineering and Spares projects authorized funding was reduced to reflect the FY08 current scope of work. This revision also adds scope and funding authorization for FY09.**
R2	09/27/2007	**No change to RFP. Revision created in order to submit an Unsolicited Proposal. This Revision adds estimated costs for Fy08.**
R1	09/06/2006	Extended the period of performance to 9/30/2007. Identified there will be no work performed in 5.1.2 in FY'07 Addition of T-RAD tasks in 5.1.10 and 5.1.11 Updated deliverables milestones.

5.7.1 Reserved
i. EVA Window Bag Deleted Rev 5
- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Deleted Rev 5
ii. EVA Window Bag Deleted Rev 7
- PDs will be closed by CCB Chair, TMR, or designee upon receipt of all deliverables Deleted Rev 7
iii. Reserved
- PDs will be closed by CCB Chair, TMR, or designee upon receipt of all deliverables Added Rev 7

5.8 Solar Array Rotary Joint (SARJ) Recovery Tools Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform engineering projects inclusive of design, analysis, fabrication, assembly and test and delivery of the miscellaneous EVA compatible tools required for the repair of the SARJ.

Project Directives will be used define deliverables including scope, milestones, changes to applicable documents or reference documents, process tailoring, etc. Project Directives (PDs) will be approved by the EC7 CCB chair. The contractor shall track and maintain all PD and report costs at the PD level.
Updated Rev 5

5.8.1 Solar Array Rotary Joint (SARJ) Recovery Tools Updated Rev 5
Project Code:

Products defined per PD.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	Rev D 02-04
JSC 28035 Added Rev 5	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
CTSD 2987 Added Rev 4	Crew and Thermal Systems Division EVA Tools and Equipment Branch (EC7) Technical Specifications Document	B
EA-WI-024 Added Rev 4	General Operating Procedures Manual for EA Test	Baseline/11-02
JPR 8500.4 Added Rev 4	Engineering Drawing System Manual	K
JPR-8080.5 Added Rev 4	JSC Design and Procedural Standards	Rev A/03-95
JSC-26626 Added Rev 5	EVA Generic Design Requirements Document	Rev A/05-95

c. **Required DRDs**

5.8.1 Solar Array Rotary Joint (SARJ) Recovery Tools		
DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 5	Engineering Drawings and Model Files	per PD
107 Updated Rev 7	Test Report	if applicable per PD
213 Updated Rev 5	Flight Product Critical Design Review (CDR) Data Package	Per EA-WI-023
218 Updated Rev 7	Engineering Analysis	per PD
221 Updated Rev 7	Flight Products Acceptance Test Procedures	per PD

230 Updated Rev 7	Acceptance Data Package	per PD
234 Updated Rev 7	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	per PD
236 Updated Rev 5	Certification and Acceptance Requirements Document (CARD)	per PD
239 Updated Rev 7	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	per PD
240 Updated Rev 5	Space Station Hazard Reports (HR's)	as required for RAESR
241 Updated Rev 5	Risk Assessment Executive Summary Report (RAESR)	per Task Agreement with NT
242 Deleted Rev 5	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	if applicable
242 Updated Rev 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	per PD

d. **Products**

5.8.1 Solar Array Rotary Joint (SARJ) Recovery Tools

Product(s)	Quantity	Delivery Date
Products defined per Project Directive(s) Updated Rev 7	as defined in PD	per PD

e. **Product Verification**

5.8.1 Solar Array Rotary Joint (SARJ) Recovery Tools

i. Products defined per Project Directive(s)

- Project Directives will be closed by the CCB chair, TMR or designee upon receipt of deliverables

5.9 Life Support Technology Development Added Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide products for life support technology projects inclusive of design, analysis, fabrication, assembly and test and delivery. Project scope is expected to focus on advancing the Technology Readiness Levels of target concepts via flight Detailed/Development Test Objectives (DTOs) or similar hardware demonstrations.

Project Directives will be used define deliverables including scope, milestones, changes to applicable documents or reference documents, process tailoring, etc. Project Directives (PDs) will be approved by the EC7 CCB chair. The contractor shall track and maintain all PD and report costs at the PD level.

Added Rev 5

5.9.1 Life Support Technology Products Added Rev 5
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4 Added	Engineering Drawing System Manual	Rev H 11-

4	Specifications Document	
EA-WI-024 Added Rev 4	General Operating Procedures Manual for EA Test	Baseline
JPR 8500.4 Added Rev 4	Engineering Drawing System Manual	K
JPR-8080.5 Added Rev 4	JSC Design and Procedural Standards	A
JSC 26626 Added Rev 5	EVA Generic Design Requirements Document	A
SSP 50005 Added Rev 4	ISS Flight Crew Integration Standard	C

c. **Required DRDs**

5.7.1 Reserved

DRD #	DRD Title	Quantity/Frequency
102 Deleted Rev 7	Engineering Drawings and Model Files	as required
107 Deleted Rev 7	Test Report	if applicable
213 Deleted Rev 7	Flight Product Critical Design Review (CDR) Data Package	per EA-WI-023
218 Deleted Rev 7	Engineering Analysis	as required
221 Deleted Rev 7	Flight Products Acceptance Test Procedures	if applicable
230 Deleted Rev 7	Acceptance Data Package	per CARD
234 Deleted Rev 5	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	per EA-WI-023
234 Deleted Rev 7	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	if applicable
236 Deleted Rev 7	Certification and Acceptance Requirements Document (CARD)	per PD
237 Deleted Rev 7	Certification Data Package	per EA-WI-023
239 Deleted Rev 7	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	if applicable
240 Deleted Rev 7	Space Station Hazard Reports (HR's)	as required for RAESR
241 Deleted Rev 7	Risk Assessment Executive Summary Report (RAESR)	per Task Agreement with NT
242 Deleted Rev 5	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	if applicable
242 Deleted Rev 7	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	if applicable

d. **Products**

5.7.1 Reserved

Product(s)	Quantity	Delivery Date
EVA Window Bag Deleted Rev 5	1 set	9/30/09
EVA Window Bag Deleted Rev 7	per PD	Per PD
Reserved Added Rev 7	Per PD	Per PD

e. **Product Verification**

4	Furnished Equipment

c. **Required DRDs**

5.5.1 IVA GFE Hardware Development for ISS		
DRD #	**DRD Title**	**Quantity/Frequency**
230 Deleted Rev 5	Acceptance Data Package	As defined by EC7-TBD
230 Added Rev 5	Acceptance Data Package	As required by EA Work Instructions
231 Added Rev 5	Limited Life Items List	if applicable
231 Deleted Rev 5	Limited Life Items List	As defined by EC7-TBD
237 Updated Rev 5	Certification Data Package	As defined by EA-WI-023
238 Deleted Rev 5	Space Station Reliability and Maintainability Predictions Report	As defined by EC7-TBD
238 Added Rev 5	Space Station Reliability and Maintainability Predictions Report	Per PD
239 Updated Rev 5	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	if applicable
240 Updated Rev 5	Space Station Hazard Reports (HR's)	as required for each RAESR
241 Updated Rev 5	Risk Assessment Executive Summary Report (RAESR)	per task agreement with NT

d. **Products**

5.5.1 IVA GFE Hardware Development for ISS		
Product(s)	**Quantity**	**Delivery Date**
ISS IVA Hardware Development Items Deleted Rev 5	5	2/13/09
CR Evaluation Deleted Rev 5	10	2/13/09
IVA Bi-weekly update to webpage Deleted Rev 5	9	2/13/09
Products defined per Project Directive(s) Updated REV 7	as defined in PD	per PD

e. **Product Verification**

5.5.1 IVA GFE Hardware Development for ISS
i. ISS IVA Hardware Development Items Deleted Rev 5
- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Deleted Rev 5
ii. CR Evaluation Deleted Rev 5
- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Deleted Rev 5
iii. IVA Bi-weekly update to webpage Deleted Rev 5
- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Deleted Rev 5
iv. Products defined per Project Directive(s)
- Project Directives will be closed by CCB chair, TMR, or designee upon receipt of deliverables.

5.6 Space Shuttle IVA GFE Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide a transition phase to NASA that will take place between 1/12/09 and 2/13/09. This phase will include the transfer of all drawings, data, certificates of conformance, CAD files, and inventory to NASA that has not previously been accomplished. (Revision 4)

All inventory will be transferred via form 1149 or DD250 as ?work in progress?. Beyond the transition phase the remainder of the work under this WBS has been deleted for FY09.

Updated Rev 5

5.6.1 Space Shuttle IVA GFE Added Rev 4

Project Code:

In compliance with the above identified SOW(s) contractor shall perform Space Shuttle Vehicle IVA GFE project engineering and design, development, testing, and evaluation (DDT&E) per the FY08 EC7 IVA Government Furnished Equipment Requirements Document, EC7-TBD. Division and Branch approval of Change Requests will constitute authority to Proceed.

Typical activity required for the products are:

a) Preparation and submittal of draft CR and presentation charts for the FCE CCB.

b) Define, develop and obtain approval for the Applicable Requirements Matrix (ARM), Project Requirements & Verification Document (PRVD), and PTRS.

c) Submittal of information necessary for the Materials Certification.

d) Submittal of information necessary for the Toxicology approval (if required).

e) Processing and delivering certified hardware in accordance with PDA/PIA requirements.

f) Preparing Task Performance Sheets (TPS) to move, configure, or test, class I hardware.

g) Procurement of material or spares.

h) Provide design, stress, materials, safety, test and verification, configuration management, etc. as required for products.

i) Preparing a CDP and ADP as required by the project.

j) Provide hardware manufacturing and assembly

k) Provide 3 Shuttle CR Evaluations

The products are:

2 Shuttle IVA GFE items

3 Shuttle CR Evaluations

b. Applicable Documents

Document Number	Document Name	Rev.
EA-WI-016 Added Rev 4	Off-the-Shelf Hardware Utilization in Flight Hardware Development	Baseline/10-98
EA-WI-023 Added Rev 4	Project Management of GFE Flight Projects	Rev E/02-05
EC7-TBD Added Rev 4	IVA Government Furnished Equipment Requirements Document	Basic
JPR 8500.4 Added Rev	Engineering Drawing System Manual	Rev K/03-06

4		
JSC 28484 Added Rev 4	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	A/01-05

c. **Required DRDs**

5.6.1 Space Shuttle IVA GFE

DRD #	DRD Title	Quantity/Frequency
230 Added Rev 4	Acceptance Data Package	As defined by EC7-TBD
231 Added Rev 4	Limited Life Items List	As defined by EC7-TBD
237 Added Rev 4	Certification Data Package	As defined by EC7-TBD
239 Added Rev 4	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	As defined by EC7-TBD
240 Added Rev 4	Space Station Hazard Reports (HR's)	As defined by EC7-TBD
241 Added Rev 4	Risk Assessment Executive Summary Report (RAESR)	As defined by EC7-TBD

d. **Products**

5.6.1 Space Shuttle IVA GFE

Product(s)	Quantity	Delivery Date
Shuttle IVA GFE Items Added Rev 4	2	2/13/09
CR Evaluations Added Rev 4	3	2/13/09

e. **Product Verification**

5.6.1 Space Shuttle IVA GFE

i. Shuttle IVA GFE Items

- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Added Rev 4

ii. CR Evaluations

- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Added Rev 4

5.7 Reserved, insce EVA Softgoods were discontinued Updated REV 7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Reserved, since EVA Softgoods were discontinued. Updated REV 7

5.7.1 Reserved Updated REV 7
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	Rev D 02-04
CTSD 2987 Added Rev	Crew and Thermal Systems Division EVA Tools and Equipment Branch (EC7) Technical	B

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.2 EVA Development & Verification Testing Updated Rev 5

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall perform highly-specialized engineering and technical services to accomplish the programmatic objectives of NASA/JSC Crew and Thermal Systems Division for Shuttle, ISS, and Advanced NASA Programs.

Project Directives will be used define deliverables including scope, milestones, changes to applicable documents or reference documents, process tailoring, etc. Project Directives (PDs) will be approved by the EC7 CCB chair. The contractor shall track and maintain all PD and report costs at the PD level. Updated Rev 5

5.2.1 EVA Development Testing Updated Rev 5
Project Code: Not Applicable

Contractor shall perform all aspects relating to the conducting of the ISS EVA development testing including test planning, test objective development, test performance and post test data documentation and reporting. The contractor shall also provide unique test hardware inclusive of design, fabrication, assembly and integration, coordination and performance of test readiness reviews and the preparation of hazard reports and analysis. Contractor shall maintain the Crew Consensus Report Database.

5.2.2 EVA Worksite Analysis Updated Rev 5
Project Code: Not Applicable

Contractor shall perform engineering design and analysis tasks, generate analysis and verification reports, and participate in technical design reviews specific to EVA worksite accessibility, and engineering design drawings in support of the ISS element Node 2 and Node 3 EVA activity and labels drawings development.

Contractor shall lead the effort for the performance of design and analysis tasks in performance of the EVA portions of the NASA Node 2 and Node 3 Bilateral Data Exchange Agreement. Specifically, contractor shall perform EVA worksite analysis, Prime Item Delivery Specification (PIDS) verification for EVA translation aides and attachments.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AOD 33899	JSC Reduced Gravity User's Guide	
CTSD-SS-2987	Crew and Thermal Systems Division EVA Tools and Equipment Branch (EC7) Technical Specifications Document	Current
DX12-002	NBL SOP	E
DX12-0113	NBL Mockup Requirements	A
DX14-0027	Space Vehicle Mockup Facility Test Readiness Review	A
EA-WI-024 Added Rev 4	General Operating Procedures Manual for EA Test	Baseline / 11-02
JPR 8080.5 Added Rev 5	JSC Design and Procedural Standards	Current
JPR 8500.4 Added Rev 4	Engineering Drawing System Manual	K / 03-06
JSC 22803	Operations User's Guide - JSC Reduced Gravity	Latest Revision
JSC 26798	Mockup and Integration Laboratory - Precision Air	NC

SSP 50005	ISS Flight Crew Integration Standard	C
SSP 50290	Node 2 PIDS	Latest Revision
SSP 50318	Node 3 PIDS	Latest Revision
STB-F-365	Crew and Thermal Systems Division Test Laboratories	

c. **Required DRDs**

5.2.1 EVA Development Testing

DRD #	DRD Title	Quantity/Frequency
107 Updated Rev 5	Test Report	as required per PD

5.2.2 EVA Worksite Analysis

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 7	Engineering Drawings and Model Files	as required per PD
218 Updated Rev 5	Engineering Analysis	as required per PD

d. **Products**

5.2.1 EVA Development Testing

Product(s)	Quantity	Delivery Date
Per Project Directive(s) Updated Rev 7	as defined in PD	per PD

5.2.2 EVA Worksite Analysis

Product(s)	Quantity	Delivery Date
Per Project Directive(s) Updated Rev 7	as defined in PD	per PD

e. **Product Verification**

5.2.1 EVA Development Testing

i. Per Project Directive(s)

- Completed upon verification and acceptance by the EC7 Branch Chief or Designee

5.2.2 EVA Worksite Analysis

i. Per Project Directive(s)

- Completed upon verification and acceptance by the EC7 Branch Chief or Designee

5.3 Large Area Repair - LAR Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall

Project Directives will be used define deliverables including scope, milestones, changes to applicable documents or reference documents, process tailoring, etc. Project Directives (PDs) will be approved by the EC7 CCB chair. The contractor shall track and maintain all PD and report costs at the PD level.

Note: Contractor is not submitting a proposal for FY09 work (Rev 3) under this WBS. FY08 scope was deleted in DO Revision 2. Updated Rev 5

5.3.1 Large Area Repair - LAR Updated Rev 5
Project Code:

Rev 5: No work is defined for this WBS at this time.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AOD 33899 Added Rev 4	JSC Reduced Gravity User's Guide	
CTSD 2987 Added Rev 4	Crew and Thermal Systems Division EVA Tools and Equipment Branch (EC7) Technical Specifications Document	B
DX12-002 Added Rev 4	NBL SOP	E
DX12-0113 Added Rev 4	NBL Mockup Requirements	A
DX14-0027 Added Rev 4	Space Vehicle Mockup Facility Test Readiness Review	A
EA-WI-024 Added Rev 4	General Operating Procedures Manual for EA Test	Baseline / 11-02
JPR 8500.4 Added Rev 4	Engineering Drawing System Manual	K / 03-06
JPR-8080.5 Added Rev 4	JSC Design and Procedural Standards	A/ 03-95
JSC 22803 Added Rev 4	Operations User's Guide - JSC Reduced Gravity	Current
JSC 26798 Added Rev 4	Mockup and Integration Laboratory - Precision Air	NC
SSP 50005 Added Rev 4	ISS Flight Crew Integration Standard	C
SSP 50290 Added Rev 4	Node 2 PIDS	Current
SSP 50318 Added Rev 4	Node 3 PIDS	Current

c. **Required DRDs**

5.3.1 Large Area Repair - LAR

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 4	Engineering Drawings and Model Files	As defined in CTSD 2987
107 Added Rev 4	Test Report	As defined in CTSD 2987
213 Added Rev 4	Flight Product Critical Design Review (CDR) Data Package	As defined in CTSD 2987
218 Added Rev 4	Engineering Analysis	As defined in CTSD 2987
221 Added Rev 4	Flight Products Acceptance Test Procedures	As defined in CTSD 2987
230 Added Rev 4	Acceptance Data Package	As defined in CTSD 2987
234 Added Rev 4	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	As defined in CTSD 2987
237 Added Rev 4	Certification Data Package	As defined in CTSD 2987

239 Added Rev 4	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	As defined in CTSD 2987
240 Added Rev 4	Space Station Hazard Reports (HR's)	As defined in CTSD 2987
241 Added Rev 4	Risk Assessment Executive Summary Report (RAESR)	As defined in CTSD 2987
242 Added Rev 4	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	As defined in CTSD 2987

d. **Products**

5.3.1 Large Area Repair - LAR		
Product(s)	**Quantity**	**Delivery Date**
Large Area Repair - Deleted for FY08 (Rev 2) Deleted Rev 5	1 set	9/30/08

e. **Product Verification**

5.3.1 Large Area Repair - LAR
i. Large Area Repair - Deleted for FY08 (Rev 2) Deleted Rev 5
- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Deleted Rev 5

5.4 ISS FCE Sustaining Engineering (SE) and Spares Updated Rev 5

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall perform new work on IVA GFE in accordance with Project Directives. (Revision 5)

Project Directives will be used define deliverables including scope, milestones, changes to applicable documents or reference documents, process tailoring, etc. Project Directives (PDs) will be approved by the EC7 CCB chair. The contractor shall track and maintain all PD and report costs at the PD level.

All other IVA FCE work defined prior to Rev 5 has been transitioned off this DO. The contractor will provide a transition phase to NASA that will take place between 1/12/09 and 2/13/09. This phase will include the transfer of all drawings, data, certificates of conformance, CAD files, and inventory to NASA that has not previously been accomplished. NOTE: Transition was completed prior to Rev 5. Updated Rev 5

5.4.1 ISS FCE Sustaining Engineering (SE) and Spares Updated Rev 5

Project Code:

In compliance with the above identified SOW(s) contractor shall provide engineering assurance and subsystem management. Division and Branch approval of Change Requests will constitute authority to Proceed.

Typical activity required for the products are:

a) Processing and delivering certified hardware in accordance with PDA/PIA requirements.

b) Preparing Task Performance Sheets (TPS) to move, configure, or test, class I hardware.

c) Procurement of spares.

d) Provide design, stress, materials, safety, test and verification, configuration management, etc. as required for product improvements or corrective action.

e) Provide hardware manufacturing and assembly

f) Provide ISS CR evaluations to the Program and Division

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-016 Added Rev 4	Off-the-Shelf Hardware Utilization in Flight Hardware Development	Baseline/10-98
JPR 8500.4 Added Rev 4	Engineering Drawing System Manual	Rev K/03-06
JSC 28484 Added Rev 4	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	A
JSC-28533 Added Rev 4	ISS Catalog of IVA GFE FCE	E

c. **Required DRDs**

5.4.1 ISS FCE Sustaining Engineering (SE) and Spares		
DRD #	DRD Title	Quantity/Frequency
230 Deleted Rev 5	Acceptance Data Package	As defined by EC7-TBD
230 Added Rev 5	Acceptance Data Package	updates
231 Added Rev 5	Limited Life Items List	updates as required for deliverables
231 Deleted Rev 5	Limited Life Items List	As defined by EC7-TBD
237 Deleted Rev 5	Certification Data Package	As defined by EC7-TBD
237 Added Rev 5	Certification Data Package	updates as required for deliverables
241 Added Rev 5	Risk Assessment Executive Summary Report (RAESR)	updates as required for deliverables
241 Deleted Rev 5	Risk Assessment Executive Summary Report (RAESR)	As defined by EC7-TBD

d. **Products**

5.4.1 ISS FCE Sustaining Engineering (SE) and Spares		
Product(s)	Quantity	Delivery Date
ISS IVA Sustaining Products Deleted Rev 5	10	2/13/09
IVA Bi-weekly update to webpage Deleted Rev 5	9	2/13/09
CR Evaluations Deleted Rev 5	6	2/13/09
Products defined by approved Project Directives Added Rev 5	as req.	per PD

e. **Product Verification**

5.4.1 ISS FCE Sustaining Engineering (SE) and Spares
i. ISS IVA Sustaining Products Deleted Rev 5
- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Deleted Rev 5

ii. IVA Bi-weekly update to webpage Deleted Rev 5
- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Deleted Rev 5
iii. CR Evaluations Deleted Rev 5
- Completed upon verification and acceptance by the EC7 Branch Chief or Designee Deleted Rev 5
iv. Products defined by approved Project Directives
- PDs will be closed by CCB chair, TMR, or designee upon receipt of all deliverables. Added Rev 5

5.5 IVA ISS Hardware Development Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform for new work in IVA ISS Hardware Development in accordance with Project Directives. (Revision 5)

Project Directives will be used define new deliverables including scope, milestones, changes to applicable documents or reference documents, process tailoring, etc. Project Directives (PDs) will be approved by the EC7 CCB chair. The contractor shall track and maintain all PD and report costs at the PD level.

Revision 4: Contractor shall provide a transition phase that will take place between 1/12/09 and 2/13/09. This phase will include the transfer of all drawings, data, certificates of conformance, CAD files, and inventory to NASA that has not previously been accomplished. NOTE: The transition effort was fully accomplished prior to Rev. 5.

Updated Rev 5

5.5.1 IVA GFE Hardware Development for ISS Updated Rev 5
Project Code:

In compliance with the above identified SOW(s) contractor shall perform design, development, testing and evaluation (DDT&E) as related to IVA GFE hardware being developed for the ISS per individual Project Directives.

Typical activity required for the products are:

a) Preparation and submittal of draft CR and presentation charts for the CCB.
b) Define, develop and obtain approval for the requirements document.
c) Submittal of information necessary for the Materials Certification.
d) Submittal of information necessary for the Toxicology approval (if required).
e) Processing and delivering certified hardware in accordance with PDA/PIA requirements.
f) Preparing Task Performance Sheets (TPS) to move, configure, or test, class I hardware.
g) Procurement of material or spares
h) Provide hardware manufacturing and assembly
i) Provide design, stress, materials, safety, test and verification, configuration management, etc. as required for products.
j) Preparing a CDP and ADP as required by the project.
g) Provide ISS CR evaluations to the Program and Division

h) Draft Project Directives to define product deliverables requested by the program or division

i) Track and report schedule, cost, and technical progress

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-016 Added Rev 4	Off the Shelf Hardware	Baseline/10-98
JPR 8500.4 Added Rev 4	Engineering Drawing System Manual	Rev K/ 03-06
JSC 28484 Added Rev	Program Requirements Document for Johnson Space Center Non-Critical Government	A / 01-05

5.1.11 Tile Repair Ablator Dispenser (T-RAD) Repair Systems		
DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 4	Engineering Drawings and Model Files	As defined in CTSD 2987
107 Updated Rev 4	Test Report	As defined in CTSD 2987
218 Updated Rev 4	Engineering Analysis	As defined in CTSD 2987
221 Updated Rev 4	Flight Products Acceptance Test Procedures	As defined in CTSD 2987
230 Updated Rev 4	Acceptance Data Package	As defined in CTSD 2987
234 Updated Rev 4	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	As defined in CTSD 2987
236 Updated Rev 4	Certification and Acceptance Requirements Document (CARD)	As defined in CTSD 2987
237 Updated Rev 4	Certification Data Package	As defined in CTSD 2987
241 Updated Rev 4	Risk Assessment Executive Summary Report (RAESR)	As defined in CTSD 2987
242 Updated Rev 4	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	As defined in CTSD 2987

d. **Products**

5.1.1 Tile Repair Cure-In-Place-Ablator (CIPA) Applicator Hardware		
Product(s)	Quantity	Delivery Date
Tile Repair Ablator Dispenser (T-RAD) projects Deleted Rev 5	1 Set	09-30-2007
CIPA Training Hardware Engineering Projects Deleted Rev 5	1 Set	09-30-2007
Deleted Rev 5	1 Set	09-30-2007
Tile Repair Ablator Dispenser Engineering Projects	1 set	9/30/2006

5.1.2 Tile Repair Hand Tools Hardware Development		
Product(s)	Quantity	Delivery Date
No products requested in FY'07 Deleted Rev 4	0	9/30/2007
Tile Repair Hand Tools Engineering Projects	1 set	9/30/06

5.1.3 Reinforced Carbon-Carbon (RCC) Repair Tools Development		
Product(s)	Quantity	Delivery Date
RCC Repair Tools Development Projects Deleted Rev 4	1 Set	9-30-2007
Per Project Directive Updated REV 7	as defined in PD	per PD

5.1.4 Reinforced Carbon-Carbon (RCC) Repair Systems		
Product(s)	Quantity	Delivery Date
RCC Repair Systems Projects Deleted Rev 4	1 Set	9-30-2007
Per Project Directive Updated Rev 7	as defined in PD	per PD

5.1.5 ORU Temporary Stowage Device (OTSD) Development

Product(s)	Quantity	Delivery Date
ORU Temporary Stowage Device Development Projects Deleted Rev 4	1 set	9-30-2007
ORU Temporary Stowage Device Projects	1 set	9/30/08

5.1.6 EVA GFE Hardware Projects

Product(s)	Quantity	Delivery Date
Per Project Directive Updated Rev 7	as defined in PD	per PD

5.1.7 Worksite Stabilization Projects

Product(s)	Quantity	Delivery Date
Worksite Stabilization Engineering Projects	1 Set	9-30-2007

5.1.8 GFE Tile Overlay Repair Tools

Product(s)	Quantity	Delivery Date
Per Project Directive Updated Rev 7	Per PD	1/31/2010

5.1.9 GFE Tile Overlay Repair System

Product(s)	Quantity	Delivery Date
Per Project Directive Updated Rev 7	as defined in PD	per PD

5.1.10 Tile Repair Ablator Dispenser (T-RAD) Tool

Product(s)	Quantity	Delivery Date
Per Project Directive Updated Rev 7	as defined in PD	per PD

5.1.11 Tile Repair Ablator Dispenser (T-RAD) Repair Systems

Product(s)	Quantity	Delivery Date
T-RAD Systems Engineering Projects	1 set	9/30/2008

e. **Product Verification**

5.1.1 Tile Repair Cure-In-Place-Ablator (CIPA) Applicator Hardware

i. Tile Repair Ablator Dispenser (T-RAD) projects Deleted Rev 5

- Completed upon verification and acceptance by the EC7 Branch Chief or designee Deleted Rev 5

ii. CIPA Training Hardware Engineering Projects Deleted Rev 5

- Completed upon verification and acceptance by the EC7 Branch Chief or designee Deleted Rev 5

iii. Deleted Rev 5

- CCompleted upon verification and acceptance by the EC7 Branch Chief or designee Deleted Rev 5

iv. Tile Repair Ablator Dispenser Engineering Projects

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.2 Tile Repair Hand Tools Hardware Development

i. No products requested in FY'07 Deleted Rev 4

- Completed upon verification and acceptance by the EC7 Branch Chief or designee Deleted Rev 4

ii. Tile Repair Hand Tools Engineering Projects

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.3 Reinforced Carbon-Carbon (RCC) Repair Tools Development

i. RCC Repair Tools Development Projects Deleted Rev 4

- Completed upon verification and acceptance by the EC7 Branch Chief or designee Deleted Rev 4

ii. Per Project Directive

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.4 Reinforced Carbon-Carbon (RCC) Repair Systems

i. RCC Repair Systems Projects Deleted Rev 4

- Completed upon verification and acceptance by the EC7 Branch Chief or designee Deleted Rev 4

ii. Per Project Directive

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.5 ORU Temporary Stowage Device (OTSD) Development

i. ORU Temporary Stowage Device Development Projects Deleted Rev 4

- Completed upon verification and acceptance by the EC7 Branch Chief or designee Deleted Rev 4

ii. ORU Temporary Stowage Device Projects

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.6 EVA GFE Hardware Projects

i. Per Project Directive

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.7 Worksite Stabilization Projects

i. Worksite Stabilization Engineering Projects

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.8 GFE Tile Overlay Repair Tools

i. Per Project Directive

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.9 GFE Tile Overlay Repair System

i. Per Project Directive

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.10 Tile Repair Ablator Dispenser (T-RAD) Tool

i. Per Project Directive

- Completed upon verification and acceptance by the EC7 Branch Chief or designee

5.1.11 Tile Repair Ablator Dispenser (T-RAD) Repair Systems

i. T-RAD Systems Engineering Projects

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ06HA85D DO 88 R19

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 02/08/2006 – 01/31/2013

7. BILLING ADDRESS:
NSSC –FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: **10/06/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Life Support and Habitability Systems**					
DO	**88 R19**	64				
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel/NLR Misc					
	Est. M&T Burden				64	
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total
$92,882,614.81

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ06HA85D-DO88 REV 19

Originator: Carolyn Krumrey (EC3) (281) 483-5586 **TMR:** Marie Kowal (EC) (281) 483-8875

Revision Summary:

This revision adds FY12 scope for Habitation sustaining engineering (Crew Quarters, Urine Transfer Hardware, Potable Water Dispenser), ITCS/ECLSS sustaining engineering, Water Recover Systems, Air Revitalization Systems, and Emergency Mask. It also moves PD scope for Velocicalc and CEV ECLSS from FY11 to FY12.

Adds following to DO: Project Directives will be used to incrementally provide technical direction during project implementation. Project Directives (PDs) are approved through the EC/Branch CCB. In accordance with clause G.7 of the Engineering Science Contract, ALL technical direction (including Project Directives) shall be issued by the Contracting Officer?s Technical Representative (COTR). No other individual is authorized to issue technical direction and acceptance of technical direction by an unauthorized individual is taken at the Contractor?s risk.

Any changes to scope, estimated cost, quality, quantity, or schedule shall be issued through a revision of the delivery order and approved by the Contracting Officer.

1. Title of Effort: Life Support and Habitability Systems

2. Date of Request: 09/13/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and SA facilities. The contractor shall transition facility operational readiness conditions for EA and SA facilities.

e. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

f. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

g. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and

aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

h. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

i. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

j. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

k. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

l. **2.5 Education, Commercialization, and Technology Outreach**
The contractor shall plan and implement educational, commercialization, and technology outreach activities including special projects, curriculum development, demonstrations, displays, seminars, and presentations.

The contractor shall develop outreach materials including brochures, multi-media products, exhibit materials, and newsletters. These materials shall be disseminated through activities including web based and educational forums, and other public events.

m. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 14

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 12/01/2005 and ends 01/31/2013.

5. Product Requirements

5.1 Water Transfer for ISS and SSP Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform project engineering PDA/PIA testing coordination and documentation necessary for the Activated Carbon/Ion Exchange (ACTEX) units as defined in JSC-39084 ?ACTEX Hardware Requirements Document?, JSC 39223 ?ACTEX Project Technical Requirements Specification?, and JSC 39316, ?ACTEX Pre-Installation Acceptance Procedures. Contractor shall perform repairs as defined by Program CR. Program and Division approval of Change Request will constitute authority to proceed.

Contractor shall perform project engineering PDA/PIA testing coordination and documentation necessary for the Contingency Water Container (CWC) and Payload Water Reservoir (PWR) units as defined in JSC 39375 ?CWC Project Technical Requirements Specification?, JSC 39551 ?Assembly and Pre-Delivery/Pre-Installation Acceptance Test Procedures for the CWC?, JSC-40177, ?Project Technical Requirements Specification for the Payload Water Reservoir?, and JSC-47604, ?PDA/PIA for the Payload Water Reservoir?.

Contractor shall provide anomaly resolution and resupply and logistics activities for PWR, CWC, and ACTEX. Contractor shall attend weekly WET Meetings, bench reviews, and other appropriate water transfer meetings.

Contractor shall provide sustaining engineering for the Shuttle Orbiter Repackaged Galley (SORG).

Contractor shall provide sustaining engineering for the 20-Micron Filter Assembly (US Lab Particulate Filter).

Rev 11: Contractor shall provide project engineering to develop and deliver the ISS Microbial Removal Filter (MRF). Contractor shall provide project engineering to develop trade study / white paper for the filling of CWC-iodine bags, to be delivered to JAXA.

Revision 12 adds the Water Conversion Kit and ACTEX Spares. It also authorizes the use of Project Directives to define deliverables including specifc products required, due dates, process tailoring, etc. Project Directives are to be approved by the EC3 CCB and maintained under configuration control.

Revision 14 removes the Microbial Removal Filter task. It also deletes all Water Transfer scope for this WBS effective 1/31/10.

Revision 15 adds the Microbial Removal Filter (MRF) task to be defined by Project Directive.

Revision 16 adds additional MRF tasks to be defined by PD.

Revision 17 adds additional MRF tasks to be defined by PD.

Revision 18 adds additional water transfer hardware tasks to be defined by PD.

Revision 19 adds additional water transfer hardware tasks to be defined by PD. The contractor shall provide a copy of all PDs issued after the date of this revision to the contracting office within 5 days of approval. Updated REV 19

5.1.1 ACTEX/PWR/CWC/GIRA/SORG and SSP Water Transfer Hardware Updated Rev 17

Project Code:

Perform project engineering and documentation for the ACTEX/PWR/CWC/GIRA/SORG and SSP Water Transfer Hardware.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 11	Project Management of GFE Flight Projects	E, 02-06
JPR 8500.4 Added Rev 11	Engineering Drawing System Manual	K, 03-06
JSC 28484 Added Rev 11	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	A
JSC 39084 Added Rev 11	ACTEX Hardware Requirements Document	E
JSC 39223 Added Rev 11	Technical Requirements Specification Document for the ISS Water Transfer Hardware	B
JSC 39316	ACTEX Pre-Installation Acceptance Procedure	Basic
JSC 39375	Project Technical Requirements Specification for the CWC	A
JSC 39551	Assembly and Pre-Delivery/Pre-Installation Acceptance Test Procedures for the CWC	B
JSC 40177	Project Technical Specification for the Payload Water Reservoir	Basic
JSC 47604	PDA/PIA for Payload Water Reservoir	Basic
JSC 62387	PTRS for O2 Contingency Hose	Basic

c. **Required DRDs**

5.1.1 ACTEX/PWR/CWC/GIRA/SORG and SSP Water Transfer Hardware

DRD #	DRD Title	Quantity/Frequency
230	Acceptance Data Package	1 per flight unit delivered
233	Government Certification Approval Request (GCAR)	1 per Certification of Galley Sampling Adapter
234	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	1 per update of ACTEX FMEA/SAR and 1 per update of SORG FMEA/SAR
237	Certification Data Package	1 per flight unit delivered
241	Risk Assessment Executive Summary Report (RAESR)	1 per flight unt delivered

d. **Products**

5.1.1 ACTEX/PWR/CWC/GIRA/SORG and SSP Water Transfer Hardware

Product(s)	Quantity	Delivery Date
ACTEX/CWC/PWR Engineering Technical Report Updated REV 19	1	09/30/2006
ACTEX Delta Qualification Results Report Updated REV 19	1	03/31/2006
ACTEX Assembly Packing and PIA Deleted Rev 11	1	06/31/2006
CWC Bladder assembly from Government Owned property and PDA/PIA Deleted Rev 11	10	05/04/2006
Update ACTEX FMEA/SAR Deleted Rev 11	1	02/28/2006
Certification of Galley Sampling Adapter Deleted Rev 11	1	02/28/2006
SORG SAR Update Updated Rev 11	1	09/30/2006
Shuttle Water Transfer Sustaining Engineering Technical Report Updated Rev 11	2	09/30/2008
ACTEX Refurbishment, PIA, and ADP Updated REV 19	per EC3 flight manifest	per EC3 flight manifest
CWC assembly from Government Owned property and PDA/PIA Updated REV 19	per EC3 flight manifest	per EC3 flight manifest
Shuttle Water Transfer Sustaining Engineering Technical Report Updated REV 19	2	09/30/08
SORG SAR Update Updated REV 19	1	9/30/06
ACTEX Build-up, PIA, and ADP Updated REV 19	8	9/30/07
OGS PWR PIA and ADP Updated REV 19	4	9/30/07
Repair STS & ISS ACTEX Updated REV 19	10	12/30/08
20 Micron Filter build-up, PIA & ADP Updated REV 19	1	9/30/08
PWR PIA and ADP Updated REV 19	8	9/30/09
MRF PIA and ADP Deleted Rev 14	10	9/30/09
MRF EDU Deleted Rev 14	2	9/30/09
CWC-I with Iodinated Water, Trade Study Updated REV 19	1	2/10/09
Delta Fluid PWR Compatibility Cert (Phase I) Updated REV 19	1	7/30/08
Delta Fluid PWR Compatibility Cert (Phase II) Updated REV 19	1	3/30/09
Delta Fluid PWR Compatibility Cert (Phase III) Updated REV 19	1	9/30/09
Water Conversion Kit Added Rev 12	per PD	per PD
ACTEX Spares Added Rev 12	per PD	per PD
Microbial Removal Filter (MRF)	per PD	per PD
Water Transfer Hardware Added Rev 18	per PD	per PD

e. **Product Verification**

5.1.1 ACTEX/PWR/CWC/GIRA/SORG and SSP Water Transfer Hardware

i. ACTEX/CWC/PWR Engineering Technical Report

- Approval by the EC3 branch review of the deliverable

ii. ACTEX Delta Qualification Results Report

- Approval by the EC3 branch review of the deliverable

iii. ACTEX Assembly Packing and PIA Deleted Rev 11

- Approval by the EC3 branch review of the deliverable Deleted Rev 11

iv. CWC Bladder assembly from Government Owned property and PDA/PIA Deleted Rev 11

- Approval by the EC3 branch review of the deliverable Deleted Rev 11

v. Update ACTEX FMEA/SAR Deleted Rev 11

- Approval by the EC3 branch review of the deliverable Deleted Rev 11

vi. Certification of Galley Sampling Adapter Deleted Rev 11

- Approval by the EC3 branch review of the deliverable Deleted Rev 11
vii. SORG SAR Update Updated Rev 11
- Approval by the EC3 branch review of the deliverable Updated Rev 11
viii. Shuttle Water Transfer Sustaining Engineering Technical Report Updated Rev 11
- Approval by the EC3 branch review of the deliverable Updated Rev 11
ix. ACTEX Refurbishment, PIA, and ADP
- Approval by the EC3 branch review of the deliverable
x. CWC assembly from Government Owned property and PDA/PIA
- Approval by the EC3 branch review of the deliverable
xi. Shuttle Water Transfer Sustaining Engineering Technical Report
- Approval by the EC3 branch review of the deliverable
xii. SORG SAR Update
- Approval by the EC3 branch review of the deliverable
xiii. ACTEX Build-up, PIA, and ADP
- Approval by the EC3 branch review of the deliverable
xiv. OGS PWR PIA and ADP
- Approval by the EC3 branch review of the deliverable
xv. Repair STS & ISS ACTEX
- Approval by the EC3 branch review of the deliverable
xvi. 20 Micron Filter build-up, PIA & ADP
- Approval by the EC3 branch review of the deliverable
xvii. PWR PIA and ADP
- Approval by the EC3 branch review of the deliverable
xviii. MRF PIA and ADP Deleted Rev 14
- Approval by the EC3 branch review of the deliverable Deleted Rev 14
xix. MRF EDU Deleted Rev 14
- Approval by the EC3 branch review of the deliverable Deleted Rev 14
xx. CWC-I with Iodinated Water, Trade Study
- Approval by the EC3 branch review of the deliverable
xxi. Delta Fluid PWR Compatibility Cert (Phase I)
- Approval by the EC3 branch review of the deliverable
xxii. Delta Fluid PWR Compatibility Cert (Phase II)
- Approval by the EC3 branch review of the deliverable
xxiii. Delta Fluid PWR Compatibility Cert (Phase III)
- Approval by the EC3 branch review of the deliverable
xxiv. Water Conversion Kit
- PD will be closed upon EC3 review and acceptance of the deliverable Added Rev 12
xxv. ACTEX Spares
- PD will be closed upon EC3 review and acceptance of the deliverable Added Rev 12
xxvi. Microbial Removal Filter (MRF)
- PD will be closed upon EC3 review and acceptance of the deliverable
xxvii. Water Transfer Hardware
- PD will be closed upon EC3 review and acceptance of the deliverable Added Rev 18

5.2 Space Shuttle Vehicle Intravehicular Activity (IVA) Government Furnished Equipment (GFE) Updated Rev 11

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall perform Space Shuttle Vehicle IVA GFE project engineering and design, development, testing, and evaluation (DDT&E) per the FY06 EC3 IVA Government Furnished Equipment Requirements Document, EC3-GFE-073.

Note that this activity was moved to Delivery Order 87 with revision 6, effective FY08.

Updated Rev 11

5.2.1 Space Shuttle Vehicle Intravehicular Activity (IVA) Government Furnished Equipment (GFE) Project Code: Updated Rev 11

Typical activity required for the products are:

a) preparation and submittal of draft CR and presentation charts for the FCE CCB.
b) define, develop and obtain approval for the Applicable Requirements Matrix (ARM), Project Requirements & Verification Document (PRVD), and PTRS.
c) submittal of information necessary for the Materials Certification.
d) submittal of information necessary for the Toxicology approval (if required).
e) processing and delivering certified hardware in accordance with PDA/PIA requirements.
f) preparing Task Performance Sheets (TPS) to move, configure, or test, class I hardware.
g) procurement of material or spares.
h) provide design, stress, materials, safety, test and verification, configuration management, etc. as required for products.
i) preparing a CDP and ADP as required by the project.
j) Provide hardware manufacturing and assembly

This includes recertification, fabrication and delivery of Emesis Bags; improvements to the Volume E Stowage Bag; and documenting the extent of certification and fabrication in FY?06 for the Wicket Safety Caps project

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
EA-WI-016	Off-the-Shelf Hardware Utilization in Flight Hardware Development	Baseline
EC3-GFE-073	FY06 EC3 IVA Government Furnished Equipment Requirements Document	Basic
JPR 8500.4 Added Rev 11	Engineering Drawing System Manual	K, 03-06

c. **Required DRDs**

5.2.1 Space Shuttle Vehicle Intravehicular Activity (IVA) Government Furnished Equipment (GFE)

DRD #	DRD Title	Quantity/Frequency
230	Acceptance Data Package	As defined by EC3-GFE-073
231	Limited Life Items List	As defined by EC3-GFE-073
237	Certification Data Package	As defined by EC3-GFE-073
239 Added Rev 11	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	As defined by EC3-GFE-073
241	Risk Assessment Executive Summary Report (RAESR)	As defined by EC3-GFE-073

d. **Products**

5.2.1 Space Shuttle Vehicle Intravehicular Activity (IVA) Government Furnished Equipment (GFE)

Product(s)	Quantity	Delivery Date
Shuttle IVA GFE items Updated Rev 11	15	09/30/2007

e. **Product Verification**

5.2.1 Space Shuttle Vehicle Intravehicular Activity (IVA) Government Furnished Equipment (GFE)

i. Shuttle IVA GFE items

- Approval by the EC3 branch review of deliverable

5.3 ISS FCE Sustaining Engineering (SE) and Spares Updated Rev 11

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall the contractor shall provide engineering assurance and subsystem management per FY06 EC3 IVA Government Furnished Equipment Requirements Document, EC3-GFE-073.

This activity moved to Delivery Order 87 with revision 6. In compliance with the above identified SOW(s) ESCG will provide engineering assurance and subsystem management per FY06 EC3 IVA Government Furnished Equipment Requirements Document, EC3-GFE-073. Rev 5 changes the requirement for IVA weekly updates to the webpage to bi-weekly updates. No additional activities will occur against this WBS. This work is being transferred to D087 beginning FY08. Updated Rev 11

5.3.1 ISS FCE Sustaining Engineering (SE) and Spares Updated Rev 11
Project Code:

The contractor shall provide engineering process assurance and subsystem management for ISS Sustaining Enginee Spares.

Typical activity required for the products are:
a) processing and delivering certified hardware in accordance with PDA/PIA requirements.
b) preparing Task Performance Sheets (TPS) to move, configure, or test, class I hardware.
c) procurement of spares.
d) provide design, stress, materials, safety, test and verification, configuration management, etc. as required for improvements or corrective action.
e) Provide hardware manufacturing and assembly

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
EA-WI-016	Off-the-Shelf Hardware Utilization in Flight Hardware Development	Baseline
EC3-GFE-073	FY06 EC3 IVA Government Furnished Equipment Requirements Document	Current
JPR 8500.4 Added Rev 11	Engineering Drawing System Manual	K
JSC-28533	ISS Catalog of IVA GFE FCE	Rev D

c. **Required DRDs**

5.3.1 ISS FCE Sustaining Engineering (SE) and Spares		
DRD #	DRD Title	Quantity/Frequency
230	Acceptance Data Package	As defined by EC3-GFE-073
231	Limited Life Items List	As defined by EC3-GFE-073
237	Certification Data Package	As defined by EC3-GFE-073
241	Risk Assessment Executive Summary Report (RAESR)	As defined by EC3-GFE-073

d. **Products**

5.3.1 ISS FCE Sustaining Engineering (SE) and Spares		
Product(s)	Quantity	Delivery Date
IVA GFE Catalog Revisions Updated Rev 11	2	6/30/07
IVA Weekly Updates to Webpage	52/year	Weekly
ISS IVA GFE Sustaining Products Updated Rev 11	36	9/30/07
IVA Bi-Weekly Updates to Webpage Added Rev 11	16	Bi-weekly

e. **Product Verification**

5.3.1 ISS FCE Sustaining Engineering (SE) and Spares
i. IVA GFE Catalog Revisions
- Approval by the EC3 branch review of deliverable
ii. IVA Weekly Updates to Webpage

- Approval by the EC3 branch review of deliverable

iii. ISS IVA GFE Sustaining Products

- Approval by the EC3 branch review of deliverable

iv. IVA Bi-Weekly Updates to Webpage

- Approval by the EC3 branch review of deliverable Added Rev 11

5.4 ISS Hardware Development Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform design, development, testing and evaluation (DDT&E) as related to FCE hardware being developed for the ISS per the FY06 EC3 IVA Government Furnished Equipment Requirements Document, EC3-GFE-073.

Effective with Revision 7 of this delivery order, contractor shall perform, design, development, testing and evaluation (DDT&E) and sustaining engineering as related to IVA hardware for the ISS per Project Directives.

Project Directives must be approved by the EC3 CCB chair and are maintained under configuration control. The contractor shall provide a copy of all PDs issued after the date of this revision to the contracting office within 5 days of approval.

Revision 12 includes development of the First Response Respirator and the IMV filter. Rev 12 also removes document, EC3-GFE-073 - IVA GFE Requirements Document, from applicability.

Revision 14 adds scope for FY10. Sustaining engineering hardware delivery quantities and dates will be in accordance with the EC3 Flight Manifest which is maintained in the EC3 Share Folder. PDs will no longer be used to direct sustaining engineering flight hardware deliveries.

Revision 15 adds scope for the Fire Cartridge Task to be defined by PD.

Revision 16 adds scope for FY11 tasks (through March 2011)in accordance with the EC3 Flight Manifest.

Revision 17 adds scope for the Internal Thermal Control System (ITCS) Water Analysis Kit (IWAK) to be defined by PD.

Revision 18 adds scope for Fire Cartridge and ERADK. It removes the IWAK.

Revision 19 moves PD scope for Velocicalc from FY11 to FY12 and adds FY12 ITCS/ECLSS sustaining engineering scope. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.4.1 ISS Hardware Development Updated Rev 18
Project Code: MRK, Ammonia Respirator, CCTK, ERADK - 00065; IMV Filter - 00091; CQMK, Non-instrusive Flowmeter - 00104, Fire Cartridge - 00110

Typical activity required for the products are:

a) preparation and submittal of draft CR and presentation charts for the CCB.

b) define, develop and obtain approval for the requirements document.

c) submittal of information necessary for the Materials Certification.

d) submittal of information necessary for the Toxicology approval (if required).

e) processing and delivering certified hardware in accordance with PDA/PIA requirements.

f) preparing Task Performance Sheets (TPS) to move, configure, or test, class I hardware.

g) procurement of material or spares

h) provide hardware manufacturing and assembly

i) provide design, stress, materials, safety, test and verification, configuration management, etc. as required for products.

j) preparing a CDP and ADP as required by the project.

k) providing anomaly resolution and resupply activities

This includes certification of the Ultra-Sonic Leak Detector audio cable, and a report documenting the extent of FY'06

project completion on the Non- Intrusive Flowmeter. This also includes the development and delivery of the Expanded Range Ammonia Detection Kit (ERADK), additional quantities of CQMK and Connector Cleaner Kit.

The scope of this WBS was modified in Revision 7 of this delivery order to include sustaining engineering for Crew & Thermal Systems Division Life Support and Habitability hardware. Sustaining engineering hardware includes the CQMK, MRK, Ammonia Respirator, Connector Cleaner Kit, Velocicalc, Non-intrusive Flow Meter, and ERADK. Provide CQMKs as specified by the manifest. Provide development for the IMV Filter project. Transfer hardware processing responsibility to USA FCE as directed.

These EA project codes encompass the Life Support and Habitability subsystems:

Life Support and Habitability Hardware	Project Code
MRK, Ammonia Respirator, CCTK, Velocicalc, ERADK	00065
IMV Filter	00091
CQMK, Non-intrusive Flowmeter	00104

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03

c. **Required DRDs**

5.4.1 ISS Hardware Development

DRD #	DRD Title	Quantity/Frequency
230 Updated Rev 14	Acceptance Data Package	As defined by PD or EC3 Flight Manifest
231 Updated Rev 12	Limited Life Items List	As defined by PD
237 Updated Rev 12	Certification Data Package	As defined by PD
238 Updated Rev 12	Space Station Reliability and Maintainability Predictions Report	As defined by PD
239 Updated Rev 12	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	As defined by PD
240 Updated Rev 12	Space Station Hazard Reports (HR's)	As defined by PD
241 Updated Rev 12	Risk Assessment Executive Summary Report (RAESR)	As defined by PD

d. **Products**

5.4.1 ISS Hardware Development

Product(s)	Quantity	Delivery Date
ISS IVA GFE Hardware Development Items Updated REV 19	2	09/30/2008

ISS Hardware Sustaining items Updated REV 19	3	9/30/08
Monthly Cost & Schedule Updated REV 19	12	Monthly
Refurbishment and calibration of non-intrusive flow meter Updated REV 19	1	12/18/08
Process waiver to extend flow meter calibration life on orbit Updated REV 19	1	1/5/09
Deliver CQMK for 15A Updated REV 19	1	12/19/08
Deliver CQMK for 17A Updated REV 19	1	17A
Fire Cartridge	per PD	per PD
IMV Screen	per PD	per PD
Flight deliveries for sustaining hardware	per EC3 Flight Manifest	per EC3 Flight Manifest
IWAK Deleted Rev 18	per PD	per PD
Velocicalc Added REV 19	per PD	per PD

e. **Product Verification**

5.4.1 ISS Hardware Development

i. ISS IVA GFE Hardware Development Items

- Approval by the EC3 branch review of deliverable

ii. ISS Hardware Sustaining items

- Approval by the EC3 branch review of deliverable

iii. Monthly Cost & Schedule

- Approval by the EC3 branch review of deliverable

iv. Refurbishment and calibration of non-intrusive flow meter

- Approval by the EC3 branch review of deliverable

v. Process waiver to extend flow meter calibration life on orbit

- Approval by the EC3 branch review of deliverable

vi. Deliver CQMK for 15A

- Approval by the EC3 branch review of deliverable

vii. Deliver CQMK for 17A

- Approval by the EC3 branch review of deliverable

viii. Fire Cartridge

- PDs will be closed upon review and acceptance of the deliverable by the EC3 CCB chair or designee

ix. IMV Screen

- PDs will be closed upon review and acceptance of the deliverable by the EC3 CCB chair or designee

x. Flight deliveries for sustaining hardware

- PDs will be closed upon review and acceptance of the deliverable by the EC3 CCB chair or designee

xi. IWAK Deleted Rev 18

- PDs will be closed upon review and acceptance of the deliverable by the EC3 CCB chair or designee Deleted Rev 18

xii. Velocicalc

- PDs will be closed upon review and acceptance of the deliverable by the EC3 CCB chair or designee. Added REV 19

5.5 ISS IVA GFE Updated Rev 11

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide design, development, testing and evaluation (DDT&E) and hardware certification for ISS IVA GFE, per the FY06 EC3 IVA Government Furnished Equipment Requirements Document, EC3-GFE-073.

This activity moved to Delivery Order 87 with revision 6. No additional activities will occur against this WBS. This work is being transferred to D087 beginning FY08. Updated Rev 11

5.5.1 ISS IVA GFE Updated Rev 12
Project Code:

Typical activity required for the products are:

a) preparation and submittal of draft CR and presentation charts for the CCB.

b) define, develop and obtain approval for the Requirements document.

c) submittal of information necessary for the Materials Certification.

d) submittal of information necessary for the Toxicology approval (if required).

e) processing and delivering certified hardware in accordance with PDA/PIA requirements.

f) preparing Task Performance Sheets (TPS) to move, configure, or test, class I hardware.

g) procurement of material and spares

h) provide hardware manufacturing and assembly

i) provide design, stress, materials, safety, test and verification, configuration management, etc. as required for products.

j) preparing a CDP and ADP as required by the project.

This is limited to; completion of certification and delivery of the QD Trainer; fabrication, test and delivery of EMU A/L CLR spares; and documenting the extent of FY?06 project engineering and safety products completed for the Criticality 1 CDK certification.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
EC3-GFE-073	FY06 EC3 IVA Government Furnished Equipment Requirements Document	Current

c. **Required DRDs**

5.5.1 ISS IVA GFE

DRD #	DRD Title	Quantity/Frequency
230	Acceptance Data Package	As defined by EC3-GFE-073
231	Limited Life Items List	As defined by EC3-GFE-073
237	Certification Data Package	As defined by EC3-GFE-073
238	Space Station Reliability and Maintainability Predictions Report	As defined by EC3-GFE-073
239	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	As defined by EC3-GFE-073
241	Risk Assessment Executive Summary Report (RAESR)	As defined by EC3-GFE-073

d. **Products**

5.5.1 ISS IVA GFE

Product(s)	Quantity	Delivery Date
ISS IVA GFE items	4	09/30/2006

e. **Product Verification**

5.5.1 ISS IVA GFE

i. ISS IVA GFE items
- Approval by the EC3 branch review of deliverable

5.6 Capability Upgrades Crew Quarters (CQ) Updated REV 19

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall conduct project engineering, system engineering, design, analysis, manufacturing, assembly, and test for capability upgrades to the crew quarters for integration into the ISS.

EC3 has directed the use of the Crew Quarters Project Technical Requirements Specification (PTRS), SSP 50781, revision A as the End Item Specification (EIS). FY06 development activity is through preliminary design review (PDR) phase per EA-WI-023. The Delta SRR Data Package is not included. It was completed under the TO 49. FY07 development activity is through critical design review (CDR) per EA-WI-023. FY08-09 activities are through delivery and Systems Acceptance Review (SAR).

Data products shall be uploaded to the EC3 share folder at \\Jsc-ifs-02.jsc.nasa.gov\data\EA\EC_SHR\ISS Expanded Hab\HAB Inbox\DO Deliveries.

Contractor shall prepare the PDR and CDR Data Packages and submit initially to the EC3 share folder two weeks prior to the scheduled review. Contractor shall update the PDR and CDR data package with RID Data and dispositions upon completion of RID close out. The final PDR and CDR Data Packages will be submitted in accordance with DRD 204 (PDR) and DRD 213 (CDR).

Revision 8 includes changes to delivery dates based on the current launch schedule.

Revision 9 includes splitting the delivery of Crew Quarters Units 1 and 2 into a -303/304 configuration (-301/-302 configuration without the Electrical Panel, ATU Speaker, Intake and Exhaust Flow Sensors, and Power Supply) and the ship short electronic items.

Revision 10 includes adding sustaining engineering activities in FY09. It also changes the delivery configuration for CQ1 to -301 and for CQ2 to -302 since electronics were integrated into the racks at KSC to complete the launch configurations.

Revision 11 changes the delivery dates for CQ3 and CQ4 and adds sustaining engineering activities. Spares and ATU upgrade activities will be added in a future revision.

Revision 12 adds Japanese Experiment Module (JEM) certification and spares for the Crew Quarters. Project Directives will be used to define deliverables including specific products quantities, due dates, process tailoring, etc.

Note: The project requirements document serves as the End Item Specification Document for all flight hardware projects.

Revision 16 adds FY10 and FY11 (through March 2011) Crew Quarters tasks to be defined by project directive. PDs are to be approved by the EC3 CCB and maintained under configuration control.

Revision 18 adds FY11 and FY12 scope for Crew Quarters sustaining engineering and spares activities to be defined per PD.

Revision 19 adds FY12 scope for Crew Quarters sustaining engineering to be defined by PD. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.6.1 Capability Upgrades Crew Quarters (CQ) Updated Rev 18

Project Code:

Perform project engineering, documentation and hardware for the for Crew Quarters sustaining engineering and spares activities.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
SSP 50357 Added Rev 11	Node 2 to Crew Quarters Interface Control Document	A
SSP 62302 Added Rev 11	Project Technical Requirements Specification for the Crew Quarters	A

c. **Required DRDs**

5.6.1 Capability Upgrades Crew Quarters (CQ)

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 11	Engineering Drawings and Model Files	1
103 Added Rev 11	Electrical, Electronic, and Electromechanical (EEE) Parts List and Analysis Report	1
204 Updated Rev 11	Preliminary Design Review (PDR) Data Package	1
209 Added Rev 11	Flight Products Verification and Validation Plan	1

213 Added Rev 11	Flight Product Critical Design Review (CDR) Data Package	1
219 Added Rev 11	Flight Product User's Guide	1
230 Added Rev 11	Acceptance Data Package	4
231 Added Rev 11	Limited Life Items List	1
233 Added Rev 11	Government Certification Approval Request (GCAR)	1
237 Added Rev 11	Certification Data Package	1
241 Added Rev 11	Risk Assessment Executive Summary Report (RAESR)	1

d. **Products**

5.6.1 Capability Upgrades Crew Quarters (CQ)

Product(s)	Quantity	Delivery Date
Monthly Project Schedule (FY06) Updated REV 19	8	09/30/2006
Delta SRR Data Package Deleted Rev 11	1	09/30/2006
Preliminary Design Data Package Updated REV 19	1	09/30/2006
Semi-Monthly Detailed Project Schedule Updated REV 19	53	Semi-monthly
Risk Assessment Executive Summary Report (RAESR) Phase I Updated REV 19	1	10/30/06
Required Government Furnished Equipment list Updated REV 19	1	10/15/2006
De-rated commercial material properties of non-metallic structural materials report. Updated REV 19	1	01/31/2007
EEE Parts Assessment Updated REV 19	1	1/31/07
Long lead procurement list (requiring pre-CDR authorization) Updated REV 19	1	2/28/07
Updated PTRS with PDR RIDs incorporated (draft input for CR) Updated REV 19	1	01/31/2007
Updated ICD with PDR RIDs incorporated (draft input for CR) Updated REV 19	1	01/31/2007
Manufacturing Plan Updated REV 19	1	04/20/2007
Operations Nomenclature List Updated REV 19	1	04/20/2007
Updated preliminary fabrication and completion to SAR cost estimate Updated REV 19	1	07/17/2007
Risk Assessment Executive Summary Report (RAESR) Phase II Updated REV 19	1	07/10/2007
Critical Design Review Data Package Updated REV 19	1	07/10/2007
Sustaining Engineering Plan Updated REV 19	1	07/10/2007
Drawing Tree (Excel listing by subassembly order) Updated REV 19	1	06/20/2007
Mid-Fidelity Mockup (preliminary for SF evaluations; not delivered to NASA) Updated REV 19	1	05/30/2007
Test Plan Updated REV 19	1	08/31/2007
Post-CDR Stress Report Updated REV 19	1	09/23/2007
Post-CDR Drawing Tree (with all configurations) Updated REV 19	1	08/31/2007
Government Certification Approval Request (GCAR) Updated REV 19	1	10/30/2008
Acceptance Data Package (ADP): CQ1&2, CQ3, CQ4 Updated REV 19	2, 1, 1	11/12/2008, 2/20/09, 7/22/09
Certification Data Package (CDP) Updated REV 19	1	10/30/2008
Final Risk Assessment Executive Summary Report (RAESR) Updated REV 19	1	10/30/2008
IDD Updated REV 19	1	4/17/09
Mid-Fidelity Crew Quarter Mockup Updated REV 19	1	2/27/09
Crew Quarters Flight Unit 1 (-301 config) Updated REV 19	1	9/1/2008
Crew Quarters Flight Unit 2 (-302 config) Updated REV 19	1	9/1/2008
Crew Quarters Flight Unit 3 (-301 config) to bond Updated REV 19	1	2/13/2009
Crew Quarters Flight Unit 4 (-302 config) to bond Updated REV 19	1	7/8/2009
SAR Presentation Updated REV 19	1	10/28/2008
Close out Photography Package for CQ1-2, CQ3, CQ4 Updated REV 19	2, 1, 1	10/30/2008, 2/20/09, 6/26/09
Lessons Learned Report Updated REV 19	1	2/24/09
Monthly Earned Value Management Report (FY07) Updated REV 19	12	Monthly
CQ/JEM Certification Added Rev 12	per PD	per PD
CQ Spares Added Rev 12	per PD	per PD
CQ Sustaining Engineering Activities Added Rev 14	per PD	per PD

e. **Product Verification**

5.6.1 Capability Upgrades Crew Quarters (CQ)

i. Monthly Project Schedule (FY06)
- Approval by the EC3 branch review of deliverable
ii. Delta SRR Data Package Deleted Rev 11
- Approval by the EC3 branch review of deliverable Deleted Rev 11
iii. Preliminary Design Data Package
- Approval by the EC3 branch review of deliverable
iv. Semi-Monthly Detailed Project Schedule
- Approval by the EC3 branch review of deliverable
v. Risk Assessment Executive Summary Report (RAESR) Phase I
- Approval by the EC3 branch review of deliverable
vi. Required Government Furnished Equipment list
- Approval by the EC3 branch review of deliverable
vii. De-rated commercial material properties of non-metallic structural materials report.
- Approval by the EC3 branch review of deliverable
viii. EEE Parts Assessment
- Approval by the EC3 branch review of deliverable
ix. Long lead procurement list (requiring pre-CDR authorization)
- Approval by the EC3 branch review of deliverable
x. Updated PTRS with PDR RIDs incorporated (draft input for CR)
- Approval by the EC3 branch review of deliverable
xi. Updated ICD with PDR RIDs incorporated (draft input for CR)
- Approval by the EC3 branch review of deliverable
xii. Manufacturing Plan
- Approval by the EC3 branch review of deliverable
xiii. Operations Nomenclature List
- Approval by the EC3 branch review of deliverable
xiv. Updated preliminary fabrication and completion to SAR cost estimate
- Approval by the EC3 branch review of deliverable
xv. Risk Assessment Executive Summary Report (RAESR) Phase II
- Approval by the EC3 branch review of deliverable
xvi. Critical Design Review Data Package
- Approval by the EC3 branch review of deliverable
xvii. Sustaining Engineering Plan
- Approval by the EC3 branch review of deliverable
xviii. Drawing Tree (Excel listing by subassembly order)
- Approval by the EC3 branch review of deliverable
xix. Mid-Fidelity Mockup (preliminary for SF evaluations; not delivered to NASA)
- Approval by the EC3 branch review of deliverable
xx. Test Plan
- Approval by the EC3 branch review of deliverable
xxi. Post-CDR Stress Report
- Approval by the EC3 branch review of deliverable
xxii. Post-CDR Drawing Tree (with all configurations)
- Approval by the EC3 branch review of deliverable
xxiii. Government Certification Approval Request (GCAR)
- Approval by the EC3 branch review of deliverable
xxiv. Acceptance Data Package (ADP): CQ1&2, CQ3, CQ4
- Approval by the EC3 branch review of deliverable
xxv. Certification Data Package (CDP)
- Approval by the EC3 branch review of deliverable
xxvi. Final Risk Assessment Executive Summary Report (RAESR)
- Approval by the EC3 branch review of deliverable
xxvii. IDD
- Approval by the EC3 branch review of deliverable
xxviii. Mid-Fidelity Crew Quarter Mockup
- Approval by the EC3 branch review of deliverable
xxix. Crew Quarters Flight Unit 1 (-301 config)

- Approval by the EC3 branch review of deliverable

xxx. Crew Quarters Flight Unit 2 (-302 config)

- Approval by the EC3 branch review of deliverable

xxxi. Crew Quarters Flight Unit 3 (-301 config) to bond

- Approval by the EC3 branch review of deliverable

xxxii. Crew Quarters Flight Unit 4 (-302 config) to bond

- Approval by the EC3 branch review of deliverable

xxxiii. SAR Presentation

- Approval by the EC3 branch review of deliverable

xxxiv. Close out Photography Package for CQ1-2, CQ3, CQ4

- Approval by the EC3 branch review of deliverable

xxxv. Lessons Learned Report

- Approval by the EC3 branch review of deliverable

xxxvi. Monthly Earned Value Management Report (FY07)

- Approval by the EC3 branch review of deliverable

xxxvii. CQ/JEM Certification

- PDs will be closed upon review and acceptance of the deliverable by the EC3 CCB chair or designee Added Rev 12

xxxviii. CQ Spares

- PDs will be closed upon review and acceptance of the deliverable by the EC3 CCB chair or designee Added Rev 12

xxxix. CQ Sustaining Engineering Activities

- PDs will be closed upon review and acceptance of the deliverable by the EC3 CCB chair or designee Added Rev 14

5.7 ISS Capability Upgrades Regen ECLSS Hoses (RH) Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide the engineering design and development for the ISS capability upgrades Regen ECLSS Hoses. EC3 has directed the use of the Project Technical Requirements Specification (PTRS) for the Regenerative Environmental Control and Life Support System Fluid Hoses (REFH), ESCG-4120-07-ECLSS-DOC-0001-A (JSC 65135), as the End Item Specification (EIS). Four hose functions for potable water and one hose function for pretreated urine will be developed. Rev 4 adds one additional common hose assembly (flight unit) with a longer length will also be developed. This unit will have all the functions and components of the common hose, but will only differ in length. It will be qualified by similarity to the common hose. The MDP for all of the hoses is increased from 35 psig to 40 psig. The GFE provided by NASA are two flight ACTEX filters, urine compatible hydro-connectors, two triple crew transfer bags (CTBs) (1 flight and 1 class 3), and urine compatible line assemblies (with QDs, fittings, and caps). Data products shall be uploaded to the EC3 share folder at \\Jsc-ifs-02.jsc.nasa.gov\data\EA\EC_SHR\ISS Expanded Hab\HAB Inbox\DO Deliveries.

Revision 7 divided the three hose sets into three deliverables in order to more clearly describe the products. 1 deliverable is for the complete hose kit, including the CTB and two ACTEX units (which will be provided as GFE). 1 deliverable is for the four kit components developed under this task (delivered as individual hoses, not as a kit). 1 deliverable is for the class 3 trainer kit except the two ACTEX units.

Revision 8 includes the redesign effort for the pre-treated urine transfer hose and the changes in the delivery schedule.

Revision 9 reduces the number of Pre-treated Urine Transfer Hoses from 2 to 1 due to a future redesign of the hose.

Revision 10 adds sustaining engineering.

Revision 11 adds the regen hose redesign effort per CR011333. This includes the preliminary concept development, long lead item procurement, and delta Systems Requirements Review (dSRR) activities.

Revision 12 add the DDT&E and certification activities following the delta SRR for the Regen Hose.

Project Directives (PDs) will be used to define deliverables including, quanities, due dates, documentation and process tailoring.

Revision 15 adds REFH sustaining engineering tasks for FY10 to be defined by Project Directive (PD).

Revision 16 adds scope for urine transfer hardware tasks (including the Urine Funnel Adapter) to be defined by PD. PDs are to be approved by the EC3 CCB and maintained under configuration control.

Revision 18 adds scope for urine transfer hardware tasks to be defined by PD.

Revision 19 adds scope for urine transfer hardware tasks to be defined by PD. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.7.1 ISS Capability Upgrades Regen ECLSS Hoses (RH) Updated Rev 18
Project Code: 2C906

Provide the engineering design and development for the ISS capability upgrades Regen ECLSS Hoses.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
JPR 8500.4 Added Rev 11	Engineering Drawing System Manual	K, 03-06
JSC 65315 Added Rev 11	Project Technical Requirements Specification (PTRS) for the Regenerative Environmental Control and Life Support System Fluid Hoses (REFH)	C

c. **Required DRDs**

5.7.1 ISS Capability Upgrades Regen ECLSS Hoses (RH)

DRD #	DRD Title	Quantity/Frequency
230 Added Rev 11	Acceptance Data Package	1 per Hose Set Delivery
231 Updated Rev 11	Limited Life Items List	1
237 Updated Rev 11	Certification Data Package	1
239 Updated Rev 11	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	1
240 Updated Rev 11	Space Station Hazard Reports (HR's)	1
241 Updated Rev 11	Risk Assessment Executive Summary Report (RAESR)	1

d. **Products**

5.7.1 ISS Capability Upgrades Regen ECLSS Hoses (RH)

Product(s)	Quantity	Delivery Date
Monthly Project Schedule Updated REV 19	1 per month	Monthly
Design Review Data Package Updated REV 19	1	09/30/2006
Certification Test (Qual Unit) Deleted Rev 1	1	09/30/2006
Acceptance Test (Flight Unit) Deleted Rev 1	1	09/30/2006
GCAR Deleted Rev 1	1	09/30/2006
Safety Data Package Deleted Rev 1	1	09/30/2006
Initial Assessment of Criticality (IAC) Updated REV 19	1	09/30/2006
Risk Assessment Executive Summary Report (RAESR) Deleted Rev 1	1	09/30/2006
Hose Set Delivery - 5 Regen Hoses (2 flight and one qual unit each) Updated Rev 1	1 set	01//2006
Project Technical Requirements Specification (draft) Updated REV 19	1	09/30/2006
Certification Test (Qual Unit) ? potable water functions Updated REV 19	1	03/28/2007
Acceptance Test (Flight Units) ? pretreated urine function Updated REV 19	1	06/02/2008
GCAR Updated REV 19	1	6/17/08
Initial Assessment of Criticality (IAC) Updated REV 19	1	09/30/2006
Risk Assessment Executive Summary Report (RAESR) Updated REV 19	1	06/17/2008
Flight Kit (SEG33119505-302) (no PTU hose) Updated REV 19	1	06/04/2008
Flight Kit Components (SEG33119491-301, SEG33119492-301, SEG33119493-301) (no PTU hose) Updated REV 19	1	06/04/2008
Class 3 Trainer Kit not including ACTEX units Updated REV 19	1	05/20/2008
Long Common Hose Delivery (SEG33119491-302) Updated REV 19	1	06/04/2008
Phase II RAESR (responses to board actions) Updated REV 19	1	11/15/08
PIA/PDA Procedure Updated REV 19	1	5/15/08
Phase III RAESR input to NT Updated REV 19	1	1/15/2008
SAR presentation Updated REV 19	1	06/27/2008

PTU Hose (SEG33119500-302) Updated REV 19	1	06/17/2008
Delta SRR Presentation Updated REV 19	1	01/14/2009
Upgraded REFH set Updated REV 19	per PD	per PD
Certification Test (Qual Unit) - pretreated urine function Updated REV 19	1	6/2/08
Acceptance Test (Flight Units) -potable water functions Updated REV 19	1	3/28/07
Sustaining Engineering Tasks Updated REV 19	per PD	per PD
Urine Transfer Hardware Added Rev 16	per PD	perPD

e. **Product Verification**

5.7.1 ISS Capability Upgrades Regen ECLSS Hoses (RH)
i. Monthly Project Schedule
- Approval by EC3 Branch Review of deliverable
ii. Design Review Data Package
- Approval by EC3 Branch Review of deliverable
iii. Certification Test (Qual Unit) Deleted Rev 1
- Approval by EC3 Branch Review of deliverable Deleted Rev 1
iv. Acceptance Test (Flight Unit) Deleted Rev 1
- Approval by EC3 Branch Review of deliverable Deleted Rev 1
v. GCAR Deleted Rev 1
- Approval by EC3 Branch Review of deliverable Deleted Rev 1
vi. Safety Data Package Deleted Rev 1
- Approval by EC3 Branch Review of deliverable Deleted Rev 1
vii. Initial Assessment of Criticality (IAC)
- Approval by EC3 Branch Review of deliverable
viii. Risk Assessment Executive Summary Report (RAESR) Deleted Rev 1
- Approval by EC3 Branch Review of deliverable Deleted Rev 1
ix. Hose Set Delivery - 5 Regen Hoses (2 flight and one qual unit each) Updated Rev 1
- Approval by EC3 Branch Review of deliverable Updated Rev 1
x. Project Technical Requirements Specification (draft)
- Approval by EC3 Branch Review of deliverable
xi. Certification Test (Qual Unit) ? potable water functions
- Approval by EC3 Branch Review of deliverable
xii. Acceptance Test (Flight Units) ? pretreated urine function
- Approval by EC3 Branch Review of deliverable
xiii. GCAR
- Approval by EC3 Branch Review of deliverable
xiv. Initial Assessment of Criticality (IAC)
- Approval by EC3 Branch Review of deliverable
xv. Risk Assessment Executive Summary Report (RAESR)
- Approval by EC3 Branch Review of deliverable
xvi. Flight Kit (SEG33119505-302) (no PTU hose)
- Approval by EC3 Branch Review of deliverable
xvii. Flight Kit Components (SEG33119491-301, SEG33119492-301, SEG33119493-301) (no PTU hose)
- Approval by EC3 Branch Review of deliverable
xviii. Class 3 Trainer Kit not including ACTEX units
- Approval by EC3 Branch Review of deliverable
xix. Long Common Hose Delivery (SEG33119491-302)
- Approval by EC3 Branch Review of deliverable
xx. Phase II RAESR (responses to board actions)
- Approval by EC3 Branch Review of deliverable
xxi. PIA/PDA Procedure
- Approval by EC3 Branch Review of deliverable
xxii. Phase III RAESR input to NT
- Approval by EC3 Branch Review of deliverable
xxiii. SAR presentation
- Approval by EC3 Branch Review of deliverable

xxiv. PTU Hose (SEG33119500-302)

- Approval by EC3 Branch Review of deliverable

xxv. Delta SRR Presentation

- Approval by EC3 Branch Review of deliverable

xxvi. Upgraded REFH set

- Approval by EC3 Branch Review of deliverable

xxvii. Certification Test (Qual Unit) - pretreated urine function

- Approval by EC3 Branch Review of deliverable

xxviii. Acceptance Test (Flight Units) -potable water functions

- Approval by EC3 Branch Review of deliverable

xxix. Sustaining Engineering Tasks

- PD will be closed upon EC3 review and acceptance of the deliverable.

xxx. Urine Transfer Hardware

- PD will be closed upon EC3 review and acceptance of the deliverable Added Rev 16

5.8 Advanced Life Support Water Recovery System (WRS) Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide testing, data analysis, and reporting of test data supporting development of advanced water recovery technologies in the facilities located in building 7B, rooms 1300, 1300A, 1300B, 1300C, and building 7 room 2010. Other development and testing activities for Shuttle, ISS, and Constellation programs may be required as necessary. Deliverables will be uploaded to the EC3 WRS share folder and DDMS.

WRS/Hab CEV Interfaces shall consist of the Urine Stabilization project, the Static Phase Separator C-9 flight experiment, and the Cleanser Development project. Monthly reports will not be required during the months in which quarterly reports are delivered. For FY07, the Static Phase Separator has been moved to WBS #5.16. For FY08, quarterly reports have been replaced by monthly reports.

For WRS in 5.8, the following products have been deleted with the concurrence of EC3 due to a change in program direction and a reduction in available funds: Monthly AWRS Master Schedule, Monthly Advanced Post Processing Technical & Schedule Status Report, Monthly Nanostructured Disinfection Device Technical & Schedule Status Report, Monthly Water Lab Reconfiguration Technical & Schedule Status, Nanostructured Disinfection Device Technical Report, and Nanostructured Disinfection Device Project Plan. The Advanced Post Processing Technical Report was updated to include the Schedule. The Static Phase Separator C-9 flight experiment was added to the WRS/Hab CEV Interfaces task for FY06. The Monthly Rotating Membrane System task was deleted by EC3 due to a change in project priorities. Rev 5: ELS Biweekly Report requirement is descoped and no longer a requirement as directed from the ELS Project Office. The Shuttle Wastewater Dump Line Final Report was added to the deliverables. One WRS/Hab CEV Interfaces quarterly report and one monthly report were removed from the deliverables as a result of reduced efforts on those tasks due to higher priority tasks. Rev 6: The following were added to the deliverables: a monthly integrated master schedule, a silver biocide white paper, a final CEV disinfection report, a soft water stowage final report, a final CDS test report, a CDS publishable report, a monthly pretreatment technical and schedule status report, an organic acid urine pretreatment test report, a disinfection agent urine pretreatment test report, a combined formulation urine pretreatment test report, a publishable pretreatment report, and a water recovery development and weekly status report.

Rev 7: The following tasks were added:
1) Provide technical services from Northwestern University to assist in the testing of the Rotating Reverse Osmosis system in the AWRSDF performed by NASA.
2) Evacuation of microbiology laboratory space in B29 by consolidating functions in B7B/1300B and B7/2010 laboratories. The two laboratories will be remodeled to maintain current microbiology and analytical chemistry WRS functions. The evacuation of the microbiology space is required by June 1, 2008.

Rev 8: The following tasks were added/deleted:
1) Added the test and evaluation of the Rotating Reverse Osmosis system. Provide monthly reports and a final test report.
2) Deleted the Soft Water Storage final report.
3) Deleted the Silver Biocide white paper.

Rev 10: The following tasks were added or changed:
1) Produce 11 ELS Reportable Milestone ?Two Page Summaries?
2) Consolidation of Urine Pretreatment evaluations with Cleanser, Detergent, and Personal Care Product evaluations
3) WWCTS check-out and activiation task for hygiene water collection was added
4) CDS testing is now a part of a Distillation Comparison Test task
5) Direct Osmotic Concentrator evaluation task was added
6) Brine Dewatering systems development task was added
7) Periodic update of applicable OPIS databases ? to be statused in monthly project status reports
8) CTSD division requirements for wet chemistry analyses under EC3 management oversight

Rev 11: The following changes were made:
1) Added the delivery of five Waste Water Collection and Transport System monthly technical and schedule status reports
2) Changed the delivery date of the Cascade Distillation System midtest status report from 4/10/09 to 6/19/09
3) Changed the delivery date of the Direct Osmotic Concentrator test plan from 3/30/09 to 4/17/09.
4) Deleted the Star TOC autosampler upgrade and added the Shimadzu persulfate TOC analyzer in its place.

Rev 12: The following changes were made:
1) Change the delivery date of the Distillation Comparison Test Midtest Status Report from 6/19/09 to 7/6/09.

2) Change the delivery date of the DOC Test Readiness Review Documentation from 6/1/09 to 7/1/09.
Added funding and scope to extend period of support through 1/31/10.
3) Added an Acceptable Products Development Plan for the Cleanser, detergent, personal care product, pretreat evaluation & selection task.
4) Added a CDS/ Distillation Comparison Test Task Close-out Report.
5) Descoped Water Recovery Technology Development and Program Support Weekly Status Report
6) Descoped Monthly Cleanser, detergent, personal care product, pretreat evaluation & selection Technical & Schedule Status Report
7) Descoped Monthly CDS/ Distillation Comparison Test Technical & Schedule Status Report
8) Descoped Monthly Direct Osmotic Concentrator Technical & Schedule Status Report
9) Descoped Monthly Brine Dewatering Technical & Schedule Status Report
10) Descoped Exploration Life Support (ELS) Reportable Milestone "Two Page" Summary
11) Consolidated the Semiannual Laboratory Equipment Maintenance Schedule and the Semiannual Laboratory Equipment Replacement/Upgrade Schedule deliverables into one deliverable entitled the WRS Semiannual Laboratory Equipment Replacement/Upgrade and Maintenance Schedule.

Revision 14 adds scope for the remainder of FY10. It deletes the CDS/Distillation Comparison Test Report and the Acceptable Products Development Plan. It also authorizes the use of Project Directives to define deliverables, due dates, process tailoring, and applicable DRDs. PDs are to be approved by the EC3 CCB and maintained under configuration control.

Revision 15 deletes the FY09 Cleanser , Detergent, Personal Care Product, Pre-treat evaluation and selection annual report and changes the delivery date for the Test Readiness Review Documentation for the Direct Osmotic Concentrator.

Revision 16 adds scope for FY11 to be defined by PD.

Revision 17 adds scope for FY11 tasks to be defined by PD.

Revision 18 adds scope for FY11 tasks.

Revision 19 adds scope for FY11 and FY12 tasks to be defined by PD. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.8.1 Advanced Life Support Water Recovery System (WRS) Updated Rev 17
Project Code:

as described in General Product Requirments above

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Basic
EC3-ALS-001	Advanced Life Support (ALS) Technology Development Facility Standard Operating Procedures Manual	Original
EC3-WR-001	Standard Operating Procedure (SOP) Alkalinity	A
EC3-WR-002	Standard Operating Procedure (SOP) pH	A
EC3-WR-003	Standard Operating Procedure (SOP) Conductivity, EPA 120.1	Original
EC3-WR-004	Standard Operating Procedure (SOP) Total Suspended Solids, EPA 120.1	Original
EC3-WR-005	Standard Operating Procedure (SOP) Total Dissolved Solids (Total Filterable Residue)	Original
EC3-WR-006	Standard Operating Procedure (SOP) Chemical Oxygen Demand, EPA 410.4; Method: 5220D	Original
EC3-WR-007	Standard Operating Procedure (SOP) Turbidity, EPA 120.1	Original
EC3-WR-008	Standard Operating Procedure (SOP) Iodine and Iodide, Method	Original
EC3-WR-009	Standard Operating Procedure (SOP) Ion Chromatography	Original
EC3-WR-010	Standard Operating Procedure (SOP) Lab Glassware Cleaning	Original
EC3-WR-012	Standard Operating Procedure (SOP) Nitrogen, Ammonia, Method: 10031	Original
EC3-WR-016	Standard Operating Procedure (SOP) Micro Gas Chromatography (Standard Method 6010C)	Original
EC3-WR-033	Catalyst Evaluation Test Plan for a Water Recovery Post-Processor Reactor System	Original
EC3-WR-035	Total Organic and Inorganic Carbon Analysis (TOC-VCPH)	A
EC3-WR-038	Post Processing Subsystem Optimization Test Plan	Original
EC3-WR-039	Development, Testing, and Verification of an Anoxic Biological Water Processor (BWP) Phase II Test Plan: Lifetime	Original
EC3-WR-040	Development, Testing, and Verification of an Anoxic Biological Water Processor (BWP) Phase I Test Plan	Original
EC3-WR-041	Pump Drive and Pump Head Maintenance and Operation	Basic
EC3-WR-043	General Laboratory Practices	Basic
EC3-WR-044	Autoclave	Basic
EC3-WR-045	Disposal of Waste	Basic

EC3-WR-046	Pour-Plate Method	Basic
EC3-WR-047	Buffered Water Solution	Basic
EC3-WR-048	Collection and Storage of Water and Wastewater Samples	Basic
EC3-WR-049	Cryopreservation	Basic

c. **Required DRDs**

5.8.1 Advanced Life Support Water Recovery System (WRS)

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
Deleted Rev 12	No Requirement	

d. **Products**

5.8.1 Advanced Life Support Water Recovery System (WRS)

Product(s)	Quantity	Delivery Date
Monthly AWRS Master Schedule Deleted Rev 11	8	Monthly
Monthly CEV Disinfection Technical & Schedule Status Report Updated REV 19	25	Monthly
Monthly WRS/Hab CEV Interfaces Technical and Schedule Status Report Updated REV 19	12	Monthly
Monthly Post Processing Technical & Schedule Status Report Updated REV 19	8	Monthly
Monthly Cascade Distillation Subsystem (CDS) Support Technical & Schedule Status Report Updated REV 19	25	Monthly
Monthly Nano Disinfection Technical & Schedule Status Report Deleted Rev 11	8	Monthly
Monthly Water Lab Reconfiguration Technical & Schedule Status Deleted Rev 11	5	Monthly
Quarterly CEV Disinfection Technical Report Updated REV 19	7	Quarterly
Quarterly WRS/Hab CEV Interfaces Technical Report Updated REV 19	6	Quarterly
Quarterly Advanced Post Processing Technical Report Updated REV 19	7	Quarterly
Quarterly CDS Support Technical Report Updated REV 19	7	Quarterly
Nano Disinfection Technical Report Deleted Rev 12	3	Quarterly
FY06 CEV Disinfection Project Plan Updated REV 19	1	2/15/2006
FY06 WRS/Hab CEV Interfaces Project Plan Updated REV 19	1	2/15/2006
FY06 Advanced Post Processing Project Plan Updated REV 19	1	2/15/2006
FY06 CDS Support Project Plan Updated REV 19	1	2/15/2006
Nano Disinfection Project Plan Deleted Rev 12	1	2/15/2006
Bi-weekly reports for ELS office Updated REV 19	32	Alternating Fridays
FY07 CEV Disinfection Project Plan Updated REV 19	1	10/20/06
FY07 WRS/Hab CEV Interfaces Project Plan Updated REV 19	1	10/20/06
FY07 Advanced Post Processing Project Plan Updated REV 19	1	10/20/06
FY07 CDS Support Project Plan Updated REV 19	1	10/20/06
Semiannual Laboratory Equipment Maintenance Schedule Updated REV 19	6	12/1/06, 6/1/07, 12/14/07, 6/13/08, 6/12/09. Combined for Rev. 12 July 09
Semiannual Laboratory Equipment Replacement/Upgrade Schedule Updated REV 19	6	12/1/06, 6/1/07,12/14/07, 6/13/08, 12/12/08, 6/12/09 Combined for Rev. 12 July 09
Monthly Integrated Master Water Recovery Technology Development and Program Support Schedule Updated REV 19	19	First day of the month. Deleted for Rev. 12 July 09
Final CEV Disinfection Report Updated REV 19	1	9/30/08
Final CDS Test Report Updated REV 19	1	9/30/08
CDS Publishable Report Updated REV 19	1	2/29/08
Monthly Pretreatment Technical and Schedule Status Report Updated REV 19	12	Monthly
Organic Acid Urine Pretreatment Test Report Updated REV 19	1	11/30/07
Disinfection Agent Urine Pretreatment Test Report Updated REV 19	1	2/15/08
Combined Formulation Urine Pretreatment Test Report Updated REV 19	1	8/15/08
Publishable Pretreatment Report Updated REV 19	1	2/29/08

Water Recovery Technology Development and Program Support Weekly Status Report Updated REV 19	87	Fridays. Deleted for Rev. 12 July 09.
Monthly Rotating Reverse Osmosis (RR0) Technical and Schedule Status Report Updated REV 19	6	Monthly
Rotating Reverse Osmosis (RR0) Test Report Updated REV 19	1	9/30/08
Monthly Cleanser, detergent, personal care product, pretreat evaluation & selection Technical & Schedule Status Report Updated REV 19	9	Last day of month. Deleted for Rev. 12 July 09
Monthly CDS/ Distillation Comparison Test Technical & Schedule Status Report Updated REV 19	9	Last day of month. Deleted for Rev. 12 July 09
Monthly Direct Osmotic Concentrator Technical & Schedule Status Report Updated REV 19	9	Last day of month. Deleted for Rev. 12 July 09
Monthly Brine Dewatering Technical & Schedule Status Report Updated REV 19	9	Last day of month. Deleted for Rev. 12 July 09
FY 09 CDS/ Distillation Comparison Test Annual Report Updated REV 19	1	9/30/09
FY 09 Cleanser, detergent, personal care product, pretreat evaluation & selection Annual Report Deleted Rev 14	1	9/30/09
FY 09 Brine Dewatering Annual Report Updated REV 19	1	9/30/09
CDS/ Distillation Comparison Test Publishable Report Updated REV 19	1	2/27/09
Exploration Life Support (ELS) Reportable Milestone Updated REV 19	8	First day of month. Deleted for Rev. 12 July 09
Product Survey and Research Report - Cleanser, detergent, personal care product, pretreat evaluation & selection task Updated REV 19	1	1/15/09
Plan for Current Product Evaluations - Cleanser, detergent, personal care product, pretreat evaluation & selection task Updated REV 19	1	4/8/09
Waste Water Collection and Transportation System (WWCTS) Activation and Check-out Plan - Distillation Comparison Test task Updated REV 19	1	11/7/08
Waste Water Collection and Transportation System (WWCTS) Readiness Report - Distillation Comparison Test task Updated REV 19	1	1/9/09
Test Plan - Distillation Comparison Test task Updated REV 19	1	12/21/08
Midtest Status Report - Distillation Comparison Test task Updated REV 19	1	7/6/09
Installation and Checkout Plan - Direct Osmotic Concentrator task Updated REV 19	1	11/21/08
Test Plan - Direct Osmotic Concentrator task Updated REV 19	1	4/17/09
Test Readiness Review Documentation - Direct Osmotic Concentrator task Updated REV 19	1	3/31/10
Midterm Testing Assessment Report - Direct Osmotic Concentrator task Updated REV 19	1	9/30/09
System Development Plan - Brine Dewatering task Updated REV 19	1	12/16/08
Requirements Report for AWRSDF demonstration - Brine Dewatering task Updated REV 19	1	4/6/09
Design Documentation for AWRSDF demonstrators - Brine Dewatering task Updated REV 19	1	8/30/09
Schedule of buildup and test of demonstrators - Brine Dewatering task Updated REV 19	1	9/30/09
Monthly Waste Water Collection and Transport System Technical & Schedule Status Report Updated REV 19	5	Last business day of month Oct ?08 through Feb ?09
WRS Semiannual Laborator Equipment Replacement/Upgrade and Maintenance Schedule Updated REV 19	A/R	every 6 months starting 12/09
Acceptable Products Development Plan - Cleanser et al. Deleted Rev 14	1	12/18/09
CDS / Distillation Comparison Test Task Close-out Report Deleted Rev 14	1	1/29/10
Shuttle Wastewater Dump Line Evaluation Final Report Updated REV 19	1	9/17/07
WRS Technical Reports Added Rev 14	per PD	per PD

e. **Product Verification**

5.8.1 Advanced Life Support Water Recovery System (WRS)

i. Monthly AWRS Master Schedule Deleted Rev 11

- Approval by EC3 Branch Review of deliverable Deleted Rev 11

ii. Monthly CEV Disinfection Technical & Schedule Status Report

- Approval by EC3 Branch Review of deliverable

iii. Monthly WRS/Hab CEV Interfaces Technical and Schedule Status Report

- Approval by EC3 Branch Review of deliverable

iv. Monthly Post Processing Technical & Schedule Status Report

- Approval by EC3 Branch Review of deliverable

v. Monthly Cascade Distillation Subsystem (CDS) Support Technical & Schedule Status Report

- Approval by EC3 Branch Review of deliverable

vi. Monthly Nano Disinfection Technical & Schedule Status Report Deleted Rev 11

- Approval by EC3 Branch Review of deliverable Deleted Rev 11

vii. Monthly Water Lab Reconfiguration Technical & Schedule Status Deleted Rev 11

- Approval by EC3 Branch Review of deliverable Deleted Rev 11

viii. Quarterly CEV Disinfection Technical Report

- Approval by EC3 Branch Review of deliverable

ix. Quarterly WRS/Hab CEV Interfaces Technical Report

- Approval by EC3 Branch Review of deliverable

x. Quarterly Advanced Post Processing Technical Report

- Approval by EC3 Branch Review of deliverable

xi. Quarterly CDS Support Technical Report

- Approval by EC3 Branch Review of deliverable

xii. Nano Disinfection Technical Report Deleted Rev 12

- Approval by EC3 Branch Review of deliverable Deleted Rev 12

xiii. FY06 CEV Disinfection Project Plan

- Approval by EC3 Branch Review of deliverable

xiv. FY06 WRS/Hab CEV Interfaces Project Plan

- Approval by EC3 Branch Review of deliverable

xv. FY06 Advanced Post Processing Project Plan

- Approval by EC3 Branch Review of deliverable

xvi. FY06 CDS Support Project Plan

- Approval by EC3 Branch Review of deliverable

xvii. Nano Disinfection Project Plan Deleted Rev 12

- Approval by EC3 Branch Review of deliverable Deleted Rev 12

xviii. Bi-weekly reports for ELS office

- Approval by EC3 Branch Review of deliverable

xix. FY07 CEV Disinfection Project Plan

- Approval by EC3 Branch Review of deliverable

xx. FY07 WRS/Hab CEV Interfaces Project Plan

- Approval by EC3 Branch Review of deliverable

xxi. FY07 Advanced Post Processing Project Plan

- Approval by EC3 Branch Review of deliverable

xxii. FY07 CDS Support Project Plan

- Approval by EC3 Branch Review of deliverable

xxiii. Semiannual Laboratory Equipment Maintenance Schedule

- Approval by EC3 Branch Review of deliverable

xxiv. Semiannual Laboratory Equipment Replacement/Upgrade Schedule

- Approval by EC3 Branch Review of deliverable

xxv. Monthly Integrated Master Water Recovery Technology Development and Program Support Schedule

- Approval by EC3 Branch Review of deliverable

xxvi. Final CEV Disinfection Report

- Approval by EC3 Branch Review of deliverable

xxvii. Final CDS Test Report

- Approval by EC3 Branch Review of deliverable

xxviii. CDS Publishable Report

- Approval by EC3 Branch Review of deliverable

xxix. Monthly Pretreatment Technical and Schedule Status Report

- Approval by EC3 Branch Review of deliverable

xxx. Organic Acid Urine Pretreatment Test Report

- Approval by EC3 Branch Review of deliverable

xxxi. Disinfection Agent Urine Pretreatment Test Report

- Approval by EC3 Branch Review of deliverable

xxxii. Combined Formulation Urine Pretreatment Test Report

- Approval by EC3 Branch Review of deliverable

xxxiii. Publishable Pretreatment Report

- Approval by EC3 Branch Review of deliverable

xxxiv. Water Recovery Technology Development and Program Support Weekly Status Report

- Approval by EC3 Branch Review of deliverable

xxxv. Monthly Rotating Reverse Osmosis (RR0) Technical and Schedule Status Report

- Approval by EC3 Branch Review of deliverable

xxxvi. Rotating Reverse Osmosis (RR0) Test Report

- Approval by EC3 Branch Review of deliverable

xxxvii. Monthly Cleanser, detergent, personal care product, pretreat evaluation & selection Technical & Schedule Status Report

- Approval by EC3 Branch Review of deliverable

xxxviii. Monthly CDS/ Distillation Comparison Test Technical & Schedule Status Report

- Approval by EC3 Branch Review of deliverable

xxxix. Monthly Direct Osmotic Concentrator Technical & Schedule Status Report

- Approval by EC3 Branch Review of deliverable

xl. Monthly Brine Dewatering Technical & Schedule Status Report

- Approval by EC3 Branch Review of deliverable

xli. FY 09 CDS/ Distillation Comparison Test Annual Report

- Approval by EC3 Branch Review of deliverable

xlii. FY 09 Cleanser, detergent, personal care product, pretreat evaluation & selection Annual Report Deleted Rev 14

- Approval by EC3 Branch Review of deliverable Deleted Rev 14

xliii. FY 09 Brine Dewatering Annual Report

- Approval by EC3 Branch Review of deliverable

xliv. CDS/ Distillation Comparison Test Publishable Report

- Approval by EC3 Branch Review of deliverable

vl. Exploration Life Support (ELS) Reportable Milestone

- Approval by EC3 Branch Review of deliverable

vli. Product Survey and Research Report - Cleanser, detergent, personal care product, pretreat evaluation & selection task

- Approval by EC3 Branch Review of deliverable

vlii. Plan for Current Product Evaluations - Cleanser, detergent, personal care product, pretreat evaluation & selection task

- Approval by EC3 Branch Review of deliverable

vliii. Waste Water Collection and Transportation System (WWCTS) Activation and Check-out Plan - Distillation Comparison Test task

- Approval by EC3 Branch Review of deliverable

vliv. Waste Water Collection and Transportation System (WWCTS) Readiness Report - Distillation Comparison Test task

- Approval by EC3 Branch Review of deliverable

l. Test Plan - Distillation Comparison Test task

- Approval by EC3 Branch Review of deliverable

li. Midtest Status Report - Distillation Comparison Test task

- Approval by EC3 Branch Review of deliverable

lii. Installation and Checkout Plan - Direct Osmotic Concentrator task

- Approval by EC3 Branch Review of deliverable

liii. Test Plan - Direct Osmotic Concentrator task

- Approval by EC3 Branch Review of deliverable

liv. Test Readiness Review Documentation - Direct Osmotic Concentrator task

- Approval by EC3 Branch Review of deliverable

lv. Midterm Testing Assessment Report - Direct Osmotic Concentrator task

- Approval by EC3 Branch Review of deliverable

lvi. System Development Plan - Brine Dewatering task

- Approval by EC3 Branch Review of deliverable

lvii. Requirements Report for AWRSDF demonstration - Brine Dewatering task

- Approval by EC3 Branch Review of deliverable

lviii. Design Documentation for AWRSDF demonstrators - Brine Dewatering task

- Approval by EC3 Branch Review of deliverable

lix. Schedule of buildup and test of demonstrators - Brine Dewatering task

- Approval by EC3 Branch Review of deliverable

lx. Monthly Waste Water Collection and Transport System Technical & Schedule Status Report

- Approval by EC3 Branch Review of deliverable

lxi. WRS Semiannual Laborator Equipment Replacement/Upgrade and Maintenance Schedule
- Approval by EC3 Branch Review of deliverable
lxii. Acceptable Products Development Plan - Cleanser et al. Deleted Rev 14
- Approval by EC3 Branch Review of deliverable Deleted Rev 14
lxiii. CDS / Distillation Comparison Test Task Close-out Report Deleted Rev 14
- Approval by EC3 Branch Review of deliverable Deleted Rev 14
lxiv. Shuttle Wastewater Dump Line Evaluation Final Report
- Approval by EC3 Branch Review of deliverable
lxv. WRS Technical Reports
- PD will be closed upon review of deliverable by the EC3 CCB chair or designee Added Rev 14

5.9 Advanced Life Support Air Revitalization System (ARS) Updated REV 19

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide consultation, planning, integration, testing, reporting, and data analysis supporting development of Advanced Air Revitalization Systems (ARS) process technologies including operation of the ARS test articles in the Air Revitalization Technology Evaluation Facility (ARTEF) located in building 7B, room 1302. Deliverables will be uploaded to the EC3 ARS share folder.

Due to current problems with the as-built design of the oxygen (O2) concentrator portion of the HMS, no work will be performed on this portion of the system in FY06 or FY07. An assessment for completing the O2 concentrator circuit will be delivered as part of the HMS data package.

The ARS technologies trade study report will be a compilation of results from a trade study that was performed in FY05.

The SwRI CRA compressor task was originally authorized under TO49 and has now been transitioned to this DO. See section 8.9.2 of this proposal for a detailed explanation.

Test article expert (TAE) engineering and compilation of the amine swing bed interim test report will be provided as part of DO88 for FY06. It is anticipated that FY06 testing of the amine swing bed will continue past the end of the FY, thus the interim report will cover testing up through September 15, 2006. Effort required for buildup and integration of the amine swing bed test article into the facility as well as facility operations required while in test are included in this task. No analysis is currently planned for either test article buildup or in-test processing.

The effort required to make the modification to the facility as specified in the CAMRAS Phase 4 Facilities Requirements Document are not included in the Revision 3 FY07 estimate.

Revision 4 includes an upgrade to the CAMRAS vacuum system, upgrade test sensors, and two months of testing. It also includes the installation of a vent hood for the flow-bench.

In Revision 6, the Sabatier Compressor and Sabatier Space Act Agreement (SAA) reports will simply be a compilation of monthly status reports that are delivered to NASA by an outside contractor and provided by NASA to ESC. No additional testing or analysis will be required by ESC.

In Revision 6, The HMS redesign data pack shall include, but is not limited to: drawings, list of materials/components, updated SOP, component literature, and a quick look report of the acceptance test for the redesigned system. Revision 6 assumes that the HMS redesign will require modifications to the existing HMS and not an entirely new system, which is assumed to be the less expensive of the two options. The goal is for the O2 concentrator to be incorporated in the redesign but it is not a specific requirement at this time.

In revision 7, the CCSIT CAMRAS Quick Look reports will only address the performance of the CAMRAS test article itself. The Quick Look reports will be delivered to DDMS.

In Revision 8, the second generation (or re-designed) HMS data pack was broken into two segments due to facility schedules: design and acceptance. The design data pack shall include, but is not limited to a list of materials/components, system drawings, and component literature. The acceptance data pack shall include an updated SOP and a quick look report of the acceptance test for the redesigned system.

Revision 8 removes the CAMRAS Phase 4 interim report since facility delays have pushed back test start. This revision also adds the revised CAMRAS Phase 4 test plan and DTP, CAMRAS year end summary report, and a year end report summary report on trace contaminant activities. The latter will include testing involving the flow bench in the ARTEF lab. Year end summary reports will include activities for the fiscal year through the end of August.

Revision 10 reflects that CAMRAS Phase 4 testing has been broken into two parts; Phase 4A and 4B. Phase 4A will occur in FY09. It is TBD when Phase 4B will take place.

Revision 11 adds two reports for sub-scale trace contaminant media testing. This revision also updates delivery dates based on current schedule for tasks added in Rev 9 or Rev 10. Contractor shall perform miscellaneous tasks such as reactive LiOH evaluations and development of standard operating procedures for equipment and instruments in the gas chemistry lab.

Revision 12 updates delivery dates for the SA9T Regeneration Evaluation Quick Look Report as well as the Second Generation HMS Acceptance Data Pack. This revision also adds CAMRAS and CCSIT related activities through 1/31/10.

Revision 14 adds scope for the remainder of FY10. It also authorizes the use of Project Directives to define deliverables, due dates, process tailoring, and applicable DRDs. PDs are to be approved by the EC3 CCB and maintained under configuration control.

Revision 15 changes the delivery dates for the Second Generation HMS ADP and the Multi-Media Sorbent Test Report.

Revision 16 adds scope for FY11 to be defined by PD.

Revision 18 adds scope for FY11.

Revision 19 adds scope for FY12 to be defined by PD. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.9.1 Advanced Life Support Air Revitalization System (ARS) Updated Rev 18
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Basic
EC3-ALS-001	Advanced Life Support (ALS) Technology Development Facility Standard Operating Procedures Manual	Original
STB-E-084	Drawing System and Configuration Control Procedure	B
STB-E-557	STB Facility and Major Test Build-up Procedure	C

c. **Required DRDs**

5.9.1 Advanced Life Support Air Revitalization System (ARS)

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.9.1 Advanced Life Support Air Revitalization System (ARS)

Product(s)	Quantity	Delivery Date
ARTEF Test Article Integration and Test Activities Deleted Rev 11	1	9/29/2006
HMS Data Package	1	05/30/2006
Amine Swing Bed Facility Requirements Document (interfaces, instrumentation, controls, schematic,etc)	1	03/10/2006
Detailed Test Plan for Amine Swing Bed Test Article	1	05/26/2006
ARS Technologies Trade Study	1	04/28/2006
ARTEF Air Revitalization Technology Integration Chamber ARTIC (10 ft chamber) Airlock Leak Check Report	1	05/19/2006
SwRI Upgraded CRA Compressor	1	05/31/2006
Amine Swing Bed Interim Test Report	1	09/29/2006
OGS Checkout/Test Report Deleted Rev 12	1	09/29/2006
ATCCS/CIS Test Plan	1	09/29/2006
ARTEF Power Upgrades Report	1	09/29/2006
FY06 Weekly status reports for ELS ARS	35	Fridays - FY06
Sabatier Activities Year End Summary Report	1	09/29/2006
Phase 3 CAMRAS Test Plan	1	1/26/07
Phase 3 Facilities Requirement Document	1	11/17/06
Phase 2 CAMRAS Test Quick Look Report	1	1/12/07
Phase 4 Facilities Requirements Document (Preliminary)	1	3/02/07
Phase 3 CAMRAS Test Quick Look Report	1	8/31/07
CAMRAS Testing Year End Report (FY07)	1	09/28/07
Phase 4 Facilities Requirements Document	1	9/14/07
CAMRAS Phase 3 Vacuum System Lessons Learned Report	1	09/28/07
CAMRAS Phase 4 Test Plan	1	12/21/07

CAMRAS Phase 3 Final Report	1	2/15/08
Sabatier Compressor Interim Report	1	2/25/08
Sabatier SAA Interim Report	1	3/24/08
Sabatier Compressor Year End Report	1	8/25/08
Sabatier SAA Year End Report	1	9/22/08
CCSIT Phase 1 CAMRAS Quick Look	1	Draft 3 weeks post test ? Final 5 weeks post-test
CCSIT Phase 2 CAMRAS Quick Look	1	4wks prior to Orion ECLS review or no earlier than 5/25/09
Revised CAMRAS Phase 4 Test Plan	1	6/17/08
CAMRAS Phase 4A DTP	1	at CAMRAS TRR
Second Generation HMS Design Data Pack	1	7/31/08
Second Generation HMS Acceptance Data Pack	1	per PD
2008 Trace Contaminant (renamed to ARTEF Lab & CTSD Gas Lab Upgrade) Year End Activity Report	1	9/30/08
2008 CAMRAS Year End Summary Report	1	9/30/08
CAMRAS 4A Quick Look Test Report	1	1wk prior to Orion ECLS review or no earlier than 6/22/09
FY09/10 Monthly Budget Assessment* (submitted as one consolidated doc for 5.9,5.17,5.23) Deleted Rev 14	A/R	5 business days post 533 delivery
2009 CAMRAS Year End Summary Report	1	9/30/09
SA9T Regeneration Evaluation Quick Look Report	1	3/13/09
Multi-Media Sorbent Test Report	1	per PD
SA9T Amine Small Scale Testing Report Updated REV 19	1	8/18/06
ARS Technical Reports Updated REV 19	per PD	per PD
Monthly Budget Assessment* (submitted as one consolidated doc for 5.9,5.17,5.23) (not to be submitted to DDMS)	monthly	5 business days post 533 delivery

e. **Product Verification**

5.9.1 Advanced Life Support Air Revitalization System (ARS)

i. ARTEF Test Article Integration and Test Activities Deleted Rev 11

- Approval by the EC3 branch review of deliverable Deleted Rev 11

ii. HMS Data Package

- Approval by the EC3 branch review of deliverable

iii. Amine Swing Bed Facility Requirements Document (interfaces, instrumentation, controls, schematic,etc)

- Approval by the EC3 branch review of deliverable

iv. Detailed Test Plan for Amine Swing Bed Test Article

- Approval by the EC3 branch review of deliverable

v. ARS Technologies Trade Study

- Approval by the EC3 branch review of deliverable

vi. ARTEF Air Revitalization Technology Integration Chamber ARTIC (10 ft chamber) Airlock Leak Check Report

- Approval by the EC3 branch review of deliverable

vii. SwRI Upgraded CRA Compressor

- Approval by the EC3 branch review of deliverable

viii. Amine Swing Bed Interim Test Report

- Approval by the EC3 branch review of deliverable

ix. OGS Checkout/Test Report Deleted Rev 12

- Approval by the EC3 branch review of deliverable Deleted Rev 12

x. ATCCS/CIS Test Plan

- Approval by the EC3 branch review of deliverable

xi. ARTEF Power Upgrades Report

- Approval by the EC3 branch review of deliverable

xii. FY06 Weekly status reports for ELS ARS

- Approval by the EC3 branch review of deliverable

xiii. Sabatier Activities Year End Summary Report

- Approval by the EC3 branch review of deliverable

xiv. Phase 3 CAMRAS Test Plan

- Approval by the EC3 branch review of deliverable

xv. Phase 3 Facilities Requirement Document

- Approval by the EC3 branch review of deliverable

xvi. Phase 2 CAMRAS Test Quick Look Report

- Approval by the EC3 branch review of deliverable

xvii. Phase 4 Facilities Requirements Document (Preliminary)

- Approval by the EC3 branch review of deliverable

xviii. Phase 3 CAMRAS Test Quick Look Report

- Approval by the EC3 branch review of deliverable

xix. CAMRAS Testing Year End Report (FY07)

- Approval by the EC3 branch review of deliverable

xx. Phase 4 Facilities Requirements Document

- Approval by the EC3 branch review of deliverable

xxi. CAMRAS Phase 3 Vacuum System Lessons Learned Report

- Approval by the EC3 branch review of deliverable

xxii. CAMRAS Phase 4 Test Plan

- Approval by the EC3 branch review of deliverable

xxiii. CAMRAS Phase 3 Final Report

- Approval by the EC3 branch review of deliverable

xxiv. Sabatier Compressor Interim Report

- Approval by the EC3 branch review of deliverable

xxv. Sabatier SAA Interim Report

- Approval by the EC3 branch review of deliverable

xxvi. Sabatier Compressor Year End Report

- Approval by the EC3 branch review of deliverable

xxvii. Sabatier SAA Year End Report

- Approval by the EC3 branch review of deliverable

xxviii. CCSIT Phase 1 CAMRAS Quick Look

- Approval by the EC3 branch review of deliverable

xxix. CCSIT Phase 2 CAMRAS Quick Look

- Approval by the EC3 branch review of deliverable

xxx. Revised CAMRAS Phase 4 Test Plan

- Approval by the EC3 branch review of deliverable

xxxi. CAMRAS Phase 4A DTP

- Approval by the EC3 branch review of deliverable

xxxii. Second Generation HMS Design Data Pack

- Approval by the EC3 branch review of deliverable

xxxiii. Second Generation HMS Acceptance Data Pack

- Approval by the EC3 branch review of deliverable

xxxiv. 2008 Trace Contaminant (renamed to ARTEF Lab & CTSD Gas Lab Upgrade) Year End Activity Report

- Approval by the EC3 branch review of deliverable

xxxv. 2008 CAMRAS Year End Summary Report

- Approval by the EC3 branch review of deliverable

xxxvi. CAMRAS 4A Quick Look Test Report

- Approval by the EC3 branch review of deliverable

xxxvii. FY09/10 Monthly Budget Assessment* (submitted as one consolidated doc for 5.9,5.17,5.23) Deleted Rev 14

- Approval by the EC3 branch review of deliverable Deleted Rev 14

xxxviii. 2009 CAMRAS Year End Summary Report

- Approval by the EC3 branch review of deliverable

xxxix. SA9T Regeneration Evaluation Quick Look Report

- Approval by the EC3 branch review of deliverable

xl. Multi-Media Sorbent Test Report

- Approval by the EC3 branch review of deliverable

xli. SA9T Amine Small Scale Testing Report

- EC3 branch review of deliverable

xlii. ARS Technical Reports

- PDs will be closed upon approval by the EC3 CCB Chair or designee

xliii. Monthly Budget Assessment* (submitted as one consolidated doc for 5.9,5.17,5.23) (not to be submitted to DDMS)

- Approval by the EC3 branch review of deliverable

5.10 Exploration Life Support (ELS) Project Office Services Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide management and technical recommendations in the technology development and management of exploration life support technologies in facilities controlled by CTSD and ELS activities located at other NASA centers. Deliverables will be uploaded to the EC ELS share folder.

Rev 4, contractor shall perform ELS SBIR proposal technical reviews and develop methods to control ammonia that could integrate into a vacuum regenerated swing bed.

Rev 5: ELS Biweekly Report and One Page requirement is descoped and is no longer a requirement as directed from the ELS Project Office.

Rev 10: ELS Quarterly Review Materials is descoped and is no longer a requirement as directed by the ELS Project Office.

Rev 12: ELS monthly report is descoped and is no longer a requirement as directed by the ELS Project Office.

Rev 14 adds scope for FY10-FY13.

Rev 19 reduces scope for FY12-13. Updated REV 19

5.10.1 Exploration Life Support (ELS) Project Office Services Updated REV 19
Project Code:

Provide engineering assessment and initiation of project plans for ELS technologies within NASA.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EC3-ALS-001 Added Rev 1	Advanced Life Support (ALS) Technology Development Facility Standard Operating Procedures Manual	Original
NASA/NPR 7120.8 Added Rev 11	NASA Research and Technology Program and Project Management Requirements	Feb. 5, 2008

c. **Required DRDs**

5.10.1 Exploration Life Support (ELS) Project Office Services

DRD #	DRD Title	Quantity/Frequency
Added Rev 1	No Requirement	

d. **Products**

5.10.1 Exploration Life Support (ELS) Project Office Services

Product(s)	Quantity	Delivery Date
ELS Bi-weekly Report	18	Biweekly
ELS Monthly Report	26	Monthly. Descoped for Rev 12 - July 09.
ELS Quarterly Review	10	Quarterly
ELS Annual Project Plan	7	annually by the end of each FY
Review of ELS One Page Management Report	18	Biweekly

e. **Product Verification**

5.10.1 Exploration Life Support (ELS) Project Office Services

i. ELS Bi-weekly Report

- Approval by EC1/EC3 Branch Review of deliverable

ii. ELS Monthly Report

- Approval by EC1/EC3 Branch Review of deliverable

iii. ELS Quarterly Review

- Approval by EC1/EC3 Branch Review of deliverable
iv. ELS Annual Project Plan
- Approval by EC1/EC3 Branch Review of deliverable
v. Review of ELS One Page Management Report
- Approval by EC1/EC3 Branch Review of deliverable

5.11 Architecture, Habitation & Integration (AH&I) Updated Rev 11

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide Systems Engineering, Integration, and Test products for the AH&I project. This shall include assessments, trade studies, requirements validation, evaluation laboratories, testing operation, and integration analysis and evaluations on development exploration technology. Products for second phase of the Lunar Architecture Trades (LAT-2) includes: CAD models that support presentations and development of mass and volume estimates; technical assessments of proposed configurations of lunar outpost architectures and pressurized logistic re-supply carriers. Deliverables will be uploaded to the AH&I share folder, as appropriate.

This work is being transferred to an EA3 TO For FY08.
Updated Rev 11

5.11.1 Architecture, Habitation & Integration (AH&I) Updated Rev 11
Project Code:

b. **Applicable Documents**

Document Number	Document Name	Rev.
JSC 62300 Added Rev 1	Advanced Integration Facility Standard Operating Procedures	Basic
JSC 65103 Added Rev 1	AH&I Documentation and Data Management and Configuration Management Plan	Basic
JSC 65195 Added Rev 1	AH&I Solicitation/Selection and Test Process Overview for Human Systems	Basic

c. **Required DRDs**

5.11.1 Architecture, Habitation & Integration (AH&I)

DRD #	DRD Title	Quantity/Frequency
Added Rev 1	No Requirement	

d. **Products**

5.11.1 Architecture, Habitation & Integration (AH&I)

Product(s)	Quantity	Delivery Date
AH&I Project Webpage Added Rev 1	1	7/3/2006
Education Outreach Module Outfitting Added Rev 1	1	5/31/2006
CEV Assessment Report Added Rev 1	1	7/31/2006
Lunar Sortie Ascent Module (LSAM)/Lunar Habitation Assessment Added Rev 1	1	9/29/2006
Walkback Test Report Added Rev 1	1	6/19/2006
Low Impact Docking System (LIDS) and CEV Hatch Evaluation Test Report Added Rev 1	1	5/1/2006
Phase I Habitation Autonomy Test Report Added Rev 1	1	9/29/2006
Phase II Habitation Autonomy Test Plan Added Rev 1	1	9/29/2006
Habitat Mockup Added Rev 11	1	7/21/2006
Lander/Sortie Hab CAD model Added Rev 11	1	8/14/2006
Walkback Test Report Added Rev 11	1	10/31/2006
CEV Systems Engineering Status Report (FY06) Added Rev 11	4	monthly
Facilities Upgrades Customer Added Rev 11	1	08/30/2007
Facility Interface Definition Document Revision Added Rev 11	1	03/30/2007
Advanced Integration Facility Capabilities Revision Added Rev 11	1	03/16/2007
Advanced Integration Facility Requirements Revision Added Rev 11	1	03/23/2007
AH&I Facilities Strategic Plan Added Rev 11	1	03/09/2007

LAT-2 Habitation Kick-off TIM Added Rev 11	1	02/08/2007
LAT-2 Habitation CAD Models Added Rev 11	1	06/08/2007
Logistics Carrier Technical Baseline Added Rev 11	1	08/30/2007
LAT-2 Outpost Configuration Assesment Added Rev 11	1	08/30/2007

e. **Product Verification**

5.11.1 Architecture, Habitation & Integration (AH&I)

i. AH&I Project Webpage

- Approval by EC3 Branch Review of deliverable Added Rev 1

ii. Education Outreach Module Outfitting

- Approval by EC3 Branch Review of deliverable Added Rev 1

iii. CEV Assessment Report

- Approval by EC3 Branch Review of deliverable Added Rev 1

iv. Lunar Sortie Ascent Module (LSAM)/Lunar Habitation Assessment

- Approval by EC3 Branch Review of deliverable Added Rev 1

v. Walkback Test Report

- Approval by EC3 Branch Review of deliverable Added Rev 1

vi. Low Impact Docking System (LIDS) and CEV Hatch Evaluation Test Report

- Approval by EC3 Branch Review of deliverable Added Rev 1

vii. Phase I Habitation Autonomy Test Report

- Approval by EC3 Branch Review of deliverable Added Rev 1

viii. Phase II Habitation Autonomy Test Plan

- Approval by EC3 Branch Review of deliverable Added Rev 1

ix. Habitat Mockup

- Approval by EC3 Branch Review of deliverable Added Rev 11

x. Lander/Sortie Hab CAD model

- Approval by EC3 Branch Review of deliverable Added Rev 11

xi. Walkback Test Report

- Approval by EC3 Branch Review of deliverable Added Rev 11

xii. CEV Systems Engineering Status Report (FY06)

- Approval by EC3 Branch Review of deliverable Added Rev 11

xiii. Facilities Upgrades Customer

- Approval by EC3 Branch Review of deliverable Added Rev 11

xiv. Facility Interface Definition Document Revision

- Approval by EC3 Branch Review of deliverable Added Rev 11

xv. Advanced Integration Facility Capabilities Revision

- Approval by EC3 Branch Review of deliverable Added Rev 11

xvi. Advanced Integration Facility Requirements Revision

- Approval by EC3 Branch Review of deliverable Added Rev 11

xvii. AH&I Facilities Strategic Plan

- Approval by EC3 Branch Review of deliverable Added Rev 11

xviii. LAT-2 Habitation Kick-off TIM

- Approval by EC3 Branch Review of deliverable Added Rev 11

xix. LAT-2 Habitation CAD Models

- Approval by EC3 Branch Review of deliverable Added Rev 11

xx. Logistics Carrier Technical Baseline

- Approval by EC3 Branch Review of deliverable Added Rev 11

xxi. LAT-2 Outpost Configuration Assesment

- Approval by EC3 Branch Review of deliverable Added Rev 11

5.12 CEV ECLSS System Manager and Systems Engineering Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide development of Environmental Control and Life Support System (ECLSS) advanced water recovery technologies, air revitalization technologies, and systems engineering for the Crew Exploration Vehicle (CEV). Contractor shall provide off-site capability for elementary development of these ECLSS technologies. Deliverables will be uploaded to the EC share folder.

Revision 10 adds FY09 activities and reports.

Revision 12 adds FY10 scope.

Revision 17 adds FY11 scope.

Revision 18 adds FY11 scope.

Revision 19 moves FY11 PD scope to FY12. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.12.1 CEV ECLSS System Manager and Systems Engineering Updated Rev 17
Project Code:

Requirements for system management support are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EC3-ALS-001 Added Rev 11	Advanced Life Support (ALS) Technology Development Facility Standard Operating Procedures Manual	Original

c. **Required DRDs**

5.12.1 CEV ECLSS System Manager and Systems Engineering		
DRD #	**DRD Title**	**Quantity/Frequency**
Added Rev 11	No Requirement	

d. **Products**

5.12.1 CEV ECLSS System Manager and Systems Engineering		
Product(s)	**Quantity**	**Delivery Date**
Monthly CEV ECLSS Status Reports	A/R	Monthly

e. **Product Verification**

5.12.1 CEV ECLSS System Manager and Systems Engineering
i. Monthly CEV ECLSS Status Reports
- Receipt of the deliverable

5.13 ISS High Pressure Oxygen Updated Rev 15

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide trade-off analysis to assess options for providing high pressure oxygen to the International Space Station (ISS) for extra-vehicular activities (EVA) after the Space Shuttle is phased out. This shall include performing a packaging study for the High Pressure Oxygen Generator Assembly (HPOGA). Deliverables will be uploaded to the EC share folder.

Rev 15: no change Updated Rev 15

5.13.1 ISS High Pressure Oxygen Updated Rev 12
Project Code:

Requirements for ISS High Pressure Oxygen are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.

c. **Required DRDs**

5.13.1 ISS High Pressure Oxygen		
DRD #	DRD Title	Quantity/Frequency
Deleted Rev 15	No Requirement	

d. **Products**

5.13.1 ISS High Pressure Oxygen		
Product(s)	Quantity	Delivery Date
High Pressure Oxygen Generator Assembly (HPOGA) Phase 1 Technical Report	1	3/30/07
HPOGA Phase 1 Flight Program Development Presentation	1	4/30/07
HPOGA Phase 2 Status Report	1	7/31/07
ISS High Pressure Oxygen Assessment Quarterly Status Report	3	Quarterly
ISS High Pressure Oxygen Assessment Year End Report	1	9/30/07
HPOGA Phase 2 Final Report	1	9/30/10

e. **Product Verification**

5.13.1 ISS High Pressure Oxygen
i. High Pressure Oxygen Generator Assembly (HPOGA) Phase 1 Technical Report
- Approval by EC Branch Review of deliverable
ii. HPOGA Phase 1 Flight Program Development Presentation
- Approval by EC Branch Review of deliverable
iii. HPOGA Phase 2 Status Report
- Approval by EC Branch Review of deliverable
iv. ISS High Pressure Oxygen Assessment Quarterly Status Report
- Approval by EC Branch Review of deliverable
v. ISS High Pressure Oxygen Assessment Year End Report
- Approval by EC Branch Review of deliverable
vi. HPOGA Phase 2 Final Report
- Approval by EC Branch Review of deliverable

5.14 CEV Habitation Updated Rev 14

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide Systems Engineering products for the CEV Crew Module Habitation Accommodations. This includes the CEV hygiene systems, seats, stowage accommodations, sleep stations, galley accommodations, privacy accommodations, internal restraints and mobility aids, & flight crew equipment interfaces. Additional activities include researching and collecting historical information related to Habitation Accommodations from previous programs and disseminating the information and lessons learned to the appropriate communities. Provide input to NASA Design Reference mission studies & operations analyses, performing analyses for CEV requirements development and validation studies. Products, including activity reports, will be delivered to the EC6 Share Folder.

Rev 10: Contractor shall provide development of requirements definition and clarification. Contractor shall provide technical expertise for the preparations and technical reviews for the CEV Preliminary Design Review (PDR) during FY 09.

Revision 14 terminates the scope for this task and transfers it to DO374 as of January 31, 2010.
Updated Rev 14

5.14.1 CEV Habitation Updated Rev 12
Project Code:

The specific requirements for CEV Hab are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 12	No Requirement	

c. **Required DRDs**

5.14.1 CEV Habitation

DRD #	DRD Title	Quantity/Frequency
Added Rev 11	No Requirement	

d. **Products**

5.14.1 CEV Habitation

Product(s)	Quantity	Delivery Date
Habitation Technology Road Map Report Added Rev 11	1	9/30/08
Weekly Activity Reports	A/R	Weekly
Technical Interchange Meetings Added Rev 11	3	9/30/08
Technical Reviews and Preparations Added Rev 11	1 set	9/30/09

e. **Product Verification**

5.14.1 CEV Habitation

i. Habitation Technology Road Map Report

- Approval by EC Branch Review of deliverable Added Rev 11

ii. Weekly Activity Reports

- Receipt of the deliverable

iii. Technical Interchange Meetings

- Approval by EC Branch Review of deliverable Added Rev 11

iv. Technical Reviews and Preparations

- Approval by EC Branch Review of deliverable Added Rev 11

5.15 ISS Galley Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall develop the hardware products for the ISS Galley. The ISS Galley project entails design, manufacture, test and integration of a Potable Water Dispenser (PWD). The PWD effort will also include a Filter ORU that will provide a means of deiodination as well as provide an alternate form of microbial control (e.g. microbial removal filter). The PWD will be integrated into an existing EXPRESS Rack. The existing ISS Food Warmer design will be evaluated for interface to the EXPRESS Rack. To allow the Food Warmer to connect and draw power from an EXPRESS Rack, a Power Cable will be designed, manufactured, tested and certified.

Revision 10 adds sustaining engineering activities.

Revision 11 adds spare manufacturing activities. One Filter ORU and two Needle ORUs will be assembled, tested, and certified. Parts for three additional Filter ORUs will be procured, but not assembled. The spare printed wiring boards and components will be procured, but not assembled. The spare compliance vessel will be procured, but not certified.

Revision 12 adds PWD spares and the PWD shock kit. Project Directives (PDs) will be used to define deliverables.

Rev 14 adds FY10 content.

Revision 16 adds FY11 scope. Project Directives are to be approved by the EC3 CCB and maintained under configuration control.

Revision 18 adds FY112 scope to be defined per PD.

Rev 19 adds FY12 spares, sustaining engineering and a new build of the PWD scope to be defined by PD. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.15.1 ISS Galley Updated Rev 18
Project Code:

Specific requirements for the ISS Galley are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 11	Project Management of GFE Flight Projects	Rev D 02-04

c. **Required DRDs**

5.15.1 ISS Galley

DRD #	DRD Title	Quantity/Frequency
102 Deleted Rev 12	Engineering Drawings and Model Files	1
202 Added Rev 11	Flight Products Systems Requirements Review (SRR) Data Package	1
230 Added Rev 11	Acceptance Data Package	1 - PWD ; 3 - PWD Fliter ORU
233 Added Rev 11	Government Certification Approval Request (GCAR)	1
241 Added Rev 11	Risk Assessment Executive Summary Report (RAESR)	1

d. **Products**

5.15.1 ISS Galley

Product(s)	Quantity	Delivery Date
PWD System Requirements Review Package	1	3/16/07
PWD Preliminary Design TIM Package	1	8/31/07
Food Warmer Rack and Connector Design Evaluation	1	9/30/07
Food Warmer EXPRESS Rack Power Cable	4	9/30/08
ISS Galley Monthly Report (FY07)	12	Monthly
Revise HRD for ISS Food Warmer	1	9/30/08
Revise GCAR for ISS Food Warmer	1	9/30/08
Revise Safety Assessment Report (SAR) for ISS Food Warmer	1	9/30/08
PWD System Design Review (SDR) Data Package	1	1/28/08
PWD Final Risk Assessment Executive Summary Report (RAESR)	1	9/30/08
PWD Acceptance Data Package (ADP)	1	9/30/08
PWD Government Certification Approval Request (GCAR)	1	9/30/08
PWD Flight Unit ? Class I	1	9/30/08
PWD Training Unit ? Class III	1	9/30/08
PWD Filter ORU Flight Units (2 flight & 1 test) ? Class I (FY08)	3	9/30/08
PWD Filter ORU Training Unit ? Class III	1	9/30/08
ISS Galley Monthly Report (FY08)	12	Monthly
PWD Filter ORU	per PD	per PD
PWD Needle ORU	per PD	per PD
PWD Shock Kit Added Rev 12	1	per PD
PWD Spare Components	per PD	per PD
PWD New Build Added REV 19	per PD	per PD

e. **Product Verification**

5.15.1 ISS Galley

i. PWD System Requirements Review Package

- Approval by EC Branch Review of deliverable

ii. PWD Preliminary Design TIM Package

- Approval by EC Branch Review of deliverable

iii. Food Warmer Rack and Connector Design Evaluation

- Approval by EC Branch Review of deliverable

iv. Food Warmer EXPRESS Rack Power Cable

- Approval by EC Branch Review of deliverable

v. ISS Galley Monthly Report (FY07)

- Approval by EC Branch Review of deliverable

vi. Revise HRD for ISS Food Warmer

- Approval by EC Branch Review of deliverable

vii. Revise GCAR for ISS Food Warmer

- Approval by EC Branch Review of deliverable

viii. Revise Safety Assessment Report (SAR) for ISS Food Warmer

- Approval by EC Branch Review of deliverable

ix. PWD System Design Review (SDR) Data Package

- Approval by EC Branch Review of deliverable

x. PWD Final Risk Assessment Executive Summary Report (RAESR)

- Approval by EC Branch Review of deliverable

xi. PWD Acceptance Data Package (ADP)

- Approval by EC Branch Review of deliverable

xii. PWD Government Certification Approval Request (GCAR)

- Approval by EC Branch Review of deliverable

xiii. PWD Flight Unit ? Class I

- Approval by EC Branch Review of deliverable

xiv. PWD Training Unit ? Class III

- Approval by EC Branch Review of deliverable

xv. PWD Filter ORU Flight Units (2 flight & 1 test) ? Class I (FY08)

- Approval by EC Branch Review of deliverable

xvi. PWD Filter ORU Training Unit ? Class III

- Approval by EC Branch Review of deliverable

xvii. ISS Galley Monthly Report (FY08)

- Approval by EC Branch Review of deliverable

xviii. PWD Filter ORU

- Approval by EC Branch Review of deliverable

xix. PWD Needle ORU

- Approval by EC Branch Review of deliverable

xx. PWD Shock Kit

- Approval by EC Branch Review of deliverable Added Rev 12

xxi. PWD Spare Components

- Approval by EC Branch Review of deliverable

xxii. PWD New Build

- Approval by EC Branch Review of deliverable Added REV 19

5.16 Static Separator & Water Bag Development Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering and testing of a small deployable air/water separator that uses capillary action to separate the liquid and air. ESCG will also provide research and engineering for the development of soft bags for CEV water storage. Deliverables will be uploaded to the EC3 WRS share folder.

Monthly reports will not be required during the months in which quarterly reports are delivered.

For Rev 6, there will be no products required for delivery.

Revision 16 adds Swingbed Payload tasks to be defined by project directive (PD). Project Directives are to be approved by the EC3 CCB and maintained under configuration control. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.16.1 Static Separator & Water Bag Development Updated REV 19

Project Code:

Requirements as described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-024 Added Rev 11	General Operating Procedures Manual for EA Testing Facilities	Basic
EC3-ALS-001 Added Rev 11	Advanced Life Support (ALS) Technology Development Facility Standard Operating Procedures Manual	Original

c. **Required DRDs**

5.16.1 Static Separator & Water Bag Development

DRD #	DRD Title	Quantity/Frequency
Added Rev 11	No Requirement	

d. **Products**

5.16.1 Static Separator & Water Bag Development

Product(s)	Quantity	Delivery Date
Monthly Static Air/Water Separator Technical & Schedule Status Report (FY07) Added Rev 11	8	Monthly
Monthly CEV Soft Water Storage Bag Technical & Schedule Status Report (FY07) Added Rev 11	8	Monthly
Quarterly Static Air/Water Separator Technical & Schedule Status Report (FY07) Added Rev 11	4	Quarterly
Quarterly CEV Soft Water Storage Bag Technical & Schedule Status Report (FY07) Added Rev 11	4	Quarterly
FY07 Static Air/Water Separator Project Plan Added Rev 11	1	10/20/06
FY07 CEV Soft Water Storage Bag Project Plan Added Rev 11	1	10/20/06

e. **Product Verification**

5.16.1 Static Separator & Water Bag Development

i. Monthly Static Air/Water Separator Technical & Schedule Status Report (FY07)
- EC Branch review and acceptance of deliverables Added Rev 11

ii. Monthly CEV Soft Water Storage Bag Technical & Schedule Status Report (FY07)
- EC Branch review and acceptance of deliverables Added Rev 11

iii. Quarterly Static Air/Water Separator Technical & Schedule Status Report (FY07)
- EC Branch review and acceptance of deliverables Added Rev 11

iv. Quarterly CEV Soft Water Storage Bag Technical & Schedule Status Report (FY07)
- EC Branch review and acceptance of deliverables Added Rev 11

v. FY07 Static Air/Water Separator Project Plan
- EC Branch review and acceptance of deliverables Added Rev 11

vi. FY07 CEV Soft Water Storage Bag Project Plan
- EC Branch review and acceptance of deliverables Added Rev 11

5.17 Amine Swingbed Payload, CAMRAS and CxP Suit Integrated Testing (CCSIT) (added Rev 5) Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide project engineering, planning, facility buildup, testing, and integration coordination for the development of integrated testing between the CO2 and Moisture Removal Amine Swingbed (CAMRAS) and CxP Suit. Deliverables will be uploaded to the EC3 CCSIT share folder.

Revision 6 completes buildup and testing for CCSIT Phase 1 activities.

Revision 7 completes buildup and facility test operations of CCSIT Phase 1 activities as well as buildup and facility test operations for Phase 2 and Phase 3. Contractor shall also provide test subjects for Phase 1 and 3 tests.

Revision 10 completes buildup and facility test operations for CCSIT Phase 2. This revision also includes preliminary planning and facility evaluations for CCSIT Phase 3.

Revision 11 completes buildup and facility test operations for CCSIT Phase 2. This revision includes additional planning and facility evaluations for CCSIT 3.

Revision 15 adds the Swingbed Payload activities to be defined by Project Directive (PD). Project Directives are to be approved by the EC3 CCB and maintained under configuration control.

Revision 17 adds Swingbed Payload tasks to be defined by PD.

Revision 18 adds Swingbed Payload tasks to be defined by PD. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.17.1 Amine Swingbed Payload, CAMRAS and CxP Suit Integrated Testing (CCSIT) Updated Rev 17
Project Code:

Requirements for CCSIT are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-024 Added Rev 11	General Operating Procedures Manual for EA Testing Facilities	Basic
EC3-ALS-001 Added Rev 11	Advanced Life Support (ALS) Technology Development Facility Standard Operating Procedures Manual	Original
SSP 52000-IDD-ERP Added Rev 15	EXpedite the PRocessing of Experiments to Space Station (EXPRESS) Rack Payloads Interface Definition Document	H
SSP 52000-PVP-ERP Added Rev 15	Generic Payload Verification Plan, EXpedite the PRocessing of Experiments to Space Station (EXPRESS) Rack Payloads	H
STB-E-084 Added Rev 11	Drawing System and Configuration Control Procedure	B
STB-E-557 Added Rev 11	STB Facility and Major Test Build-up Procedure	C

c. **Required DRDs**

5.17.1 Amine Swingbed Payload, CAMRAS and CxP Suit Integrated Testing (CCSIT)

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 15	No Requirement	
230 Added Rev 15	Acceptance Data Package	per PD
233 Added Rev 15	Government Certification Approval Request (GCAR)	per PD
237 Added Rev 15	Certification Data Package	per PD
241 Added Rev 15	Risk Assessment Executive Summary Report (RAESR)	per PD

d. **Products**

5.17.1 Amine Swingbed Payload, CAMRAS and CxP Suit Integrated Testing (CCSIT)

Product(s)	Quantity	Delivery Date
Phase 1 Test Plan Updated REV 19	1	7/31/07
Phase 1 Facility Buildup Data Package Updated REV 19	1	8/31/07
Phase 2 Mobile CAMRAS Design Package Updated REV 19	1	8/31/07
Phase 1 Facility URR Updated REV 19	1	1/16/08
Monthly Budget Assessment (consolidated w/ 5.9 & 5.23) (not to be submitted to DDMS) Updated REV 19	A/R	monthly - 5 days post 533 delivery
Swingbed Payload Activities Added Rev 15	per PD	per PD

e. **Product Verification**

5.17.1 Amine Swingbed Payload, CAMRAS and CxP Suit Integrated Testing (CCSIT)

i. Phase 1 Test Plan

- EC Branch review and acceptance of deliverables

ii. Phase 1 Facility Buildup Data Package

- EC Branch review and acceptance of deliverables

iii. Phase 2 Mobile CAMRAS Design Package

- EC Branch review and acceptance of deliverables

iv. Phase 1 Facility URR

- EC Branch review and acceptance of deliverables

v. Monthly Budget Assessment (consolidated w/ 5.9 & 5.23) (not to be submitted to DDMS)

- EC Branch review and acceptance of deliverables

vi. Swingbed Payload Activities

- PD will be closed upon EC3 review and acceptance of the deliverable. Added Rev 15

5.18 ISS Environmental Health Systems (EHS) Air Updated Rev 14

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform the sustaining engineering and resupply and logistics efforts for hardware related to monitoring the ISS atmosphere environment. The sustaining activity includes anomaly resolution and analysis of in-flight data, failure and root cause investigations, stress and materials analysis, technical products to disposition discrepancy reports, development and off-nominal on-orbit crew procedures, System Problem Resolution Team action request for hardware assessments and analysis, assessments for hardware improvements and modifications, certifying hardware improvements and modifications, analysis of performance trending, and manifest plans. Resupply and Logistics is providing services for the logistics, maintenance, repair, hardware and software integration, inter/intra-center integration, and pre/post-flight processing of hardware. The EHS ISS subsystems include the Compound Specific Analyzer System (CSA-CP & CSA-O2) incorporating the CSAS Calibration Adapter, Carbon Dioxide Monitoring Kit (CDMK), and Volatile Organic Analyzer (VOA). ISS Change Directive 010557 specifies procurement of 22 CSA-CP monitors. Due to the malfunctioning of one of the CSA-CP monitors, and not being cost effective to manufacture one additional unit, 21 CSA-CP units were procured. Certify 15 of these 21 CSA-CP monitors for flight in FY08. The EHS-Air Team will assume sustaining engineering functions for the Inflight Gas Delivery System (IGDS) post-Systems Acceptance Review (SAR). Included in this effort are familiarization activities between certification and SAR prior to assuming full responsibility. The SAR for the IGDS is anticipated during January 2008. Included in IGDS is the potential evaluation of PIA testing to determine if additional valve testing is required during PIA. An Oxygen (O2) Sensor market study including evaluation of the Vaisala Optical Sensor will be accomplished in FY09. Provide sustaining engineering for the MEC migration, including coordination and feasibility studies, for the interface and functionality of the CSAS and CDM interface with the SSC Client operating system. Specific tasks will be defined by Project Directives approved by EC3 and contractor management.

Revision 11: Contractor has been tasked to generate a Portable O2 Monitoring Device requirements document. The Portable O2 Monitoring Device will be written using the requirements defined in SSP 50835, ISS Pressurized Volume Hardware Common Interface Requirements Document as directed by NASA.

These EA project codes encompass the EHS subsystems:

EHS - Air ISS Hardware Project Code

CSA-CP and CSA-O2 00042
IGDS 00072
CDM and VOA 00080

Contractor shall provide Environmental Health Systems logistics and maintenance data (including schedules) to the ISS program offices as input towards their development of vehicle manifests. This includes Integration activities for EHS hardware launch and return manifesting (excluding GOLD database entries). Acceptance Data Packages (ADPs) will be provided or updated as necessary for each delivery. Contractor shall plan and coordinate the use of the launch delivery method that provides the best opportunity to maintain the systems functionality on-board ISS. Vehicle launch schedules are fluid; therefore, a baseline schedule must be assumed in order to estimate the scope of the work. Per the launch vehicles schedules providing up-mass capability to the International Space Station and their associated frequencies are assumed to be:
? the Space Shuttle with flights scheduled per Calendar Year as follows:
o two (2) remaining flights in 2008, one (1) of which includes an MPLM;
o five (5) flights in 2009, one (1) of which includes an MPLM; and
? the Progress with flights scheduled per Calendar Year as follows:
o one (1) remaining flight in 2008;
o five (5) flights in 2009; and
? the Soyuz with flights scheduled per Calendar Year as follows:
o one (1) remaining flight in 2008;
o four (4) flights in 2009;

Contractor shall provide replacement hardware and software; plan, schedule and perform associated testing; develop procedures; and develop and deliver technical data. Contractor shall establish and maintain a flight product inventory and replace that inventory due to product life depletion. Where specified by Project Directive, contractor shall include a build-up of hardware needed for concurrent on-orbit and ground processing operations. If not otherwise specified the Project Directive, contractor assumes the need for zero spares. Contractor shall assess this ?zero spares? posture and will recommend to NASA a spares-plan that reduces any identified risks. NASA could then implement this plan (or portions thereof) through an amendment to this Delivery Order.

Contractor shall coordinate with the ISS Program regarding the delivery of flight products. Contractor shall deliver the products from the Bond Room to the JSC Center Operation Directorate, Logistics Division for all MPLM and nominally-stowed Spacehab deliveries. The Logistics Division will then be responsible for delivering the items to their respective launch processing facilities. Unless otherwise specified in a Project Directive, ESCG will deliver the products from the Bond Room through the JSC Center Operation Directorate, Logistics Division to United Space Alliance Flight Crew Equipment (USA FCE) for all Shuttle Middeck, Soyuz, Progress, and late-stow Spacehab deliveries. USA FCE will then be responsible for delivering the items to their respective launch processing facilities.

The number of crewmembers assigned to an ISS increment will have an impact upon the required, on-orbit quantity and upon the resupply period of the hardware items. The Project Directive provides this data as a function of crew size. For planning the work specified in this Delivery Order, the size will be baselined at three (3) crewmembers.

Travel will be required for hardware activities and integration of items launched aboard the Space Shuttle and Russian vehicles. Within the scope of this Delivery Order, ESCG personnel will participate in the following travel:
? ?Hardware-related travel? ? As required for hardware identified by Project Directive for flight processing or anomaly investigation.

The processes, plans and procedures used to perform this work will comply with the relevant EA and EC Work Instructions and other applicable documents as specified in the table below.

Rev 14 adds scope for FY10. Sustaining engineering flight hardware deliveries will be per the EC3 Flight Manifest (not PDs) which is

located on the EC3 share server.
Updated Rev 14

5.18.1 ISS Environmental Health Systems (EHS) Air Updated Rev 12
Project Code: CSA-CP and CSA-O2 00042; IGDS 00072; CDM & VOA 00080

Requirements for EHS are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 14	Project Management of GFE Flight Projects	Rev D 02-04
EA3-WI-023 Added Rev 11	Control/Handling of Class I Hardware in Support of Remote Site Activities	B
EA3-WI-044 Added Rev 11	Bond Room Operations/Building 36	Rev B 04-07
EC-WI-4.9-3 Added Rev 11	EC Configuration Control Board (CCB) Work Instruction	Rev D 10-04
EC-WI-4.9-4 Added Rev 11	GFE Configuration Management Plan	Basic
EC-WI-4.9-5 Added Rev 11	Change Procedures for ChecS EHS Vendor Drawings	Basic
JSC 63675 Added Rev 11	Project Technical Requirements Specification for the IGDS	B
JSC 64015 Added Rev 11	IGDS Pre-Installation Acceptance Test Plan	A

c. **Required DRDs**

5.18.1 ISS Environmental Health Systems (EHS) Air

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 11	Regular Status Report/Summary Review	As defined by Project Directive
230 Updated Rev 14	Acceptance Data Package	If required per EC3 Flight Manifest
237 Updated Rev 14	Certification Data Package	As defined by EC3 Flight Manifest

d. **Products**

5.18.1 ISS Environmental Health Systems (EHS) Air

Product(s)	Quantity	Delivery Date
Cost & Schedule Status Report Updated Rev 14	12	Monthly
VOA Data Analysis - Monthly Updated Rev 14	18	Monthly
CDM On Orbit Data Report ? Quarterly Updated Rev 14	4	Quarterly
Revision of CDMK GCAR 4102C to update criticality from 3 to 2R Updated Rev 14	1	April 2009
CSAS On Orbit Data Report ? Quarterly Updated Rev 14	4	Quarterly
Manufacture Sample Probes (including drawings update) Updated Rev 14	8	Sep 08
Revision of G5331 to include usage of IGDS and Calibration Adapter Updated Rev 14	1	1E
Revision of G5214 to include usage of IGDS and Calibration Adapter Updated Rev 14	1	1E
Calibration Adapter (Class I flight unit) Updated Rev 14	1	1E
Calibration Adapter (Class I flight unit) for 30P Updated Rev 14	1	Jun 08
Calibration Adapter (Class III Flight Like) Updated Rev 14	1	Dec 07
Calibration Adapter (Class III Flight Like) Updated Rev 14	1	Jul 08
Certify CSAS monitors for flight (15 in test program) Updated Rev 14	15	Sep 08
Fleet Leader Test Report Updated Rev 14	2	Semi-annual
Acceptance Data Package Deleted Rev 14	a/r	As required per flight delivery
Portable Gas Monitors or associated parts processed for flight Deleted Rev 14	per PD	per PD
VOA or associated parts processed for flight Deleted Rev 14	per PD	per PD
Portable O2 Monitoring Device Updated Rev 14	1	Jul 09
Calibration Adapter (Class I flight unit) for 33P Updated Rev 14	1	Feb 09
Calibration Adapter (Class I flight unit) Updated Rev 14	1	ULF3
IGDS Assembly (Class 1 Flight Unit) Added Rev 12	1	17A
ISS EHS Sustaining Hardware Added Rev 14	per EC3 Flight Manifest	per EC3 Flight Manifest

e. **Product Verification**

5.18.1 ISS Environmental Health Systems (EHS) Air

i. Cost & Schedule Status Report

- EC Branch review and acceptance of deliverables

ii. VOA Data Analysis - Monthly

- EC Branch review and acceptance of deliverables

iii. CDM On Orbit Data Report ? Quarterly

- EC Branch review and acceptance of deliverables

iv. Revision of CDMK GCAR 4102C to update criticality from 3 to 2R

- EC Branch review and acceptance of deliverables

v. CSAS On Orbit Data Report ? Quarterly

- EC Branch review and acceptance of deliverables

vi. Manufacture Sample Probes (including drawings update)

- EC Branch review and acceptance of deliverables

vii. Revision of G5331 to include usage of IGDS and Calibration Adapter

- EC Branch review and acceptance of deliverables

viii. Revision of G5214 to include usage of IGDS and Calibration Adapter

- EC Branch review and acceptance of deliverables

ix. Calibration Adapter (Class I flight unit)

- EC Branch review and acceptance of deliverables

x. Calibration Adapter (Class I flight unit) for 30P

- EC Branch review and acceptance of deliverables

xi. Calibration Adapter (Class III Flight Like)

- EC Branch review and acceptance of deliverables

xii. Calibration Adapter (Class III Flight Like)

- EC Branch review and acceptance of deliverables

xiii. Certify CSAS monitors for flight (15 in test program)

- EC Branch review and acceptance of deliverables

xiv. Fleet Leader Test Report

- EC Branch review and acceptance of deliverables

xv. Acceptance Data Package Deleted Rev 14

- EC Branch review and acceptance of deliverables Deleted Rev 14

xvi. Portable Gas Monitors or associated parts processed for flight Deleted Rev 14

- EC Branch review and acceptance of deliverables Deleted Rev 14

xvii. VOA or associated parts processed for flight Deleted Rev 14

- EC Branch review and acceptance of deliverables Deleted Rev 14

xviii. Portable O2 Monitoring Device

- EC Branch review and acceptance of deliverables

xix. Calibration Adapter (Class I flight unit) for 33P

- EC Branch review and acceptance of deliverables

xx. Calibration Adapter (Class I flight unit)

- EC Branch review and acceptance of deliverables

xxi. IGDS Assembly (Class 1 Flight Unit)

- EC Branch review and acceptance of deliverables Added Rev 12

xxii. ISS EHS Sustaining Hardware

- EC Branch review and acceptance of deliverables Added Rev 14

5.19 ISS EHS Water/Microbiology Updated Rev 14

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform the sustaining engineering and resupply and logistics efforts for hardware related to monitoring the ISS atmosphere, potable water, and microbiological environment. The sustaining activities include anomaly resolution and analysis of in-flight data, failure and root cause investigations, stress and materials analysis, technical products to disposition discrepancy reports, development and off-nominal on-orbit crew procedures, System Problem Resolution Team action request for hardware assessments and analysis, assessments for hardware improvements and modifications, certifying hardware improvements and modifications, analysis of performance trending, and manifest plans. Resupply and Logistics is providing services for the logistics, maintenance, repair, hardware and software integration, inter/intra-center integration, and pre/post-flight processing of Government Furnished Equipment related to monitoring the ISS atmosphere, potable water, and microbiological environment identified by

Project Directive. The EHS subsystems include Water Monitoring Subsytem (WMS); the EHS Water Kit, the Microbial Water Analysis Kit (MWAK), Microbial Air Sampler (MAS), Surface Sampler Kit (SSK), Water Microbiology Kit (WMK), Water Sample Collection Kit (WSCK).

These EA project codes encompass the EHS subsystems:

EHS Hardware Project Code

WMS, MWAK, WSCK, SSK, WMK, MAS 00081

Specific tasks also include outsourcing of SSK and MASK to outside vendor in order to reduce process contamination problems, utilizing electron beam facilities, and manufacturing, assembling and sterilizing flight hardware for on orbit air sample and surface sample collection and analyses at Texas A&M laboratory (MAPLES). Provide sustaining engineering for the design and certification of WMS through flight hardware delivery to reflect the bacterial enumeration limit of 50 cfu/ ml and combining the three kits (MWAK, WSCK, WMK) into one final Water Kit.

Contractor shall provide Environmental Health Systems logistics and maintenance data (including schedules) to the ISS program office as input towards their development of vehicle manifests. This includes Integration activities for EHS hardware launch and return manifesting (excluding GOLD database entries). Acceptance Data Packages (ADPs) will be provided or updated as necessary for each delivery. Contractor shall plan and coordinate the use of the launch delivery method that provides the best opportunity to maintain the systems functionality on-board ISS. Vehicle launch schedules are fluid; therefore, a baseline schedule must be assumed in order to estimate the scope of the work. Per the launch vehicles schedules providing up-mass capability to the International Space Station and their associated frequencies are assumed to be:
? the Space Shuttle with flights scheduled per Calendar Year as follows:
o two (2) remaining flights in 2008, one (1) of which includes an MPLM;
o five (5) flights in 2009, one (1) of which includes an MPLM; and
? the Progress with flights scheduled per Calendar Year as follows:
o one (1) remaining flight in 2008;
o five (5) flights in 2009; and
? the Soyuz with flights scheduled per Calendar Year as follows:
o one (1) remaining flight in 2008;
o four (4) flights in 2009;

Contractor shall provide replacement hardware and software; plan, schedule and perform associated testing; develop procedures; and develop and deliver technical data. Contractor shall establish and maintain a flight product inventory and replace that inventory due to product life depletion. Where specified by Project Directive, contractor shall include within their proposal a build-up of hardware needed in concurrent on-orbit and ground processing operations. If not otherwise specified, the Project Directive assumes the need for zero spares. Under this Delivery Order, contractor shall assess this ?zero spares? posture and will recommend to NASA a spares-plan that reduces any identified risks. NASA could then implement this plan (or portions thereof) through an amendment to this Delivery Order.

Contractor shall coordinate with the ISS program regarding the delivery of flight products. Contractor shall deliver the products from the Bond Room to the JSC Center Operation Directorate, Logistics Division for all MPLM and nominally-stowed Spacehab deliveries. The Logistics Division will then be responsible for delivering the items to their respective launch processing facilities. Unless otherwise specified by Project Directive, ESCG will deliver the products from the Bond Room through the JSC Center Operation Directorate, Logistics Division to United Space Alliance Flight Crew Equipment (USA FCE) for all Shuttle Middeck, Soyuz, Progress, and late-stow Spacehab deliveries. USA FCE will then be responsible for delivering the items to their respective launch processing facilities.

The number of crewmembers assigned to an ISS increment will have an impact upon the required, on-orbit quantity and upon the resupply period of the hardware items. The Project Directive provides this data as a function of crew size. For planning the work specified in this Delivery Order, the size will be baselined at three (3) crewmembers.

Travel will be required for hardware activities and integration of items launched aboard the Space Shuttle and Russian vehicles. Within the scope of this Delivery Order, contractor personnel will require the following travel:
? ?Hardware-related travel? ? As required for hardware identified in the Project Directive for flight processing or anomaly investigation.

The processes, plans and procedures used to perform this work will comply with the relevant EA and EC Work Instructions and other applicable documents as specified in the table below.

Rev 14 adds scope for FY10. Sustaining engineering flight hardware deliveries will be per the EC3 Flight Manifest which is located on the EC3 share server.
Updated Rev 14

5.19.1 ISS EHS Water/Microbiology Updated Rev 12
Project Code: WMS, MWAK, WSCK, SSK, WMK, MAS 00081

Requirements for ISS EHS/Micro are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 11	JSC Lessons Learned Process	10-02
ANSI/ESD S20.20-1999 Added Rev 11	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)	1999 05-99

Clinger-Cohen Act of 1996 (as revised) Added Rev 11	IT Management Reform Act of 1996 (the "Clinger-Cohen Bill")	1996
EA-WI-023 Added Rev 14	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-025 Added Rev 11	GFE Flight Project Software and Firmware Development	Rev A 11-01
IEEE/ASTM SI 10-2002 Added Rev 11	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
IPC 2222 Added Rev 11	Sectional Design Standard for Rigid Organic Printed Boards	02-98
IPC-6011 Added Rev 11	Generic Performance Specification for Printed Boards	07-96
ISO 10012 Added Rev 11	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13 Added Rev 11	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 2800.3 Added Rev 11	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JPG 2810.1 Added Rev 11	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4 Added Rev 14	Engineering Drawing System Manual	Rev H 11-01
JPG 8800.1 Added Rev 11	Asbestos Control Manual	
JSC 17773 Added Rev 11	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 23642 Added Rev 11	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549 Added Rev 11	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 26648 Added Rev 11	JSC Automated Information System User?s Security Guide	7-94
JSC 27260 Added Rev 11	Decal Design and Production Facility- Decal Process Document and Catalog	Rev D 05-02
JSC 27472 Added Rev 11	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 28035 Added Rev 11	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 28484 Added Rev 11	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
JSC 49879 Draft Added Rev 11	Johnson Space Center (JSC) Wire and Cable Integrity Compliance Program	Draft
MIL-STD-882 Added Rev 11	Standard Practice for System Safety	Rev D 02-02
MIL-STD-973 Added Rev 11	Configuration Control	Notice 4
NASA-STD-2101-91 Added Rev 11	NASA Software Documentation Standard	7-91
NASA-STD-2202-93 Added Rev 11	Software Formal Inspections	3/01
NASA-STD-8739.3 Added Rev 11	Soldered Electrical Connection	12-97
NPR 7150.2 Added Rev 11	NASA Software Engineering Requirements	Basic 09-04
NT-CWI-001 Added Rev 11	Task Performance Sheet (TPS)	Rev A 03-01
NT-CWI-003 Added Rev 11	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01
EA-WI-023 Added Rev 11	Project Management of GFE Flight Projects	E, 02-06
JPR 8500.4 Added Rev 11	Engineering Drawing System Manual	K, 03-06

c. **Required DRDs**

5.19.1 ISS EHS Water/Microbiology

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 11	Regular Status Report/Summary Review	As defined by Project Directive
230 Updated Rev 14	Acceptance Data Package	If required per PD or EC3 Flight Manifest

237 Updated Rev 14	Certification Data Package		per PD or EC3 Flight Manifest

d. **Products**

5.19.1 ISS EHS Water/Microbiology

Product(s)	Quantity	Delivery Date
WMS Safety Data Package Phase I and Phase II Added Rev 11	1 set	Feb 2008
WMS Project Technical Requirements Specification Added Rev 11	1 set	Feb 2008
WMS End Item Specification Added Rev 11	2 sets	May 2008
WMS Cert. Data Package Added Rev 11	1 set	June 2008
WMS GCAR Added Rev 11	1	June 2008
WMS GCAR Rev A Added Rev 11	1 set	Feb 2009
WMS RAESR III Added Rev 11	1 set	Sep 2009
WMS SAR Added Rev 11	1 set	ULF3
EHS Water Kits Updated Rev 12	4,5,1,1	30P, 31P, 33P, 34P
EHS Water Kits for Trainers Added Rev 11	2, 2	30P, Dec 2009
Project Schedule Updated Rev 12	A/R	Monthly
Regular Status Report / Summary Review Updated Rev 12	A/R	Monthly
Test Report (MAS) - Report for the Engineering Evaluation and recommendation Added Rev 11	1 set	Sep 2009
DRD 230 ? Acceptance Data Package excluding DRD 219 ?Flight Products User?s Guide.? Added Rev 11	One (1) per item per flight preparation (new ADP for newly-built hardware; update to existing ADP for refurbished hardware	As required per flight delivery
Water and microbiology sample kits processed for flight Updated Rev 14	per EC3 Flight Manifest	per EC3 Flight Manifest
WMS GCAR Rev B Added Rev 12	1	Sept 2009
Water Kit Spares Added Rev 12	per PD	per PD

e. **Product Verification**

5.19.1 ISS EHS Water/Microbiology

i. WMS Safety Data Package Phase I and Phase II

- EC Branch review and acceptance of deliverables Added Rev 11

ii. WMS Project Technical Requirements Specification

- EC Branch review and acceptance of deliverables Added Rev 11

iii. WMS End Item Specification

- EC Branch review and acceptance of deliverables Added Rev 11

iv. WMS Cert. Data Package

- EC Branch review and acceptance of deliverables Added Rev 11

v. WMS GCAR

- EC Branch review and acceptance of deliverables Added Rev 11

vi. WMS GCAR Rev A

- EC Branch review and acceptance of deliverables Added Rev 11

vii. WMS RAESR III

- EC Branch review and acceptance of deliverables Added Rev 11

viii. WMS SAR

- EC Branch review and acceptance of deliverables Added Rev 11

ix. EHS Water Kits

- EC Branch review and acceptance of deliverables

x. EHS Water Kits for Trainers

- EC Branch review and acceptance of deliverables Added Rev 11

xi. Project Schedule

- EC Branch review and acceptance of deliverables

xii. Regular Status Report / Summary Review

- EC Branch review and acceptance of deliverables
xiii. Test Report (MAS) - Report for the Engineering Evaluation and recommendation
- EC Branch review and acceptance of deliverables Added Rev 11
xiv. DRD 230 ? Acceptance Data Package excluding DRD 219 ?Flight Products User?s Guide.?
- EC Branch review and acceptance of deliverables Added Rev 11
xv. Water and microbiology sample kits processed for flight
- EC Branch review and acceptance of deliverables
xvi. WMS GCAR Rev B
- EC Branch review and acceptance of deliverables Added Rev 12
xvii. Water Kit Spares
- EC Branch review and acceptance of deliverables Added Rev 12

5.20 Environmental Health Systems (EHS) Radiation Sustaining Engineering Added Rev 11

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall [All future EHS Radiation Sustaining Engineering work from DO88 R6 moved to DO280 on 2/19/2008]. Contractor shall perform the sustaining engineering efforts for the active radiation hardware and software related to monitoring the ISS radiation environment. The sustaining activities include anomaly resolution and analysis of in-flight data, failure and root cause investigations, performance trending, development of off-nominal on-orbit crew procedures, as well as operations, MER and manifest activities, stress and materials analysis, technical products to disposition discrepancy reports, and SPRT and system action request for hardware assessments and analysis, improvements and modifications. The EHS ISS subsystems include the Intra-vehicular Charged Particle Directional Spectrometer (IV-CPDS), Extra-vehicular Charged Particle Directional Spectrometer (EV-CPDS), and Tissue Equivalent Proportional Counter (TEPC). Specific tasks related to the sustaining engineering effort are defined in the Project Directive.

In addition, ESCG will aid in the development of the Advanced Development and Strategic Planning (ADSP) for the Next Generation Radiation Projects (NGRP) on the ISS. This task includes providing the technical expertise and engineering knowledge to define and document the program?s functional requirements for a suite of active radiation devices that will monitor and characterize the ionizing radiation environment on the ISS, participate in Technical Interchange Meetings (TIMs), investigating and identifying available technologies, developing an interim plan for replacement devices, as well as conducting feasibility assessments for the next generation of radiation equipment for the ISS. Specific tasks related to the Next Generation Radiation Projects (NGRP) are defined in the Project Directive.

The processes, plans and procedures used to perform this work will comply with the relevant EA and EC Work Instructions and other applicable documents as specified in the table below.

Revision 8 moved all remaining deliverables and cost estimates to DO 280.
Added Rev 11

5.20.1 Environmental Health Systems (EHS) Radiation Sustaining Engineering Updated Rev 12
Project Code:

Requirements for Environmental Health Systems (EHS) Radiation Sustaining Engineering are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 12	No Requirement	

c. **Required DRDs**

5.20.1 Environmental Health Systems (EHS) Radiation Sustaining Engineering

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 11	Regular Status Report/Summary Review	As defined by Project Directive
230 Added Rev 11	Acceptance Data Package	As defined by Project Directive
237 Added Rev 11	Certification Data Package	As defined by Project Directive
241 Added Rev 11	Risk Assessment Executive Summary Report (RAESR)	As defined by Project Directive

d. **Products**

5.20.1 Environmental Health Systems (EHS) Radiation Sustaining Engineering

Product(s)	Quantity	Delivery Date

Completion of Functional Hardware Requirements Document Added Rev 11	1	Dec07
Completion of TEPC Detector and Spectrometer Repairs and Results of Initial Failure Assessment Added Rev 11	1	Apr 08
Interim Plan for Near- to Mid-term Replacement Devices Added Rev 11	1	May 08

e. **Product Verification**

5.20.1 Environmental Health Systems (EHS) Radiation Sustaining Engineering
i. Completion of Functional Hardware Requirements Document
- EC Branch review and acceptance of deliverables Added Rev 11
ii. Completion of TEPC Detector and Spectrometer Repairs and Results of Initial Failure Assessment
- EC Branch review and acceptance of deliverables Added Rev 11
iii. Interim Plan for Near- to Mid-term Replacement Devices
- EC Branch review and acceptance of deliverables Added Rev 11

5.21 Environmental Health Systems (EHS) Logistics & Resupply Added Rev 11

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering services for the logistics, maintenance, repair, hardware and software integration, inter/intra-center integration, and pre/post-flight processing of Government Furnished Equipment identified in a Project Directive approved by EC3 and contractor management. The processes, plans and procedures used to perform this work will comply with the relevant EA and EC Work Instructions and other applicable documents as specified in the table below.

The Project Directive contains data necessary to plan, schedule, and coordinate the activities required to maintain or restore biomedical systems functionality aboard the International Space Station. While configuration-controlled by NASA at the Branch-level, proposed changes to the document must also be approved by both the contractor Division Technical Manager and the NASA Technical Managers Representative before they may be effected.

Contractor shall provide Environmental Health Systems logistics and maintenance data (including schedules) to the ISS and SSP program offices as input towards their development of vehicle manifests. Acceptance Data Packages (ADPs) will be provided or updated as necessary for each delivery. Contractor shall plan and coordinate the use of the launch delivery method that provides the best opportunity to maintain the systems functionality on-board ISS. Vehicle launch schedules are fluid; therefore, a baseline schedule must be assumed in order to estimate the scope of the work. Per the launch vehicles schedules providing up-mass capability to the International Space Station and their associated frequencies are assumed to be:
? the Space Shuttle with flights scheduled per Calendar Year as follows:
o two (2) flights remaining in 2007, one (1) of which includes an MPLM;
o five (5) flights in 2008, one (1) of which includes an MPLM; and
? the Progress with flights scheduled per Calendar Year as follows:
o five (5) flights in 2007 and 2008;
? the Soyuz with flights scheduled per Calendar Year as follows:
o two (2) flights in 2007, and 2008;

Contractor shall provide replacement hardware and software; plan, schedule and perform associated testing; develop procedures; and develop and deliver technical data. Contractor shall establish and maintain a flight product inventory and replace that inventory due to product life depletion. Where specified by Project Directive, ESCG has included within this proposal a build-up of hardware needed for concurrent on-orbit and ground processing operations. If not otherwise specified, the Project Directive assumes the need for zero spares. Under this Delivery Order, contractor shall assess this ?zero spares? posture and will recommend to NASA a spares-plan that reduces any identified risks. NASA could then implement this plan (or portions thereof) through an amendment to this Delivery Order.

Contractor shall coordinate with the ISS and SSP programs regarding the delivery of flight products. Contractor shall deliver the products from the Bond Room to the JSC Center Operation Directorate, Logistics Division for all MPLM and nominally-stowed Spacehab deliveries. The Logistics Division will then be responsible for delivering the items to their respective launch processing facilities. Unless otherwise specified in the Project Directive, contractor shall deliver the products from the Bond Room through the JSC Center Operation Directorate, Logistics Division to United Space Alliance Flight Crew Equipment (USA FCE) for all Shuttle Middeck, Soyuz, Progress, and late-stow Spacehab deliveries. USA FCE will then be responsible for delivering the items to their respective launch processing facilities.

The number of crewmembers assigned to an ISS increment will have an impact upon the required, on-orbit quantity and upon the resupply period of the hardware items. The Project Directive provides this data as a function of crew size. For planning the work specified in this Delivery Order, the size will be baselined at three (3) crewmembers.

Travel will be required for hardware activities and integration of items launched aboard the Space Shuttle and Russian vehicles. Within the scope of this Delivery Order, contractor personnel will require the following travel:
? ?Hardware-related travel? ? As required for hardware identified by the Project Directive for flight processing or anomaly investigation.

Contractor shall submit a Monthly Status Report, DRD 105.

Note that all future work from DO88 R6 is being redistributed into WBS 5.18, 5.19 and 5.22 with revision 7. Added Rev 11

5.21.1 Environmental Health Systems (EHS) Logistics & Resupply Added Rev 11

Project Code:

Specific Requirements for the EHS Logistics and Resupply hardware: Contractor shall provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, pre/post-flight processing necessary to maintain the following EHS hardware:

EHS Hardware Project Code

CSA-CP and CSA-O2	00042
SCSA-CP	00060
SCDM	00068
IGDS	00072
CDM and VOA	00080
MWAK, WSCK, SSK, WMK, MAS	00081
IVCPDS, EVCPDS, TEPC	25902

b. **Applicable Documents**

Document Number	Document Name	Rev.
IEEE/ASTM SI 10-2002 Added Rev 11	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
JHB 1710.13 Added Rev 11	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JSC 17481 Added Rev 11	Safety Requirements Document for JSC Space Shuttle Flight Equipment	Rev B 09-02
JSC 17773 Added Rev 11	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 26549 Added Rev 11	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 28035 Added Rev 11	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 61360 Added Rev 11	Engineering Directorate Certified Parts Approval Process	Revi A
NSTS 22254 Added Rev 11	Methodology for Conduct of Space Shuttle Program Hazard Analysis	Rev B 12-93
NT-CWI-001 Added Rev 11	Task Performance Sheet (TPS)	Rev A 03-01
NT-CWI-003 Added Rev 11	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01
SN-C-0005 Added Rev 11	Contamination Control Requirements	Rev D 07-98
SSP 30695 Added Rev 11	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287 Added Rev 11	Hardware/Software Acceptance Process	Rev A 05-01
EA-083 Added Rev 11	Material Usage Control Procedure	Basic
EA-CWI-033 Added Rev 11	Battery Processing	Baseline
EB-WI-0013 Added Rev 11	Receiving, Control, Shipment of NASA Property	C
EB-WI-0022 Added Rev 11	Test Facilities Coordination	C
EB-WI-0023 Added Rev 11	Control/Handling of Class I Hardware in Support of Remote Site Activities	B
EB-WI-0027 Added Rev 11	Lithium Battery Handling	B
EB-WI-0035 Added Rev 11	Thermal Chambers Operations and Configuration Control	B
SSP 50470 Added Rev 11	Crew Health Care System Government Furnished Equipment Specification	A

c. **Required DRDs**

5.21.1 Environmental Health Systems (EHS) Logistics & Resupply

DRD #	DRD Title	Quantity/Frequency

105 Added Rev 11	Regular Status Report/Summary Review	As defined by Project Directive
230 Added Rev 11	Acceptance Data Package	As defined by Project Directive

d. **Products**

5.21.1 Environmental Health Systems (EHS) Logistics & Resupply		
Product(s)	**Quantity**	**Delivery Date**
Monthly Reports Added Rev 11	4	Monthly
DRD 230 ? Acceptance Data Package excluding DRD 219 ?Flight Products User?s Guide.? Added Rev 11	One (1) per item per flight preparation (new ADP for newly-built hardware; update to existing ADP for refurbished hardware	As required per flight delivery
Portable Gas Monitors or associated parts processed for flight Added Rev 11	As defined by Project Directive to maintain the functionality on-orbit and implemented in the ISS MIOCB manifest	As required to maintain the functionality on-orbit and implemented in the ISS MIOCB manifest
VOA or associated parts processed for flight Added Rev 11	As defined by Project Directive to maintain the functionality on-orbit and implemented in the ISS MIOCB manifest	As required by ISS MIOCB manifest
Water and microbiology sample kits processed for flight Added Rev 11	As defined by Project Directive to maintain the functionality on-orbit and implemented in the ISS MIOCB manifest	As required to maintain the functionality on-orbit and implemented in the ISS MIOCB manifest

e. **Product Verification**

5.21.1 Environmental Health Systems (EHS) Logistics & Resupply
i. Monthly Reports
- EC Branch review and acceptance of deliverables Added Rev 11
ii. DRD 230 ? Acceptance Data Package excluding DRD 219 ?Flight Products User?s Guide.?
- EC Branch review and acceptance of deliverables Added Rev 11
iii. Portable Gas Monitors or associated parts processed for flight
- EC Branch review and acceptance of deliverables Added Rev 11
iv. VOA or associated parts processed for flight
- EC Branch review and acceptance of deliverables Added Rev 11
v. Water and microbiology sample kits processed for flight
- EC Branch review and acceptance of deliverables Added Rev 11

5.22 SSP Environmental Health Systems (EHS) Air Updated Rev 14

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform the sustaining engineering efforts of hardware related to monitoring the Space Shuttle atmosphere environment. The sustaining activity includes anomaly resolution and analysis of in-flight data, failure and root cause investigations, stress and materials analysis, technical products to disposition discrepancy reports, development and off-nominal on-orbit crew procedures, Shuttle Responsible Design Engineer action request for hardware assessments and analysis, assessments for hardware improvements and modifications, certifying hardware improvements and modifications, analysis of performance trending, and manifest plans. The EHS space shuttle subsystems include the Shuttle Compound Specific Analyzer System (SCSAS) and Shuttle Carbon Dioxide Monitor System (SCDMS). Specific tasks will be defined in a Project Directive approved by EC3 and contractor management.

Contractor shall provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, pre/post-flight processing necessary to maintain the CDM used on-board the Space Shuttle and to maintain the combustion products monitoring function using the CSA-CP on-board the Space Shuttle.

Rev 14 adds scope for FY10. Sustaining engineering flight hardware deliveries will be per the EC3 Flight Manifest which is located on the EC3 share server. Updated Rev 14

5.22.1 SSP Environmental Health Systems (EHS) Air Added Rev 11
Project Code:

Specific tasks will be defined in a Project Directive approved by EC3 and contractor management. Per the launch vehicles schedules providing up-mass capability to the International Space Station and their associated frequencies are assumed to be:

? the Space Shuttle with flights scheduled per Calendar Year as follows:
  - o two (2) remaining flights in 2008, one (1) of which includes an MPLM;
  - o five (5) flights in 2009, one (1) of which includes an MPLM;

These EA project codes encompass the EHS Space Shuttle subsystems:

EHS - Air Hardware Project Code

SCDMS 00068
SCSAS 00060

The processes, plans and procedures used to perform this work will comply with the relevant EA and EC Work Instructions and other applicable documents as specified in the table below.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 11	JSC Lessons Learned Process	10-02
ANSI/ESD S20.20-1999 Added Rev 11	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)	1999 05-99
Clinger-Cohen Act of 1996 (as revised) Added Rev 11	IT Management Reform Act of 1996 (the "Clinger-Cohen Bill")	1996
EA-WI-025 Added Rev 11	GFE Flight Project Software and Firmware Development	Rev A 11-01
IEEE/ASTM SI 10-2002 Added Rev 11	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
IPC 2222 Added Rev 11	Sectional Design Standard for Rigid Organic Printed Boards	02-98
IPC-6011 Added Rev 11	Generic Performance Specification for Printed Boards	07-96
IPC-6012 Added Rev 11	Qualification and Performance Specification for Rigid Printed Boards	Rev A 07-00
ISO 10012 Added Rev 11	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13 Added Rev 11	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 2800.3 Added Rev 11	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JPG 2810.1 Added Rev 11	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8800.1 Added Rev 11	Asbestos Control Manual	
JSC 17481 Added Rev 11	Safety Requirements Document for JSC Space Shuttle Flight Equipment	Rev B 09-02
JSC 17773 Added Rev 11	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 23642 Added Rev 11	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549 Added Rev 11	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 26648 Added Rev 11	JSC Automated Information System User?s Security Guide	7-94
JSC 27260 Added Rev 11	Decal Design and Production Facility- Decal Process Document and Catalog	Rev D 05-02
JSC 27472 Added Rev 11	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 28035 Added Rev 11	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 28484 Added Rev 11	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
JSC 49879 Draft Added Rev 11	Johnson Space Center (JSC) Wire and Cable Integrity Compliance Program	Draft
MIL-STD-882 Added Rev 11	Standard Practice for System Safety	Rev D 02-02
MIL-STD-973 Added Rev 11	Configuration Control	Notice 4
NASA-STD-2101-91 Added Rev 11	NASA Software Documentation Standard	7-91
NASA-STD-2202-93 Added Rev 11	Software Formal Inspections	3/01
NASA-STD-8739.3 Added Rev 11	Soldered Electrical Connection	12-97

NPR 7150.2 Added Rev 11	NASA Software Engineering Requirements	Basic 09-04
NT-CWI-001 Added Rev 11	Task Performance Sheet (TPS)	Rev A 03-01
SN-C-0005 Added Rev 11	Contamination Control Requirements	Rev D 07-98
SSP 30237 Added Rev 11	SS Electromagnetic Emissions and Susceptibility	Rev E 10-99, DCN 010 03-00, DCN011 08-00, DCN013 03-01, DCN014 03-01
SSP 30309 Added Rev 11	Safety Analysis and Risk Assessment Requirements	Rev E 01-95
SSP 30559 Added Rev 11	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01
SSP 30695 Added Rev 11	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287 Added Rev 11	Hardware/Software Acceptance Process	Rev A 05-01
EA-WI-023 Added Rev 11	Project Management of GFE Flight Projects	E, 02-06
EA3-WI-023 Added Rev 11	Control/Handling of Class I Hardware in Support of Remote Site Activities	B
EA3-WI-044 Added Rev 11	Bond Room Operations/Building 36	B
EC-WI-4.9-3 Added Rev 11	EC Configuration Control Board (CCB) Work Instruction	D
EC-WI-4.9-4 Added Rev 11	GFE Configuration Management Plan	Basic
EC-WI-4.9-5 Added Rev 11	Change Procedures for CHeCS EHS Vendor Drawings	Basic
JPR 8500.4 Added Rev 11	Engineering Drawing System Manual	K, 03-06
NT-CWI-003 Added Rev 11	Quality Assurance Record Center Discrepancy Reporting and Tracking	C, 11-06

c. **Required DRDs**

5.22.1 SSP Environmental Health Systems (EHS) Air

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 11	Regular Status Report/Summary Review	As defined by Project Directive
230 Updated Rev 14	Acceptance Data Package	per EC3 Flight Manifest
237 Updated Rev 14	Certification Data Package	per EC3 Flight Manifest

d. **Products**

5.22.1 SSP Environmental Health Systems (EHS) Air

Product(s)	Quantity	Delivery Date
Monthly Cost & Schedule Added Rev 11	12	Monthly
Acceptance Data Package Updated Rev 12	A/R	As required per flight delivery
Portable Gas Monitors or associated parts processed for flight Updated Rev 12	per PD	per PD
SSP EHS Air Hardware Added Rev 14	per EC3 Flight Manifest	per EC3 Flight Manifest

e. **Product Verification**

5.22.1 SSP Environmental Health Systems (EHS) Air

i. Monthly Cost & Schedule

- EC Branch review and acceptance of deliverables Added Rev 11

ii. Acceptance Data Package

- EC Branch review and acceptance of deliverables

iii. Portable Gas Monitors or associated parts processed for flight

- EC Branch review and acceptance of deliverables

iv. SSP EHS Air Hardware

- EC Branch review and acceptance of deliverables Added Rev 14

5.23 Advanced Life Support Air Revitalization System (ARS) Facility Upgrades and Test Support (added Rev 10) Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide under direction from the CTSD Systems Test Branch planning, buildup, integration, and testing for development of advanced Air Revitalization Systems (ARS) technologies by facilitating operation of ARS test articles in CTSD managed test facilities.

Revision 10 completes buildup for CAMRAS Phase 4A testing as well as preparations for ACRRS testing.

Revision 11 completes CAMRAS 4A testing, removes ACRRS task and removes CAMRAS 4A TRR Data Package since the latter was provided as GFP.

Revision 12 includes additional scope to support CAMRAS testing and ARTEF related activities through 1/31/10. This revision also includes FY09 upgrades to the Building 7B Gas Lab area, support flow bench testing, and continued CAMRAS test support.

Revision 16 adds scope for FY11 ARTEF activities. Project Directives are to be approved by the EC3 CCB and maintained under configuration control.

Revision 17 adds scope for FY11 ARTEF activities.

Revision 19 adds scope for FY12 ARTEF activities. The contractor shall provide a copy of the approved PD to the contracting office within 5 days of approval. Updated REV 19

5.23.1 Advanced Life Support Air Revitalization System (ARS) Facility Upgrades and Test Support (added Rev 10) Updated Rev 17

Project Code:

Requirements are described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-024 Added Rev 11	General Operating Procedures Manual for EA Testing Facilities	Basic
EC3-ALS-001 Added Rev 11	Advanced Life Support (ALS) Technology Development Facility Standard Operating Procedures Manual	Original
STB-E-084 Added Rev 11	Drawing System and Configuration Control Procedure	B
STB-E-557 Added Rev 11	STB Facility and Major Test Build-up Procedure	C

c. **Required DRDs**

5.23.1 Advanced Life Support Air Revitalization System (ARS) Facility Upgrades and Test Support (added Rev 10)		
DRD #	DRD Title	Quantity/Frequency
Added Rev 11	No Requirement	

d. **Products**

5.23.1 Advanced Life Support Air Revitalization System (ARS) Facility Upgrades and Test Support (added Rev 10)		
Product(s)	Quantity	Delivery Date
Monthly Budget Assessment (consolidated with 5.9 & 5.17) (not to be submitted to DDMS)	A/R	5 days post 533 delivery

e. **Product Verification**

5.23.1 Advanced Life Support Air Revitalization System (ARS) Facility Upgrades and Test Support (added Rev 10)
i. Monthly Budget Assessment (consolidated with 5.9 & 5.17) (not to be submitted to DDMS)
- EC Branch review and acceptance of deliverables

5.24 Emergency Response Mask (ERM) Updated REV 19

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide the engineering design, development, and certification of the ECLSS Hardware projects to be defined by Project Directive (PD), including but not limited to the Emergency Response Mask (ERM).

Revision 16 adds Ammonia Cartridge activities to be defined per project directive (PD). Changes Emergency Response Mask to Emergency Mask. Project Directives are to be approved by the EC3 CCB and maintained under configuration control.

Revision 18 adds Emergency Mask scope to be defined per PD.

Revision 19 adds FY12 Emergency Mask scope to be defined per PD. The contractor shall provide a copy of the approved PD to the

contracting office within 5 days of approval. Updated REV 19

5.24.1 Emergency Response Mask (ERM) Updated Rev 18
Project Code: 00110

Provide the engineering design, development, and certification of the ISS Emergency Response Mask (ERM) as defined in Project Directive(s).

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 15	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4 Added Rev 15	Engineering Drawing System Manual	Rev H 11-01
JSC 28484 Added Rev 15	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03

c. **Required DRDs**

5.24.1 Emergency Response Mask (ERM)		
DRD #	DRD Title	Quantity/Frequency
230 Added Rev 15	Acceptance Data Package	per PD
233 Added Rev 15	Government Certification Approval Request (GCAR)	per PD
237 Added Rev 15	Certification Data Package	per PD
241 Added Rev 15	Risk Assessment Executive Summary Report (RAESR)	per PD

d. **Products**

5.24.1 Emergency Response Mask (ERM)		
Product(s)	Quantity	Delivery Date
Emergency Mask (EM) Updated REV 19	per PD	per PD
Ammonia Cartridge Activities Added Rev 16	per PD	per PD

e. **Product Verification**

5.24.1 Emergency Response Mask (ERM)
i. Emergency Mask (EM)
- PD will be closed upon EC3 review and acceptance of the deliverable.
ii. Ammonia Cartridge Activities
- PD will be closed upon EC3 review and acceptance of the deliverable Added Rev 16

1.0 Cost Summary and Revision History

SLC	Type	CY2	CY3	CY4	CY5	CY6	CY7	CY8	G Total
AS1	Sum of Hours	0							2,727
	Sum of Dollars								
AS2	Sum of Hours								
	Sum of Dollars								
AS3	Sum of Hours								
	Sum of Dollars								
BS1	Sum of Hours								
	Sum of Dollars								
BS2	Sum of Hours								
	Sum of Dollars								
BS3	Sum of Hours								
	Sum of Dollars								
CM1	Sum of Hours								
	Sum of Dollars								
CM2	Sum of Hours								
	Sum of Dollars								
EN1	Sum of Hours								
	Sum of Dollars								
EN2	Sum of Hours								
	Sum of Dollars								
EN3	Sum of Hours								
	Sum of Dollars								
EN4	Sum of Hours								
	Sum of Dollars								
ESS	Sum of Hours								
	Sum of Dollars								
ET2	Sum of Hours								
	Sum of Dollars								
ETS	Sum of Hours								
	Sum of Dollars								
IT2	Sum of Hours								
	Sum of Dollars								
IT3	Sum of Hours								
	Sum of Dollars								
MGR	Sum of Hours								
	Sum of Dollars								
PC1	Sum of Hours								
	Sum of Dollars								
PC2	Sum of Hours								
	Sum of Dollars								
PC3	Sum of Hours								
	Sum of Dollars								
QA1	Sum of Hours								
	Sum of Dollars								
QA2	Sum of Hours								
	Sum of Dollars								
QE2	Sum of Hours								
	Sum of Dollars								
QE3	Sum of Hours								
	Sum of Dollars								
SC1	Sum of Hours								
	Sum of Dollars								
SC2	Sum of Hour.								
	Sum of Dolla.								
SC3	Sum of Hours								
	Sum of Dollars								
SC4	Sum of Hours								
	Sum of Dollar								

SE	Sum of Hours
	Sum of Dollars
SM	Sum of Hours
	Sum of Dollars
SV	Sum of Hours
	Sum of Dollars
TN1	Sum of Hours
	Sum of Dollars
TN2	Sum of Hours
	Sum of Dollars
TN3	Sum of Hours
	Sum of Dollars
Total Direct Labor Hours	
Total Direct Labor Costs	
Travel Costs	
Subcontract	
NLR Misc	
Materials	
Burden on Non-Labor	
Total Non Labor	
Total Costs	
Fee	
Total	

b4

$92,882,614.8

DO 88 Revision History:	Total Cost	Reason for Revision
Original	4,361,234	Original activities for Feb-Sept 2006.
R1	5,114,786	Reduced cost estimate due to work performed on T049 while DO88 was in the approval process. 5.1: added SORG SAR update. 5.5: added cost estimate to draw down account. 5.7: removed cost estimate for urine QDs, which will be provided as GFE. 5.8: added static separator task 5.9: added CAMRAS test facility buildup task. 5.10: new WBS for ELS task. 5.11: new WBS for AH&I task.
R2	5,240,232	5.1: added 5 CWC bladder assemblies. 5.6: deleted mock-up work that was done by SF. 5.8: added materials for WRS lab 5.9: added materials for ARTEF
R3	18,623,710	Added FY07 activities. Added new tasks for WBS 5.12 (CEV ECLSS System Manager and System Engineering), 5.13 (ISS High Pressure Oxygen), 5.14 (CEV Habitation), 5.15 (ISS Galley), and 5.16 (Static Separator and Water Bag Development).
R4	18,113,475	5.1: added 3 shuttle ACTEX and 2 OGS PWRs. 5.7: added additional common hose and change in MDP. 5.9: added buildup for CAMRAS phase 3 testing and flow-bench vent hood. 5.10: added ammonia testing subcontract and SBIR work. 5.11: added cost estimate to extend period of performance and deleted hab autonomy testing. 5.12: added administrative tasks for the CEV Office 5.14: increased scope for Seat Dynamic Response evaluation 5.15: deleted requirement for the food warmer development, design, fab, certify and delivery 5.16: Deleted the requirement to provide a C-9 flight for zero-gravity testing of the static separator.
R5	22,324,308	5.1: Added delivery of additional ACTEX units, additional units for

		flight processing of OGS PWRs, and a delta cert for PWR fluid compatibility. 5.3 Changed the requirement for IVA weekly updates to the Webpage to Bi-weekly. 5.6 Added post CDR work for the CQ project 5.8: Added Shuttle Wastewater Dump Line Evaluation Final Report, Reduced Biweekly reports from 44 to 32 Reduced scope of work for WRS/Hab CEV Interfaces, Removed one Quarterly WRS/Hab CEV Interfaces Technical Report, Removed one Monthly WRS/Hab CEV Interfaces Technical Report, Added materials for WRS laboratories 5.9 Added work for Phase 4 of the CAMRAS project 5.10 Reduced the ELS reporting requirements 5.11 Added LAT-2 project requirements 5.12 Added Integrated O2 Sorption Compressor analysis 5.14 Added Habitation Technology Road Map report 5.15 • Added design, fab, and certify of four (4) Food Warmer EXPRESS Rack Power Cables. • Deleted the requirement for 50 weekly status reports and added 12 monthly status reports for ISS Galley • Added PWD Preliminary Design TIM in lieu of PDR • Deleted PWD GFE dependencies for ACTEX and microbial filter • Deleted Food Warmer GFE dependencies for EXPRESS Rack power connectors • Added scope for PWD1 travel to design, build, test and certify a PWD Filter ORU that will include a deiodination filter and a microbial removal filter 5.16 Added requirement for CEV Soft Water Storage Bag Project Plan 5.17 This is a new WBS added with Rev 5.
R6	40,396,939	5.1 Added FY 08 deliverables 5.2 Reduced Authorization to reduce variance for FY 07. Tasks will be moving to D087 for FY08 5.3 Increased authorization to reduce FY07 variance. Tasks will be moving to D087 for FY08 5.4 Reduced authorization to reduce FY07 variance. Added FY08 deliverables 5.5 Tasks will be moved to D087 for FY08 5.6 5.10 Added FY08 deliverables; Reduced Authorization to reduce FY07 variance 5.12 Transition of 1 EN4 and 1 AS2 to TO106 for the ongoing work. 5.14 Added FY 08 Deliverables 5.18 Added Environmental Health Systems (EHS) Air Sustaining Engineering from DO129 for FY08 5.19 Added Environmental Health Systems (EHS) Water/Micro Sustaining Engineering from DO129 for FY08 5.20 Added Environmental Health Systems (EHS) Radiation Sustaining Engineering from DO129 for FY08 5.21 Added Environmental Health Systems (EHS) Logistics & Resupply from DO129 for FY08
R7	42,414,958	5.1 Added SORG sustaining engineering (No change in cost) 5.3 Closed out the WBS. Moved to DO87 in Rev 6. Reduced authorization to reflect actuals. 5.4 Reduced ISS IVA EHS Hardware development items from 8 to 2. Added 3 ISS IVA EHS Sustaining Engineering items. (No change in cost) 5.7 Clarified deliverables. No scope change.

		5.8 Added scope in FY08 including a Rotating Reverse Osmosis technical subcontract and laboratory consolidation. Re-phased the deliverable dates. 5.9 Removed CCSIT Phase 1 CAMRAS report. Added CCSIT Phase 1 and 2 CAMRAS Quick Look reports. Initiate the re-design and buildup of the HMS as well as the redesign of the CTSD gas lab 5.12 Adding FY08 scope to include additional monthly reports from 15 to 24. 5.14 Adding remaining FY08 scope. 5.15 Changed SDR date to 01/28/2008 (No change in cost). 5.17 Added funds for Phase 1 buildup as well as CCSIT Phase 2 and 3. Added ESC test subject for Phase 1 and 3 testing. Clarified GFPs. 5.18 Added Logistics and Resupply for EHS Air hardware from WBS 5.21. 5.19 Added Logistics and Resupply for EHS Water/Micro hardware from WBS 5.21. Changed the following WMS dates: SDP to January 2008 PTRS to February 2008 EISs to February 2008 Cert. Data Package May 2008 GCAR to May 2008 WMS SAR to 30 P 5.21 Redistributed Logistics and Resupply into WBS 5.18, 5.19, and 5.22. 5.22 Added WBS to break out shuttle sustaining engineering and logistics and resupply. New cost estimate of $122k.
R8	47,330,610	5.6 Changed delivery dates based on shuttle launch schedule. Added $2.7 million cost estimate. 5.7 Changed delivery dates based on PTU hose redesign. Added $269k cost estimate. 5.8 Added $109k cost estimate for Monthly Rotating Reverse Osmosis (RRO) Technical & Schedule Status Reports and a RRO Test Report. Deleted Silver Biocide White Paper and Soft Water Stowage Final Report. 5.9 Added $161k cost estimate for CAMRAS Phase 4 Test Plan, CAMRAS Phase 4 DTP, Second Generation HMS Design Data Pack and Acceptance Pack, Trace Contaminant Year End Summary Report, and CAMRAS Year End Summary Report. Deleted CAMRAS Phase 4 Interim Report, HMS Redesign Data Pack, and HMS Lessons Learned White Paper. . 5.15 Added $2.0 million cost estimate based on the post-SDR estimate to complete. 5.18 Added $14k cost estimate for integration activities. 5.19 Added 5 EHS Water Kits for 31P. Deleted $20k cost estimate. 5.20 Deleted $379k cost estimate and remaining deliverables due to activities being performed on DO280. 5.22 Added $7k cost estimate for integration activities.
R9	51,021,102	5.6 Added $3,227k for additional labor necessary to overcome CQ manufacturing and testing issues while maintaining delivery date. 5.7 Added $58k cost estimate for PTU hose redesign activities. Reduced the number of PTU hoses delivered from 2 to 1. 5.15 Added $327k cost estimate for additional labor necessary to overcome PWD testing failures while maintaining delivery date.
R10	56,994,430	5.1 Added $373k for FY09 activities. 5.4 Added $216k for FY09 activities. 5.6 Added $188k for FY09 sustaining engineering activities and lessons learned report. 5.7 Added $4k for FY09 sustaining engineering activities. 5.8 Added $1068K for cleanser et. al. evaluations, distillation comparison testing, DOC testing, brine dewatering, and CTSD wet chemistry analyses.

		5.9 Added $456k for FY09 activities. 5.10 Added $311k for FY09 activities. 5.12 Added $758k for FY09 activities and monthly reports. 5.14 Added $304k for FY09 activities and weekly reports. 5.15 Added $17k for FY09 sustaining engineering activities. 5.17 Added $50K for remaining CCSIT Phase 2 efforts and initial CCSIT Phase 3 activities. 5.18 Added $1,219k for FY09 activities. 5.19 Added $968k for FY09 activities. 5.22 Added $151k for FY09 activities. 5.23 Added $109k to new WBS to separate Facility ELS ARS activities from core ELS ARS efforts.
R11	$60,383,423	5.1 Added scope for microbial removal filter assembly and I-CWC fill options. 5.4 Added scope for non-intrusive flow meter and CQMK. 5.6 Added scope for Crew Quarters development, EMI testing, acoustic evaluations, and sustaining activities. Changed delivery dates for CQ3 and CQ4. 5.7 Added scope for REFH redesign, delta-SRR activities, and procurement of long lead items. 5.8 Added monthly Waste Water Collection and Transport System Technical & Schedule Status Reports. Added $50K for titrator instrument and laboratory upgrades. 5.9 Added scope for SA9T Regeneration Evaluation Quick Look Report and Multi-Media Sorbent Test Report, and changes delivery dates for CAMRAS testing documentation. 5.12 Added scope for the procurement of sensors to be tested and oxygen testing subcontracts. 5.15 Added scope for PWD spares activities. 5.17 Added scope for the completion of the CCSIT 2 testing and preparations for CCSIT 3. 5.18 Added scope for the revision of the CDMK GCAR and for the Portable oxygen monitoring device requirements document. 5.19 Added scope for additional ISS EHS Water/Micro hardware system engineering projects. 5.22 Added scope for additional EHS Space Shuttle hardware engineering activities. 5.23 Added scope for the additional CAMRAS 4A test activities.
R12	$64,418,450	Added FY10 scope for all WBSs. CO authorized funding through Oct 2009. 5.1 Added Water Conversion Kit and ACTEX spares. 5.4 Added First Response Respirator and IMV Filter projects. 5.6 Added CQ Spares and JEM Certification 5.7 Added REFH Upgrades 5.8 Descoped weekly and monthly reports. 5.9 Added FY10 CAMRAS and CCSIT activities 5.10 Descoped ELS monthly report and added FY10 scope 5.12 Added FY10 scope 5.14 Added FY10 scope 5.15 Added shock kit and PWD spares 5.17 Added CCSIT Phase 3 activities 5.18 Added FY10 scope 5.19 Added water kit spares 5.22 Added FY10 scope 5.23 Added CAMRAS FY10 activities and building 7B upgrades
R13	$68,636,922	CO funding authorization for Nov – Jan 2010.
R14	$72,750,409	Added FY10 scope through Sept 2010. Also added scope for WBS 10 through 1/31/2013. 5.1: Added water transfer hardware as define by the EC3 flight manifest and PD authorization for future projects 5.4: Added scope for post CDR activities for IMV Screen and Fire

		Cartridge, and refurbished hardware as define by the EC3 flight manifest. 5.8: Added scope for FY10 WRS activities and reports to be defined by PD. 5.9: Added scope for FY10 ARS activities and reports to be defined by PD. 5.10: Added activities through 1/31/13. 5.12: Added scope for FY10 CEV ECLSS activities. 5.15: Added scope for FY10 PWD spares and sustaining activities. 5.17: Reduced PD authorization. 5.18: Added scope for FY10 EHS Air activities and deliveries to be defined by the EC3 flight manifest. 5.19: Added scope for FY10 EHS water/microbiology activities and deliveries to be defined by the EC3 flight manifest. 5.22: Added scope for FY10 SSP EHS Air activities and deliveries to be defined by the EC3 flight manifest. 5.23: Reduced PD authorization.
R15	$79,462,599	Added FY10 and FY11 scope for the following tasks: 5.1: Defined MRF deliverable using PD funding added in rev 14. 5.4: Added additional scope for CQMK and FC testing per PD. 5.7: Added REFH sustaining engineering tasks per PD. 5.9: Added scope for material procurements. Changed deliverables dates. 5.12: Added scope for Portable Fire Extinguisher development. 5.17: Added Amine Swingbed Payload tasks per PD. 5.23: Added FY10 facilities scope. 5.24: Added new WBS for ECLSS Hardware development per PD, including the ERM.
R16	$81,745,739	5.1: Added MRF scope per PD. 5.4: Added FY11 ITCS/ECLSS scope per EC3 Flight Manifest 5.6: Added FY10 and FY11 CQ sustaining engineering tasks per PD. 5.7: Added FY10 and FY11 Urine Transfer Hardware tasks per PD. 5.8: Added FY11 WRS scope. 5.9: Added FY11 ARS scope. 5.12: Added FY11 CEV ECLSS scope. 5.15: Added FY11 PWD scope per PD. 5.17: Reduced FY11 Swingbed scope per PD. 5.23: Added FY11 AETEF facility scope. 5.24: Added FY10 Ammonia Cartridge tasks per PD.
R17	$83,520,687	5.1: Added FY11 MRF scope per PD. 5.4: Added FC and IWAK scope per PD. 5.8: Added FY11 WRS scope. 5.12: Added FY11 CEV ECLSS scope. 5.17: Added Amine Swingbed Payload scope per PD. 5.23: Added ARTEF facility scope.
R18	$88,021,231	5.4: Added FY11 and FY12 scope for ERADK testing, Fire Cartridge, and other tasks per PD 5.6: Added FY11 and FY12 CQ spares scope per PD 5.7: Added FY11 urine transfer hardware scope per PD 5.8: Added FY11 WRS scope per PD 5.9: Added FY11 ARS scope per PD 5.12: Added FY11 CEV ECLSS scope 5.15: Added PWD scope per PD 5.17: Added Swingbed scope per PD 5.24: Added Emergency Mask scope per PD
R19	$92,882,615	5.1: Added FY12 water transfer hardware scope per PD 5.4: Moved PD scope for Velocicalc to FY12; added FY12 ECLSS/ITCS sustaining engineering scope 5.6: Added FY12 sustaining engineering scope per PD 5.7: Added FY12 sustaining engineering scope per PD 5.8: Added FY12 scope per PD 5.9: Added FY12 scope per PD 5.10: Reduced FY12-13 scope

		5.12: Moved PD scope to FY12 5.15: FY12 sustaining engineering scope 5.23: Added FY12 ARTEF scope 5.24: Added FY12 Emergency Mask scope per PD

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ05HC37D DO 97 R10	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Chris Gaspard
Tel. No.: 281-483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 09/01/05 – 9/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.

Name: Chuck Murgia

Signature: _____ Date: _____

10. Name: **Adrian C. Clayton**

Signtature: Adrian C. Clayton Date: 09/02/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Aero science and Flight Mechanics Division (EG) Analysis					
DO	**97 R10**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However, the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$16,222,146.63

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ05HC37D-DO97 REV 10

Originator: Tuyen Hua (EG) (281) 483-8296 **TMR:** Tuyen Hua (EG) (281) 483-8296

Revision Summary:

The purpose of Revision 10 is to add requirement for COTS Vehicles Proximity Operations Analysis Summary Report on WBS 5.2.1 - ISS Dynamics and Control Analysis. The ?COTS Vehicles Proximity Operations Analysis Summary Report? is a new requirement on WBS 5.2.1 which is the Dynamics and Control (ISS GN&C task). WBS 5.5 is ISS RPO Visiting Vehicles which covers the COTS (SpaceX and Orbital) rendezvous & Prox Ops analysis. It has a product which looks similar but it pertains to the COTS side of things and not ISS GN&C.

1. Title of Effort: Aeroscience and Flight Mechanics Division (EG) Analysis

2. Date of Request: 08/22/2011

3. Statement of Work Task Description

a. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

b. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

c. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 8

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 09/01/2005 and ends 09/30/2011.

5. Product Requirements

5.1 Applied Aeroscience and CFD Analysis (EG3)

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering products in plume flow field analysis and modeling, plume contamination modeling, aerodynamics analysis, and aerothermodynamic heating analysis for on-going Aeroscience Branch projects. Tasks include development of analysis methods, tool development, application of these methods & tools.

5.1.1 ISS Aeroscience Analysis Updated Rev 9

Project Code:

The contractor shall provide technical and engineering service associated with the modeling of Reaction Control System plume flow fields and with the prediction of the heating rate and thermal response environments resulting from the impingement of these plumes upon the International Space Station. The contractor shall perform a high fidelity assessment of the plume flow field resulting from the simultaneous operation of all four main jets of the Japanese H-2 Transfer Vehicle (HTV). The contractor shall perform reconstruction of the heating rate environments resulting from the as flown RCS engine operations during both docking and separation of the Shuttle Orbiter to/from the ISS on STS-114, 121, 115 and other ISS missions flown during FY07, FY08, FY09, FY10 and FY11. The contractor shall perform a prediction of the plume impingement heating rates to the ISS assembly complete configuration for RCS engine operations typical of the RBAR Pitchover Maneuver. The contractor shall provide maintenance of the RPM3D analysis tool and of the associated ISS geometry models.

5.1.2 Shuttle Aeroscience Analysis Updated Rev 9

Project Code:

The contractor shall provide engineering services related to both the aerodynamics and aerothermodynamics of the Space Shuttle System. Services shall be applied to both the integrated Space Shuttle Vehicle during ascent and to the Shuttle Orbiter during entry. Aerodynamic services shall include maintenance and upgrades to the Shuttle Wind Tunnel Data Access Tool (SWAT) including the incorporation of new test data as it becomes available as well as the addition of existing data related to capsules such as the Apollo Command Module. Aerothermodynamic services shall include arcjet test planning and data reduction support and engineering analyses estimating heat transfer rates to the Orbiter during entry under a variety of engineering assumptions such as varying amounts of wall catalysis.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EG-WI-00015	Advanced Studies Process for EG3/Applied Aerosciences and CFD Branch Work Instruction	D
EG-WI-00353	Aeroscience Process for Supporting Flight Design	C
JSC-26507	Model for Predicting Orbiter PRCS Plume Impingement Loads and Heating	A
JSC-26583	Orbiter PRCS Plume Impingement Toolkit: RPM Ver. 3.0.1	A

c. **Required DRDs**

5.1.1 ISS Aeroscience Analysis

DRD #	DRD Title	Quantity/Frequency
218 Updated Rev 9	Engineering Analysis	37

5.1.2 Shuttle Aeroscience Analysis

DRD #	DRD Title	Quantity/Frequency
218 Updated Rev 8	Engineering Analysis	27

d. **Products**

5.1.1 ISS Aeroscience Analysis

Product(s)	Quantity	Delivery Date
Reconstruction of plume heating environments during the STS-114 Mission	1	11/30/2005
Analysis of the plume heating environment to the ISS during the RBAR Pitchover Maneuver	1	1/31/2006
High fidelity prediction of the HTV Quadruple Main Jet Plume Flow Field	1	6/30/2006
RPM3D plume environment prediction tool Users Guide	1	9/30/2006

Reconstruction of plume heating environments during the FY07 Missions	6	9/30/2007
RPM3D Tool & Users Guide Update	5	9/30/2007, 9/30/2008, 9/30/2009, 9/30/2010, 9/30/2011
Reconstruction of plume heating environments during the FY08 Missions	4	9/30/2008
ISS Aerosciences Assessment Summary Reports	1/Quarter	9/30/2008, 9/30/2009, 9/30/2010, 9/30/2011
Reconstruction of plume heating environments during the FY09 Missions	4	9/30/2009
Reconstruction of plume heating environments during the FY10 Missions	1	9/30/2010
Reconstruction of plume heating environments during the FY11 Missions	3	9/30/2011
COTS Vehicles Plume Impingement Assessments Added Rev 9	2	9/30/2011

5.1.2 Shuttle Aeroscience Analysis

Product(s)	Quantity	Delivery Date
Arcjet test planning and data reduction plans	1 set	12/31/2005
Upgrade and maintenance to SWAT	1	3/31/2006
Analysis of Orbiter entry heating assuming varying wall catalycity	1	4/14/2006
Arcjet Tile Overlay & RCC Crack Repair test data analysis report	1	9/30/2006
Aerolab Upgrade per Aerolab Upgrade Plan Document. Added Rev 2	1	9/30/2006
Shuttle Aerosciences Assessment Summary Reports	1/Quarter	9/30/2007, 9/30/2008, 9/30/2009, 9/30/2010, and 7/31/2011(3rd flight option)
Arcjet test planning and data analysis reports	11	12/26/2006, 4/1/2007, 6/1/2007, 4/1/2008, 9/30/2008, 4/1/2009, 9/30/2009, 4/1/2010, 9/30/2010, 4/1/2011, and 7/31/2011(3rd flight option)

e. **Product Verification**

5.1.1 ISS Aeroscience Analysis

i. Reconstruction of plume heating environments during the STS-114 Mission

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Analysis of the plume heating environment to the ISS during the RBAR Pitchover Maneuver

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iii. High fidelity prediction of the HTV Quadruple Main Jet Plume Flow Field

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. RPM3D plume environment prediction tool Users Guide

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

v. Reconstruction of plume heating environments during the FY07 Missions

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vi. RPM3D Tool & Users Guide Update

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vii. Reconstruction of plume heating environments during the FY08 Missions

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

viii. ISS Aerosciences Assessment Summary Reports

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ix. Reconstruction of plume heating environments during the FY09 Missions

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

x. Reconstruction of plume heating environments during the FY10 Missions

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xi. Reconstruction of plume heating environments during the FY11 Missions

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xii. COTS Vehicles Plume Impingement Assessments

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 9

5.1.2 Shuttle Aeroscience Analysis

i. Arcjet test planning and data reduction plans

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Upgrade and maintenance to SWAT

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iii. Analysis of Orbiter entry heating assuming varying wall catalycity

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. Arcjet Tile Overlay & RCC Crack Repair test data analysis report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

v. Aerolab Upgrade per Aerolab Upgrade Plan Document.

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 2

vi. Shuttle Aerosciences Assessment Summary Reports

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vii. Arcjet test planning and data analysis reports

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.2 Guidance, Navigation, and Control Analysis (EG4) Updated Rev 9

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services to the Integrated GN&C Analysis Branch (EG4). The contractor shall provide engineering analysis of Space Shuttle and International Space Station (ISS) integrated GN&C systems to ensure system safety and mission success. The contractor shall develop, implement, and maintain the software analysis tools and math models required to perform this analysis. Updated Rev 9

5.2.1 ISS Dynamics and Control Analysis Updated REV 10
Project Code:

The contractor shall provide technical and engineering services associated with the implementation and verification of the International Space Station (ISS) GN&C systems. The scope of work includes performing Verification Analysis Cycle (VAC) of ISS US Attitude Control System (ACS), both propulsive and non-propulsive, and Russian Segment Motion Control System (MCS), perfomance analyses and ISS time domain simulation development. The contractor shall present the analysis results to the VIPeR team as part of the ISS mission Certification of Flight Readiness (CoFR) process. The contractor shall develop, modify, document, validate, and maintain the ISS GN&C Space Station Multiple Rigid Body Simulator (SSMRBS) analysis tool.

5.2.2 Shuttle Ascent GN&C Analysis Updated REV 10
Project Code:

This task provides ascent/abort GN&C analysis for Shuttle flight to-flight functions including integrated GN&C trajectory analysis, flight rules, and anomaly resolution. Engineering assessment of new and enhanced ascent/abort GN&C capabilities that become a part of the baseline Shuttle capability shall be provided. The unique mission-to-mission analysis necessary for ascent GN&C flight readiness shall be provided. Maintenance of analysis tools including the time-domain based SES-III and the Ascent Flexible Airframe Response (FAR) tool shall be provided. Development of a Consolidated Simulation capability using the A/E SES and SES-II operating in a TRICK environment shall be provided.

5.2.3 Shuttle Entry GN&C Analysis Updated REV 10
Project Code:

This task provides entry/abort GN&C analysis for Shuttle flight to-flight functions including integrated GN&C trajectory analysis, flight rules, and anomaly resolution. Engineering assessment of new and enhanced entry/abort GN&C capabilities that become a part of the baseline Shuttle capability shall be provided. The unique mission-to-mission analysis necessary for entry GN&C flight readinessshall be provided. Maintenance of analysis tools which includes the batch, Monte Carlo, and real-time capabilities of the SES program and the Entry Flexible Airframe Response (FAR) tool shall be provided. Development of a Consolidated Simulation capability using the A/E SES and SES-II

operating in a TRICK environment shall be provided.

5.2.4 Ascent/Entry Trainer (AET) Upgrades Updated Rev 9
Project Code:

This task provides for the maintenance of the Ascent/Entry Trainer (AET) in support of NASA/DT. The AET shall be upgraded to remain current with the latest version of the Space Shuttle Flight Software (FSW) Operational Increment (OI) release as specified by the Shuttle Avionics Software Control Board (SASCB). Maintenance of the AET shall include resolution of issues defined by the user community, upgrades to simulation software and databases, and delivery of mission specific initialization data.

b. Applicable Documents

Document Number	Document Name	Rev.
	Spacecraft Engineering Simulator II Coding Standards	3.1
	Spacecraft Engineering Simulator II Formulation Manual	1.0
	Spacecraft Engineering Simulator II Programmers Manual	1.0
	Spacecraft Engineering Simulator II Users Manual	1.0
AET-04	Ascent/Entry Trainer (AET) Description Document	Original
EG-WI-00177	Integrated Guidance, Navigation, and Control IGN&C Work Instructions	C
EG-WI-00181	Flight Control Design and Analysis Process	C
GN&C-00-013	Ascent/Entry Shuttle Engineering Simulator Users Guide	2.0
JSC-28702N	Space Station Multi-Rigid Body Simulation (SSMRBS) Vb3.6 User's Guide (UG)	N
JSC-29033C	Space Station Multi-Rigid Body Simulation (SSMRBS) Developer's Guide	C
JSC-29133	Space Station Multi-Rigid Body Simulation (SSMRBS) Configuration Management Plan	Current

c. Required DRDs

5.2.1 ISS Dynamics and Control Analysis

DRD #	DRD Title	Quantity/Frequency
215 Updated Rev 8	Software Code	10
218 Updated Rev 1	Engineering Analysis	2/per VAC

5.2.2 Shuttle Ascent GN&C Analysis

DRD #	DRD Title	Quantity/Frequency
215 Updated Rev 8	Software Code	12
218 Updated Rev 8	Engineering Analysis	26/Quarterly

5.2.3 Shuttle Entry GN&C Analysis

DRD #	DRD Title	Quantity/Frequency
215 Updated Rev 8	Software Code	13
218 Updated Rev 8	Engineering Analysis	26/Quarterly

5.2.4 Ascent/Entry Trainer (AET) Upgrades

DRD #	DRD Title	Quantity/Frequency
215 Updated Rev 8	Software Code	8

d. Products

5.2.1 ISS Dynamics and Control Analysis

Product(s)	Quantity	Delivery Date
SSMRBS Version Baseline Software Releases Updated REV 10	7	November 2005, November 2006, September 2007, September 2008, September 2009, September 2010 & September 2011
SDFast Mass Properties and Environmental Assumptions Updated REV 10	7	Prepare and publish on a bi-annual basis. February 2006, September 2006, February 2007, September 2007 and February 2008, September 2008 and September 2011
Verification Analysis Cycle Assessment Reports Updated REV 10	2 - FY06, 4-FY07, 4-FY08, 4-FY09, 4-FY10, 2-FY11 (3 with option)	9/30/2006 (FY06), 9/30/2007 (FY07), 9/30/2008 (FY08), 9/30/2009 (FY09), 9/30/2010 (FY10) & 9/30/2011 (FY11)
Re-host SSMRBS to MAC OS10 & Lunix OS Updated REV 10	2	9/30/2008
Re-host SSMRBS version 4.0 to Lunix OS Updated REV 10	1	2/1/2009
Re-host SSMRBS (latest version) to Lunix OS Updated REV 10	1	9/30/2010
COTS Vehicles Proximity Operations Analysis Summary Report Updated REV 10	1	9/30/2011

5.2.2 Shuttle Ascent GN&C Analysis

Product(s)	Quantity	Delivery Date
Mission-specific ascent GN&C engineering studies per Shuttle Avionics Software Control Board (SASCB) with Summary of results Updated REV 10	1/Quarter	9/30/2006 (FY06), 9/30/2007 (FY07), 9/30/2008 (FY08), 9/30/2009 (FY09), 9/30/2010 (FY10) & 7/31/2011(3rd flight option)
Ascent/abort GN&C analyses per Ascent GN&C Panel with Summary of results Updated REV 10	1/Quarter	9/30/2006 (FY06), 9/30/2007 (FY07), 9/30/2008 (FY08), 9/30/2009 (FY09), 9/30/2010 (FY10) & 7/31/2011(3rd flight option)
Interim delivery of the SES-III Consolidated Simulation with verified ascent math models Updated REV 10	1	9/30/2005
Final ascent delivery of the fully verified SES-III Consolidated Simulation Updated REV 10	1	2/28/2006
Delivery of the Operational Increment (OI)-32 version of SES-III with ascent FSW upgrades Updated REV 10	1	9/30/2006
SES-III Simulation Upgrades Updated REV 10	9	4/1/2007, 9/30/2007, 11/30/2007, 9/30/2008, 3/31/2009, 9/30/2009, 3/31/2010, 9/30/2010, 3/31/2011, and 7/31/2011(3rd flight option)
SES-III Simulation Archive	1	7/31/2011(3rd flight option)

5.2.3 Shuttle Entry GN&C Analysis

Product(s)	Quantity	Delivery Date
Mission-specific entry GN&C engineering studies per Shuttle Avionics Software Control Board (SASCB) with Summary of results Updated REV 10	1/Quarter	99/30/2006 (FY06), 9/30/2007 (FY07), 9/30/2008 (FY08), 9/30/2009 (FY09), 9/30/2010 (FY10) & 7/31/2011(3rd flight option)
Entry GN&C engineering studies per Entry GN&C Panel with Summary of results Updated REV 10	1/Quarter	9/30/2006 (FY06), 9/30/2007 (FY07), 9/30/2008 (FY08), 9/30/2009 (FY09), 9/30/2010 (FY10) & 7/31/2011(3rd flight option)
NASA Ames VMS on-site landing/rollout engineering analyses sessions Updated REV 10	2 Ames Sessions/ year	2/1/2006 , 10/1/2006, 4/1/2007 , 9/1/2007, 4/1/2008 , 9/1/2008, 5/1/2009, 9/30/2009, 1/11/2010, 9/30/2010, 4/1/2011
Interim delivery of the SES-III Consolidated Simulation with verified entry math models Updated REV 10	1	9/30/2005
Final entry delivery of the fully verified SES-III Consolidated Simulation Updated REV 10	1	2/28/2006
Delivery of the Operational Increment (OI)-32 version of SES-III with entry FSW upgrades Updated REV 10	1	9/30/2006
Ascent/Entry SES Simulation Upgrades Updated REV 10	9	4/1/2007, 9/30/2007, 4/1/2008, 9/30/2008, 12/31/2008, 3/31/2009, 9/30/2009, 3/31/2010, 9/30/2010, 7/31/2011(3rd flight option)
Ascent/Entry SES Simulation Archive	1	7/31/2011(3rd flight option)

5.2.4 Ascent/Entry Trainer (AET) Upgrades

Product(s)	Quantity	Delivery Date

Install AET simulation software updates with AET Description Documents Updated REV 10	9 versions	4/1/2006, 9/30/2006, 5/30/2008, 9/30/2008, 10/31/2008, 1/31/2009, 4/30/2009, 1/31/2010, 9/30/2010
Install mission-specific I-load set, initial conditions files per SASCB Updated REV 10	5 sets & 4 sets (FY08), 4 sets (FY09), 4 sets (FY10) & 2 sets (FY11, 3 with option)	9/30/2006, 9/30/2008, 9/30/2009, 9/30/2010, 7/31/2011(3rd flight option)
AET simulation Archive	1	7/31/2011(3rd flight option)

e. **Product Verification**

5.2.1 ISS Dynamics and Control Analysis

i. SSMRBS Version Baseline Software Releases

- Regression testing on validation suite as specified in SSMRBS Developer's Guide

ii. SDFast Mass Properties and Environmental Assumptions

- Verified against Configuration Analysis, Modeling and Mass Properties (CAMMP) Revision.

iii. Verification Analysis Cycle Assessment Reports

- Peer Review by ISS GN&C Community including NASA EG TM

iv. Re-host SSMRBS to MAC OS10 & Lunix OS

- Regression testing on validation suite as specified in SSMRBS Developer's Guide

v. Re-host SSMRBS version 4.0 to Lunix OS

- Regression testing on validation suite as specified in SSMRBS Developer's Guide

vi. Re-host SSMRBS (latest version) to Lunix OS

- Regression testing on validation suite as specified in SSMRBS Developer's Guide

vii. COTS Vehicles Proximity Operations Analysis Summary Report

- Deliverable shall be reviewed for technical content by the NASA TM. When the Deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.2.2 Shuttle Ascent GN&C Analysis

i. Mission-specific ascent GN&C engineering studies per Shuttle Avionics Software Control Board (SASCB) with Summary of results

- Deliverables shall be reviewed for technical content by the NASA TM. When the Deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Ascent/abort GN&C analyses per Ascent GN&C Panel with Summary of results

- Deliverables shall be reviewed for technical content by the Ascent GN&C Panel . When the Deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iii. Interim delivery of the SES-III Consolidated Simulation with verified ascent math models

- Verification will be accomplished via regression testing against the A/E SES and SES-II simulations.

iv. Final ascent delivery of the fully verified SES-III Consolidated Simulation

- Verification will be accomplished via regression testing against the A/E SES and SES-II simulations.

v. Delivery of the Operational Increment (OI)-32 version of SES-III with ascent FSW upgrades

- Verification of individual Change Requests (CRs) will be accomplished via regression testing against the hand-coded analysis version of the CR. Final verification of the integrated OI-32 release will be accomplished via regression testing of the previous release of the simulation.

vi. SES-III Simulation Upgrades

- Verification will be accomplished via regression testing and comparison against the A/E SES

vii. SES-III Simulation Archive

- Verification will be accomplished via validation with original source codes

5.2.3 Shuttle Entry GN&C Analysis

i. Mission-specific entry GN&C engineering studies per Shuttle Avionics Software Control Board (SASCB) with Summary of results

- Deliverables shall be reviewed for technical content by the NASA TM. When the Deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Entry GN&C engineering studies per Entry GN&C Panel with Summary of results

- Deliverables shall be reviewed for technical content by the Entry GN&C Panel . When the Deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iii. NASA Ames VMS on-site landing/rollout engineering analyses sessions

- Verification will be accomplished via regression testing against NASA GN&C community simulations.

iv. Interim delivery of the SES-III Consolidated Simulation with verified entry math models

- Verification will be accomplished via regression testing against the A/E SES and SES-II simulations.

v. Final entry delivery of the fully verified SES-III Consolidated Simulation

- Verification will be accomplished via regression testing against the A/E SES and SES-II simulations.

vi. Delivery of the Operational Increment (OI)-32 version of SES-III with entry FSW upgrades

- Verification of individual Change Requests (CRs) will be accomplished via regression testing against the hand-coded analysis version of the CR. Final verification of the integrated OI-32 release will be accomplished via regression testing of the previous release of the simulation.

vii. Ascent/Entry SES Simulation Upgrades

- Verification will be accomplished via regression testing and comparison against the SES-III

viii. Ascent/Entry SES Simulation Archive

- Verification will be accomplished via validation with original source codes

5.2.4 Ascent/Entry Trainer (AET) Upgrades

i. Install AET simulation software updates with AET Description Documents

- Code verification will be accomplished via regression testing against the A/E SES simulation. Displays will be verified via comparison with displays in the A/E SES Forward Cockpit.

ii. Install mission-specific I-load set, initial conditions files per SASCB

- Verification will be accomplished via regression testing against the A/E SES simulation.

iii. AET simulation Archive

- Verification will be accomplished via validation with original source codes

5.3 Flight Mechanics & Trajectory Design Analysis (EG5)

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform detailed trade studies for the Flight Mechanics and Trajectory Design Branch in the areas of ascent, on-orbit, de-orbit, aerocapture and entry trajectory design and analysis. Specific areas of study include: Crew Exploration Vehicle (CEV)ascent/entry studies and Mars/Earth aerocapture trades.

5.3.1 CEV Ascent/Entry Abort Analysis Updated Rev 3
Project Code:

********** Note: This task is being moved to DO147 effective with Revision 3 (FY07). **********

.Perform ascent/entry abort analysis for candidate Crew Exploration Vehicle (CEV) configurations. Analysis shall include performing trajectory simulations to assess vehicle flight performance under various mission scenarios. CEV performance assessments for Abort to Orbit and Abort Once Around capability will also be evaluated. Vehicle trades shall include abort loads, thermal environments, thrust/weight, and orbit inclination. The vehicles loads shall be compared to the medical limit allowable and include dispersions. Stability of entry vehicles during ascent aborts and atmospheric re-entry shall also be provided

5.3.2 Mars/Earth Aerocapture Analysis Updated Rev 4
Project Code:

********** Note: This task is completed and closed effective Revision 4. **********

Perform trade studies to determine the inflatable aeroshell technology development requirements, and evaluate commonality among applications. The objective of this task is to determine the feasibility of inflatable aeroshells for multiple applications and demonstrate inflatable aeroshell concepts that can be used to deliver higher mass at lower cost, launch volume, and launch weight. Key issues shall be investigated, such as packaging, inflation, aerodynamic and aero-thermodynamic characteristics, and interaction between aeroshell and payload systems.
Provide engineering assessments for cis-lunar trajectory trades including simulation algorithm development.

b. **Applicable Documents**

Document Number	Document Name	Rev.
N/A	No Requirement	

c. **Required DRDs**

5.3.1 CEV Ascent/Entry Abort Analysis

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	4/Quarterly

5.3.2 Mars/Earth Aerocapture Analysis

DRD #	DRD Title	Quantity/Frequency
218 Updated Rev 3	Engineering Analysis	7/Quarterly

d. **Products**

5.3.1 CEV Ascent/Entry Abort Analysis

Product(s)	Quantity	Delivery Date
CEV Abort Analysis	1/Quarter	12/31/05, 3/31/06, 6/30/06, & 9/30/06

5.3.2 Mars/Earth Aerocapture Analysis

Product(s)	Quantity	Delivery Date
Mars/Earth Aerocapture Analysis	1/Quarter	12/31/05, 3/31/06, 6/30/06, & 9/30/06
cis-lunar Trajectory Performance Assessment Summary Reports Added Rev 3	1/Quarter	12/31/06, 3/31/07 & 6/30/07

e. **Product Verification**

5.3.1 CEV Ascent/Entry Abort Analysis

i. CEV Abort Analysis

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.3.2 Mars/Earth Aerocapture Analysis

i. Mars/Earth Aerocapture Analysis

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. cis-lunar Trajectory Performance Assessment Summary Reports

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 3

5.4 GN&C Autonomous Flight Systems Analysis (EG6)

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide analysis and engineering services to the GN&C Autonomous Flight Systems Office.

5.4.1 Engineering Trajectory Analysis Task for Rendezvous, Prox Ops, and Docking Updated Rev 9
Project Code:

********** Note: This task is completed and closed effective Revsion 3. **********

The contractor shall provide engineering assessment and trajectory analysis for the rendezvous and proximity operations community which includes the Rendezvous Prox Ops Working Group (RPOWG). This subtask will include analysis of sensor performance, trajectory dispersions, and other GN&C issues related to Shuttle rendezvous, proximity operations, and docking. Specifically, this work will include an assessment of rendezvous radar flight data to better characterize radar beam wander on the large ISS target. A new radar model including beam wonder will be implemented and Orbiter onboard navigation and targeting performance will be analyzed.

5.4.2 Interactive Control Development Simulation (ICDS) Updated Rev 9
Project Code:

ICDS shall be maintained, enhanced, and verified to perform the necessary GN&C analyses for Orbiter approach and docking studies. Simulation and analyses shall be performed to solve potential GN&C problems associated with the approach and docking of vehicles with the Shuttle. Utility software shall be developed and maintained, and systems management shall be performed. This ST shall also include ICDS configuration management and procurement of hardware / software for lab upgrade.

Guidance, Navigation and Control (GN&C) models shall be developed, verified, and integrated into ICDS. ICDS shall be delivered to the Space Flight Training Division's (DT) Desktop Systems Trainer (DST) for the rendezvous training of flight crews, flight controller, and training personnel. User documentation of ICDS GN&C models shall be developed.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	ICDS Verification Plan	
	ICDS Version Release Notes	

c. **Required DRDs**

5.4.1 Engineering Trajectory Analysis Task for Rendezvous, Prox Ops, and Docking

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	1

5.4.2 Interactive Control Development Simulation (ICDS)

DRD #	DRD Title	Quantity/Frequency
215 Updated Rev 9	Software Code	11/Release on a bi-annual basis. October 2005, September 2006, October 2006, September 2007, April 2008, September 2008, April 2009, September 2009, April 2010 & January 2010, July 2011 (3rd flight option)

d. **Products**

5.4.1 Engineering Trajectory Analysis Task for Rendezvous, Prox Ops, and Docking

Product(s)	Quantity	Delivery Date
RPOWG Assessment Summary	2	12/31/05 & 3/31/06
Radar Beam Wander Model	1	4/7/06

5.4.2 Interactive Control Development Simulation (ICDS)

Product(s)	Quantity	Delivery Date
ICDS Version Software Releases	10	Release on a bi-annual basis. October 2005, September 2006, October 2006, September 2007, April 2008, September 2008, April 2009, September 2009, April 2010, September 2010, July 2011 (3rd flight option)
ICDS Vision Nav System DTO Risk Mitigation Software Release	1	6/30/09

e. **Product Verification**

5.4.1 Engineering Trajectory Analysis Task for Rendezvous, Prox Ops, and Docking

i. RPOWG Assessment Summary

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Radar Beam Wander Model

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.4.2 Interactive Control Development Simulation (ICDS)

i. ICDS Version Software Releases

- Regression testing on validation suite as specified in ICDS Verification Plan

ii. ICDS Vision Nav System DTO Risk Mitigation Software Release

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.5 ISS RPO Visiting Vehicles Added Rev 4

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide analysis and engineering services of ISS Rendezvous Proximity (RPO) Visiting Vehicles.

Added Rev 4

5.5.1 ISS Rendezvous Proximity (RPO) Visiting Vehicles Updated Rev 8
Project Code:

The contractor shall provide analysis and engineering assessments for ISS Rendezvous Proximity (RPO) Visiting Vehicles. This work will include:
-Providing engineering assessments and trajectory analysis for the rendezvous and proximity operations.
- Analyzing sensor performance, trajectory dispersions, and other GN&C rendezvous, proximity operations, and docking issues.
- Providing simulation-based design, development, and analysis of functional performance and capability required in order to support key programmatic decisions.
- Performing trade studies and performance assessments.

b. **Applicable Documents**

Document Number	Document Name	Rev.
SSP 30459 Added Rev 4	International Space Station Interface Control Plan	
SSP 41000 Added Rev 4	System Specification for the International Space Station	

c. **Required DRDs**

5.5.1 ISS Rendezvous Proximity (RPO) Visiting Vehicles

DRD #	DRD Title	Quantity/Frequency
218 Updated Rev 8	Engineering Analysis	18/Quarterly

d. **Products**

5.5.1 ISS Rendezvous Proximity (RPO) Visiting Vehicles

Product(s)	Quantity	Delivery Date
ISS RPO Visiting Vehicle Assessment Summary Report	4-FY08, 4-FY09 & 4-FY10	9/30/08, 9/30/09, 9/30/10
Orbital Sciences CDR Assessment (RID Package) Added Rev 6	1	10/30/09
SpaceX PQR (Assessment Package) Added Rev 6	1	12/31/09
Orbital Sciences Engineering/Training Simulation (V&V Release) Added Rev 7	1	1/31/10
Orbital Sciences CDR Assessment (RID Closeout Package) Added Rev 7	1	12/31/09
Orbital Sciences Engineering/Training Simulation Added Rev 7	1	6/30/10
CYgnus PQR (Assessment Package) Added Rev 7	1	9/30/10
Cygnus Crew Training Simulation Added Rev 8	1	11/30/10
SpaceX/Orbital Safety Review Panel Phase III Data Packages Added Rev 8	2	3/31/11
SpaceX/Orbital PQR (Assessment Packages) Added Rev 8	2	6/30/11
SpaceX/Orbital Demo Readiness Review Data Packages Added Rev 8	2	9/30/11

e. **Product Verification**

5.5.1 ISS Rendezvous Proximity (RPO) Visiting Vehicles

i. ISS RPO Visiting Vehicle Assessment Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Orbital Sciences CDR Assessment (RID Package)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

iii. SpaceX PQR (Assessment Package)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

iv. Orbital Sciences Engineering/Training Simulation (V&V Release)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 7

v. Orbital Sciences CDR Assessment (RID Closeout Package)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 7

vi. Orbital Sciences Engineering/Training Simulation

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 7

vii. CYgnus PQR (Assessment Package)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 7

viii. Cygnus Crew Training Simulation

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 8

ix. SpaceX/Orbital Safety Review Panel Phase III Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 8

x. SpaceX/Orbital PQR (Assessment Packages)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 8

xi. SpaceX/Orbital Demo Readiness Review Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 8

6.0 Cost Summary and Revision History

SLC	Type	CY1	CY2	CY3	CY4	CY5	CY6	CY7	G Total
AS1	Sum of Hours								
	Sum of Dollars								
AS2	Sum of Hours								
	Sum of Dollars								
AS3	Sum of Hours								
	Sum of Dollars								
EN1	Sum of Hours								
	Sum of Dollars								
EN2	Sum of Hours								
	Sum of Dollars								
EN3	Sum of Hours								
	Sum of Dollars								
EN4	Sum of Hours								
	Sum of Dollars								
ESS	Sum of Hours								
	Sum of Dollars								
IT2	Sum of Hours								
	Sum of Dollars								
IT3	Sum of Hours								
	Sum of Dollars								
MGR	Sum of Hours								
	Sum of Dollars								
SQ2	Sum of Hours								
	Sum of Dollars								
Total Direct Labor Hours									
Total Direct Labor Costs									
Travel Costs									
Subcontract									
NLR Misc									
Materials									
Burden on Non-Labor									
Total Non Labor									
Total Costs									
Fee									
Total									$16,222,146.63

64

DO097 revision history	Total cost	Reason for revision
Original	4,377,291	Original
Rev. 1	3,574,279	1) De-scope 5.1 & 5.4 to remove products that are no longer required. 2) De-scope 5.2.2 and 5.2.3 to cover 2 mission specific studies. (Note: original Proposal assumed 5 mission specific studies)
Rev. 2	4,056,055	1) Add a requirement to 5.1 for an Aerolab Upgrade per the Aerolab Upgrade Plan Document. 2) Incorporate an administrative change to switch costs shown in materials to the subcontract cost element to properly reflect the actual costing element.
Rev. 3	6,583,499	1) Add scope and extend period of performance thru FY07. 2) CEV Ascent/Entry Abort Analysis task (5.3.1) moved to DO147 effective with Revision 3. 3) Engineering Trajectory Analysis Task for Rendezvous, Prox Ops, and Docking task (5.4.1) was completed and closed effective Revision 3.
Rev. 4	8,897,841	1) Add scope and extend period of performance thru FY08. 2) Added new WBS 5.5 for ISS RPO Visiting Vehicles.
Rev. 5	11,258,016	1) Add scope and extend period of performance thru FY09. 2) Adjust FY08/FY09 resource phasing due to Shuttle flight schedule changes.
Rev. 6	11,672,762	1) Add product to WBS 5.4.2 for ICDS Vision Nav System DTO Risk Mitigation Software Release 2) Add products to WBS 5.5.1 for Orbital Sciences CDR Assessment (RID Package) and SpaceX PQR (Assessment Package) 3) Extend period of performance thru 1/31/10.
Rev. 7	14,318,428	1) Add products to WBS 5.1, 5.2, 5.4 and 5.5. 2) Extend period of performance thru 9/30/2010.
Rev 8 (2-Flight BOE)	15,711,868	1) Add products to WBS 5.1, 5.2, 5.4 and 5.5. 2) Extend period of performance thru 9/30/2011. 3) Include option for 3rd Shuttle flight products and services if approved.
Rev. 9 (3-Flight BOE)	16,172,154	1) Add product to WBS 5.1 for COTS vehicles plume impingement assessments 2) Include option for 3rd Shuttle flight products and services thru 7/31/11.
Rev 10	16,222,147	1) Add product to WBS 5.2.1 - ISS Dynamics and Control Analysis for COTS Vehicles Proximity Operations Analysis Summary Report.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ06HS76D DO 144 R7	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/ Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 04/01/06 – 01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: See Block #1

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: 07/19/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**EC5 Space Suit Systems Branch-Crew Escape and Life Support Equipment and Portable Breathing Apparatus/Prebreathe Hose Ass.**					
DO	**144 R7**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

64 64

The contractor's proposal for this order is incorporated herein by reference. However the orders requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$7,035,328.55

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ06HS76D-DO144 REV 7

Originator: Brian Daniel (EC5) (281) 483-0268 **TMR:** Marie Kowal (EC) (281) 483-8875

Revision Summary:

The following changes are associated with Revision 7:

WBS 5.1 - Revision 7 increases scope of sustaining engineering services provided per WBS 5.1.1 for additional unanticipated anomaly resolutions, additional sustaining engineering services associated with the next generation Quick Don Mask Assembly (QDMA), and also additional review of existing government Safety documentation for the Portable Breathing Apparatus and Pre-breathe Hose Assembly hardware.

WBS 5.2 - Revision 7 increases scope of sustaining engineering services, including Shuttle Transition and Retirement requirements, additional sustaining engineering services for advanced crew escape systems, and additional sustaining engineering services for Ambient Pressure Integrated Systems Testing (APIST).

1. Title of Effort: EC5 Space Suit Systems Branch-Crew Escape and Life Support Equipment and Portable Breathing Apparatus/Prebreathe Hose Assembly

2. Date of Request: 06/02/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 6

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 04/01/2006 and ends 01/31/2013.

5. Product Requirements

5.1 Portable Breathing Apparatus (PBA)/Prebreathe Hose Assembly (PHA) Sustaining Engineering and Spares Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform sustaining engineering services including: project engineering, test, documentation, and maintenance necessary to conduct pre-flight and post flight operations for the PBA and PHA programs as defined in PBA/PHA requirements documents JSC 27058, "End Item Specification for the International Space Station Prebreathe Hose Assembly", and JSC 39226B, "Technical Requirements Plan for the Prebreathe Hose Assembly". For Revision 6, contractor shall review and provide assessment of existing government Safety documentation for the Portable Breathing Apparatus and Pre-breathe Hose Assembly hardware. The documentation will remain within JSC configuration management control. Updated Rev 6

5.1.1 Portable Breathing Apparatus (PBA)/Prebreathe Hose Assembly (PHA) Sustaining Engineering and Spares Updated Rev 5

Project Code:

The contractor shall perform project engineering, test, and documentation maintenance necessary to conduct pre-flight and post flight operations for the PBA and PHA projects as defined in PBA/PHA Requirements documents JSC 27058, "End Item Specification for the International Space Station Prebreathe Hose Assembly", and JSC 39226B, "Technical Requirements Plan for the Prebreathe Hose Assembly".

b. **Applicable Documents**

Document Number	Document Name	Rev.
JSC 47739 Added Rev 5	Pre Delivery/Pre Installation Acceptance Test for the Pre-Breathe Hose Assembly	A
JSC 27058	End Item Specification for the International Space Station Portable Breathing Apparatus	Basic
JSC 29219 Added Rev 5	Pre-Breathe Hose Assembly Safety Analysis Report	Basic
JSC 29220 Added Rev 5	Pre-Breathe Hose Assembly Failure Modes and Effects Analysis/Critical Items List	Basic
JSC 32262 Added Rev 5	Portable Breathing Apparatus Failure Modes and Effects Analysis/Critical Items List	C
JSC 32263	Certification/Acceptance Plan for the International Space Station Emergency Portable Breathing Apparatus	A
JSC 32664 Added Rev 5	Portable Breathing Apparatus Safety Analysis Report	A
JSC 38492 Added Rev 5	Pre Delivery/Pre Installation Acceptance Test for the Portable Breathing Apparatus	D
JSC 39226	Project Technical Requirements Plan for the Prebreathe Hose Assembly	B
JSC 40139	Certification/Acceptance Plan for the International Space Station Pre-Breathe Hose Assy	Basic
JSC 47168 Added Rev 5	Risk Assessment Executive Summary Report for the Portable Breathing Apparatus	Preliminary
JSC 47169 Added Rev 5	Risk Assessment Executive Summary Report for the Pre-Breathe Hose Assembly	Prliminary

c. **Required DRDs**

5.1.1 Portable Breathing Apparatus (PBA)/Prebreathe Hose Assembly (PHA) Sustaining Engineering and Spares

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
218 Added Rev 6	Engineering Analysis	1

d. **Products**

5.1.1 Portable Breathing Apparatus (PBA)/Prebreathe Hose Assembly (PHA) Sustaining Engineering and Spares

Product(s)	Quantity	Delivery Date
Assemble, test, and certify (PSMO Class I) a Class III pressurized PBA from Government Furnished Equipment Deleted Rev 1	1 Class III PBA	06/30/2006
Process(PIA) ISS PBA reducer/cylinder assemblies for flight service	12 flight	04/30/2009
Process(PIA) ISS Quick Don Mask Assemblies for flight (SEG33105020)	25 flight	04/30/2009
Assy/Process(PIA) PHA Extension Hose T-Kit Assy	2 flight	04/30/2009
Provide 50 QDMA harness replacements for Quick Don Masks with replacement and PIA	50 flight	09/30/2007
Review and Provide Comments/Incorporate NASA redlines to Safety Documentation for Portable Breathing Apparatus	1 Revised Document	05/31/2010
Review and Provide Comments/Incorporate NASA redlines to Safety Documentation for Pre-Breathe Hose Assembly	1 Revised Document	05/31/2010

e. **Product Verification**

5.1.1 Portable Breathing Apparatus (PBA)/Prebreathe Hose Assembly (PHA) Sustaining Engineering and Spares
i. Assemble, test, and certify (PSMO Class I) a Class III pressurized PBA from Government Furnished Equipment Deleted Rev 1
- Approval by the EC5 branch review of deliverable Deleted Rev 1
ii. Process(PIA) ISS PBA reducer/cylinder assemblies for flight service
- Approval by the EC5 branch review of deliverable
iii. Process(PIA) ISS Quick Don Mask Assemblies for flight (SEG33105020)
- Approval by the EC5 branch review of deliverable
iv. Assy/Process(PIA) PHA Extension Hose T-Kit Assy
- Approval by the EC5 branch review of deliverable
v. Provide 50 QDMA harness replacements for Quick Don Masks with replacement and PIA
- Approval by the EC5 branch review of deliverable
vi. Review and Provide Comments/Incorporate NASA redlines to Safety Documentation for Portable Breathing Apparatus
- Approval by the EC5 branch review of deliverable
vii. Review and Provide Comments/Incorporate NASA redlines to Safety Documentation for Pre-Breathe Hose Assembly
- Approval by the EC5 branch review of deliverable

5.2 Crew Escape and Life Support Equipment (CELSE) Laboratory Updated R5BP1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform sustaining engineering services including: project engineering, test, and documentation necessary to conduct daily operations within the CELSE laboratory in compliance with JSC 47745, "Standard Operating Procedures for the CELSE Laboratory." This includes sustaining engineering of the CELSE flight and Ground Support Equipment and configuration, documentation including Aging Vehicle Assessment Documentation revision requirements and procedure development for new and modified hardware, and failure analysis. Appropriate hardware includes the Personal Parachute Assemblies, SpaceLab Emergency Breathing Systems, Individual Cooling Units, and Thermo-Electric Liquid Cooling Units, Shuttle Crew Escape Communication Upgrade Project, Launch On Need Hardware, Rescue Strobe Light Assy, and AN PRC-112G Survival Radio upgrade Project. Updated R5BP1

5.2.1 Crew Escape and Life Support Equipment (CELSE) Laboratory Updated R5BP1
Project Code:

The contractor shall perform sustaining engineering including: project engineering, test and documentation necessary to conduct daily operations within the CELSE laboratory in compliance with JSC 47745, "Standard Operating Procedures for the CELSE Laboratory." This includes sustaining engineering of the CELSE flight and Ground Support Equipment and configuration, documentation and procedure development for new and modified hardware, and failure analysis. Hardware (flight or non-flight) is not a deliverable of this effort only assembly services for Government Furnished Equipment. Appropriate hardware includes the Personal Parachute Assemblies, Individual Cooling Units, and Thermo-Electric Liquid Cooling Units, Ice based Training Units, Training Multiple User Cooling Units, Bio-Instrumentation Pass-Thru plug assemblies, Spacelab Emergency Breathing System, Shuttle Crew Escape Communication Upgrade Project, Launch On Need Hardware, Lumbar Cushion Assy, and Rescue Strobe Light Assy. The CELSE Laboratory is a government managed laboratory and the contractor shall provide services necessary for on-going shuttle missions and training events.

Revision 5 includes the addition of : (1) Sustaining Engineering / Quality Assurance/Quality Engineering (QA/QE) - effective FY10, through Jan 2013 and (2) additonal sustaining engineering for Thermoelectric Liquid Cooling (TELCU) and Individual Cooling Units (ICU) required for every Shuttle launch.

5.2.2 AN PRC-112G Survival Radio Updated R5BP1
Project Code:

The contractor shall provide engineering for the AN/PRC-112 Survival Radio upgrade project to the AN/PRC-112G which contains Global Positioning Satellite Capability. Products shall consist of and is limited to Project Requirements and Verification Document(PRVD) preparation, Risk Assessment Executive Summary Report Preparation, and Test Procedure preparation. The contactor shall provide 2 each AN/PRC-112G and 2 each QuickDraw2 interrogators for Class III project evaluation purposes. Contractor shall provide 200 each flight AN/PRC-112G High Performance Batteries P/N 1794AS0953C/U per NASA specification SKD33120533, Revision A.

5.2.3 Crew Escape System Market Research and Feasibility Studies for Potential Improvement in Capability Updated R5BP1
Project Code:

The contractor shall provide engineering services for numerous Crew Escape Shuttle feasibility studies and options for Potential Capability Improvements of the overall System as defined below:

A) Unconscious Crewmember GPS Tracking Capability-The Contractor shall provide 4 S1035 Helmet Shells(class III) suitable for conducting protoype feasibility assessments for installation of GPS tranmitting device(NASA provided). The contractor shall document a minimum of 3 proposed packaging options for this study on preliminary engineering drawings

B) Improved Helmet Impact Protection----The Contractor shall provide 1 model S1034E USAF complete (class III) Helmet assemblies and 1 model S1035 helmet assembly(class III) suitable for NASA conducted impact protection evaluation. The contractor shall document a minimum of 3 proposed foam installation options of configuring helmets for impact testing on preliminary engineering drawings. The contractor shall provide a report of possible options and impacts that would be required to interface the USAF model S1034 E helmet to the currently used ACES model S1035 E coverall(suit) assembly.

C) Increased Oxygen Capacity Capability for Crew Escape System--The contractor shall provide engineering for possible options of increased Emergency Oxygen capacity over and above the existing Emergency Oxygen System. The contractor shall document on preliminary engineering drawings a minimum of 3 selected options including preliminary oxygen system volume analysis.

D) Market Survey For Military/Industry Single Person Life Raft Options--- The contractor shall conduct a Market/Industry Research study of potential single person Life Raft replacement possibilities for the currently used Life Raft System. The contractor shall document the results of this Market survey in Matrix Summary form with respect to be identified Metric indicators. The contractor shall support/coordinate testing of selected Life raft options at the Offshore Technology and Research Institute at the Texas A&M facility including Statement of Work and Final report Generation of tested life raft configurations.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
CTSD-SH-1402 (JSC 47743) Added Rev 5	Standard Operating Procedure for the CELSE Test Stand	C
JSC 22130 Added Rev 5	Pre-Delivery Acceptance (PDA) and Pre-Installation Acceptance (PIA) Testing Procedures for Spacelab Emergency Breathing Systems (SEBS).	F
JSC 39161 Added Rev 5	Space Shuttle Individual Cooling Unit Pre-Installation Acceptance Procedure	M
JSC 47724 Added Rev 5	Space Shuttle Thermoelectric Liquid Cooling Unit (TELC) PIA Procedure	H
JSC 47745 Added Rev 6	Standard Operating Procedure for CELSE Laboratory	Current
JSC 62184 Added Rev 5	Risk Assessment Executive Summary Report for the Shuttle CEE Communication System (SCCS)	A
JSC 65038	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Lumbar Cushion Assembly and Pneumatic Cushion Assembly	Baseline
JSC 65044	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Rescue Strobe Light Marker	Baseline
JSC 65060 Added Rev 5	Verification and Validation Document: Shuttle Crew Escape Equipment Communication Upgrade	D
JSC 65138	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE ACES	Baseline
JSC 65139	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE O2 Supply Comm	Baseline
JSC 65140	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Harness/ Personal Parachute Assembly	Baseline
JSC 65141	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Emergency Oxygen System	Baseline
JSC 65142	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Enhanced Life Preserver Unit	Baseline
JSC 65143	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Pole Crew Escape System	Baseline
JSC 65144	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Survival Packs	Baseline
JSC 65145	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE AN/PRC-112	Baseline
JSC 65146	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Space Lab Emergency Breathing System	Baseline
JSC 65147	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Shuttle Quick DON Mask Assembly	Baseline
JSC 65148	Risk Assessment Executive Summary Report for the Government Furnished Equipment	Baseline

	Shuttle CEE Individual Cooling Unit and Thermoelectric Liquid Cooling Unit	
JSC 65149	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Miscellaneous Crew Escape Equipment	Baseline
JSC 65150	Risk Assessment Executive Summary Report for the Government Furnished Equipment Shuttle CEE Launch On Need Hardware	Baseline
SED11100269 Added Rev 5	Specification/Assembly Drawing for the Space Lab Emergency Breathing System	D
SKD33120533 Added Rev 5	Procurement Specification and Component Listing For The Shuttle Crew Escape Equipment (CEE) AN/PRC-112G High-Performance, Non-Rechargeable(Primary), LiMnO2 Battery(P/N 1794AS0953C/U)	C

c. **Required DRDs**

5.2.1 Crew Escape and Life Support Equipment (CELSE) Laboratory

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	1 set
218 Deleted Rev 1	Engineering Analysis	1 set
241 Updated Rev 1	Risk Assessment Executive Summary Report (RAESR)	1/revision

5.2.2 AN PRC-112G Survival Radio

DRD #	DRD Title	Quantity/Frequency
241 Added Rev 1	Risk Assessment Executive Summary Report (RAESR)	1

5.2.3 Crew Escape System Market Research and Feasibility Studies for Potential Improvement in Capability

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 1	Engineering Drawings and Model Files	1 set
218 Added Rev 6	Engineering Analysis	1

d. **Products**

5.2.1 Crew Escape and Life Support Equipment (CELSE) Laboratory

Product(s)	Quantity	Delivery Date
Laboratory Operations/Procedures and Records Review	A/R	01/31/2013
Laboratory Checklist Performance Summary (monthly)	A/R	01/31/2013
Assembly/Test of Portable Breathing Apparatus Assys from Government Furnished Equipment in support of Shuttle CEE LON	6	01/30/2008
Assy/Test of Oxygen-T Assys from Government Furnished Equipment in support of Shuttle CEE LON	3	01/30/2008
Revision of Launch on Need (LON) Engineering Drawings per JSC/EC5 provided Redlines	3	09/30/2006
Overhaul/Assembly Test of Spacelab Emergency Breathing System from Government Furnished Equipment Deleted Rev 1	4	06/30/2006
Revision of Lumbar Cushion Assy(JSC 65038) RAESR to Phase III completion Deleted Rev 1	1	06/30/2006
Revision of Rescue Strobe Light Assy (JSC 65044) RAESR to Phase III completion	1	06/30/2006
Revision of SCCUP RAESR(JSC 62184) to Phase II completion	1	01/30/2007
Revision of SCCUP RAESR to Phase III completion Deleted Rev 1	1	09/30/2006
Revision of SCCUP Engineering Drawings per NASA/EC5 provided redlines	3	06/30/2007
Revision of SCCUP Verification and Validation Matrix (JSC65060) to incorporate Verifcation Testing Deleted Rev 5	1	01/30/2007
Revision of Crew Escape and Life Support Equipment Aging Vehicle Assessment Documentation per NASA/EC5 provided redlines Deleted Rev 5	1	01/30/2007
Revision of SCCUP RAESR to Phase III completion Deleted Rev 5	1	01/30/2007
SCCUP Test Procedure Revision/Generation for Cable Cycle Flex Test	1	09/30/2007
SCCUP Test Procedure Generation for ESTL Testing Deleted Rev 5	1	01/30/2007
SCCUP Test Procedure Revision/Generation for Intelligibility Testing	1	09/30/2007
SCCUP Test Procedure Revision/Generation for Human Factors Testing	1	09/30/2007
SCCUP Test Procedure Revision Generation for Vibration Testing Deleted Rev 5	1	01/30/2007
ACES BIP Pass-Thru (Class I and training)maintenance/overhaul/PIA per JSC 33686	30	09/30/2008

Training Ice Based Cooling Unit Maintenance Overhaul	10	09/30/2008
Training Multiple User Cooling Unit Maintenance/Overhaul	5	09/30/2008
Class I, Individual Cooling Unit PIA per JSC 39161, ?Space Shuttle Individual Cooling Unit Pre-Installation Acceptance Procedure?.	50	04/30/2009
Class I, Thermoelectric Liquid Cooling Unit PIA per JSC 47224, ?Space Shuttle Thermoelectric Liquid Cooling Unit (TELC) PIA Procedure.	20	04/30/2009
Review and Provide Comments of SCCUP Verification and Validation Matrix (JSC65060) to incorporate Verifcation Testing	1	01/30/2007
Review and Provide Comments of Crew Escape and Life Support Equipment Aging Vehicle Assessment Documentation per NASA/EC5 provided redlines	1	01/31/2010
SCCUP Test Procedure Revision/Generation for KSC Interface Test	1	9/30/07
SCCUP Test Procedure Revision Generation for Vibration Testing	1	9/30/07
Revision of SCCUP RAESR to Phase III completion	1	9/30/07

5.2.2 AN PRC-112G Survival Radio

Product(s)	Quantity	Delivery Date
RAESR for AN PRC-112 G Survival Radio	1	01/30/2008
Revision of Project Requirements and Verifcation Document (PRVD)for AN PRC-112G Survival Radio	1	08/30/2007
AN/PRC-112G Survival Radio(Class III) Added Rev 1	2	12/30/2006
QuickDraw2 Interrogator Added Rev 1	2	12/30/2006
AN/PRC-112G High Performance, LiMNO2 Batteries (P/N 1794AS0953C/U)	200	09/30/2008

5.2.3 Crew Escape System Market Research and Feasibility Studies for Potential Improvement in Capability

Product(s)	Quantity	Delivery Date
Advanced Crew Escape Suit Helmet Shells(Class III) Added Rev 1	4	12/30/2006
Preliminary Engineering Drawings for Helmet Installed GPS tracking Prototypes	3	09/30/2007
Advanced Crew Escape Suit Complete Helmet S1035(Class III) Deleted Rev 5	1	9/30/2007
USAF S1034 Complete Helmet Assy. (Class III) Deleted Rev 5	1	9/30/2007
Statement of Work/Report for S1034 E helmet I/F to S1035 Added Rev 1	1	12/30/2006
Preliminary Engineering drawings for protoype of foam installation options for Impact Protection Added Rev 1	3	3/30/2007
1Completed Market Survey for Increased Emergency Oxygen System Capacity Options for Crew Escape System	1	09/30/2007
Industry/Military Research Summary for Single person Life Rafts Added Rev 1	1	12/30/2006
Statement of Work/Report for Testing of selected life Raft options for testing at Texas A&M Offshore Technology Research Institute Wave Tank Facility Added Rev 1	1	5/30/2007

e. **Product Verification**

5.2.1 Crew Escape and Life Support Equipment (CELSE) Laboratory

i. Laboratory Operations/Procedures and Records Review

- Approval by the EC5 branch review of deliverable

ii. Laboratory Checklist Performance Summary (monthly)

- Approval by the EC5 branch review of deliverable

iii. Assembly/Test of Portable Breathing Apparatus Assys from Government Furnished Equipment in support of Shuttle CEE LON

- Approval by the EC5 branch review of deliverable

iv. Assy/Test of Oxygen-T Assys from Government Furnished Equipment in support of Shuttle CEE LON

- Approval by the EC5 branch review of deliverable

v. Revision of Launch on Need (LON) Engineering Drawings per JSC/EC5 provided Redlines

- Approval by the EC5 branch review of deliverable

vi. Overhaul/Assembly Test of Spacelab Emergency Breathing System from Government Furnished Equipment Deleted Rev 1

- Approval by the EC5 branch review of deliverable Deleted Rev 1

vii. Revision of Lumbar Cushion Assy(JSC 65038) RAESR to Phase III completion Deleted Rev 1

- Approval by the EC5 branch review of deliverable Deleted Rev 1

viii. Revision of Rescue Strobe Light Assy (JSC 65044) RAESR to Phase III completion

- Approval by the EC5 branch review of deliverable

ix. Revision of SCCUP RAESR(JSC 62184) to Phase II completion

- Approval by the EC5 branch review of deliverable

x. Revision of SCCUP RAESR to Phase III completion Deleted Rev 1
- Approval by the EC5 branch review of deliverable Deleted Rev 1
xi. Revision of SCCUP Engineering Drawings per NASA/EC5 provided redlines
- Approval by the EC5 branch review of deliverable
xii. Revision of SCCUP Verification and Validation Matrix (JSC65060) to incorporate Verifcation Testing Deleted Rev 5
- Approval by the EC5 branch review of deliverable Deleted Rev 5
xiii. Revision of Crew Escape and Life Support Equipment Aging Vehicle Assessment Documentation per NASA/EC5 provided redlines Deleted Rev 5
- Approval by the EC5 branch review of deliverable Deleted Rev 5
xiv. Revision of SCCUP RAESR to Phase III completion Deleted Rev 5
- Approval by the EC5 branch review of deliverable Deleted Rev 5
xv. SCCUP Test Procedure Revision/Generation for Cable Cycle Flex Test
- Approval by the EC5 branch review of deliverable
xvi. SCCUP Test Procedure Generation for ESTL Testing Deleted Rev 5
- Approval by the EC5 branch review of deliverable Deleted Rev 5
xvii. SCCUP Test Procedure Revision/Generation for Intelligibility Testing
- Approval by the EC5 branch review of deliverable
xviii. SCCUP Test Procedure Revision/Generation for Human Factors Testing
- Approval by the EC5 branch review of deliverable
xix. SCCUP Test Procedure Revision Generation for Vibration Testing Deleted Rev 5
- Approval by the EC5 branch review of deliverable Deleted Rev 5
xx. ACES BIP Pass-Thru (Class I and training)maintenance/overhaul/PIA per JSC 33686
- Approval by the EC5 branch review of deliverable
xxi. Training Ice Based Cooling Unit Maintenance Overhaul
- Approval by the EC5 branch review of deliverable
xxii. Training Multiple User Cooling Unit Maintenance/Overhaul
- Approval by the EC5 branch review of deliverable
xxiii. Class I, Individual Cooling Unit PIA per JSC 39161, ?Space Shuttle Individual Cooling Unit Pre-Installation Acceptance Procedure?.
- Approval by the EC5 branch review of deliverable
xxiv. Class I, Thermoelectric Liquid Cooling Unit PIA per JSC 47224, ?Space Shuttle Thermoelectric Liquid Cooling Unit (TELC) PIA Procedure.
- Approval by the EC5 branch review of deliverable
xxv. Review and Provide Comments of SCCUP Verification and Validation Matrix (JSC65060) to incorporate Verifcation Testing
- Approval by the EC5 branch review of deliverable
xxvi. Review and Provide Comments of Crew Escape and Life Support Equipment Aging Vehicle Assessment Documentation per NASA/EC5 provided redlines
- Approval by the EC5 branch review of deliverable
xxvii. SCCUP Test Procedure Revision/Generation for KSC Interface Test
- Approval by the EC5 branch review of deliverable
xxviii. SCCUP Test Procedure Revision Generation for Vibration Testing
- Approval by the EC5 branch review of deliverable
xxix. Revision of SCCUP RAESR to Phase III completion
- Approval by the EC5 branch review of deliverable

5.2.2 AN PRC-112G Survival Radio

i. RAESR for AN PRC-112 G Survival Radio
- Approval by the EC5 branch review of deliverable
ii. Revision of Project Requirements and Verifcation Document (PRVD)for AN PRC-112G Survival Radio
- Approval by the EC5 branch review of deliverable
iii. AN/PRC-112G Survival Radio(Class III)
- Approval by the EC5 branch review of deliverable Added Rev 1
iv. QuickDraw2 Interrogator
- Approval by the EC5 branch review of deliverable Added Rev 1
v. AN/PRC-112G High Performance, LiMNO2 Batteries (P/N 1794AS0953C/U)
- Approval by the EC5 branch review of deliverable

5.2.3 Crew Escape System Market Research and Feasibility Studies for Potential Improvement in Capability

i. Advanced Crew Escape Suit Helmet Shells(Class III)

- Approval by the EC5 branch review of deliverable Added Rev 1

ii. Preliminary Engineering Drawings for Helmet Installed GPS tracking Prototypes

- Approval by the EC5 branch review of deliverable

iii. Advanced Crew Escape Suit Complete Helmet S1035(Class III) Deleted Rev 5

- Approval by the EC5 branch review of deliverable Deleted Rev 5

iv. USAF S1034 Complete Helmet Assy. (Class III) Deleted Rev 5

- Approval by the EC5 branch review of deliverable Deleted Rev 5

v. Statement of Work/Report for S1034 E helmet I/F to S1035

- Approval by the EC5 branch review of deliverable Added Rev 1

vi. Preliminary Engineering drawings for protoype of foam installation options for Impact Protection

- Approval by the EC5 branch review of deliverable Added Rev 1

vii. 1Completed Market Survey for Increased Emergency Oxygen System Capacity Options for Crew Escape System

- Approval by the EC5 branch review of deliverable

viii. Industry/Military Research Summary for Single person Life Rafts

- Approval by the EC5 branch review of deliverable Added Rev 1

ix. Statement of Work/Report for Testing of selected life Raft options for testing at Texas A&M Offshore Technology Research Institute Wave Tank Facility

- Approval by the EC5 branch review of deliverable Added Rev 1

.0 Cost Summary and Revision History

SLC	Type	CY2	CY3	CY4	CY5	CY6	CY7	CY8	G To
AS2	Sum of Hours								
	Sum of Dollars								
BS1	Sum of Hours								
	Sum of Dollars								
BS2	Sum of Hours								
	Sum of Dollars								
EN1	Sum of Hours								
	Sum of Dollars								
EN2	Sum of Hours								
	Sum of Dollars								
EN3	Sum of Hours								
	Sum of Dollars								
EN4	Sum of Hours								
	Sum of Dollars								
ESS	Sum of Hours								
	Sum of Dollars								
IT1	Sum of Hours								
	Sum of Dollars								
QA1	Sum of Hours								
	Sum of Dollars								
QA2	Sum of Hours								
	Sum of Dollars								
QE2	Sum of Hours								
	Sum of Dollars								
SE	Sum of Hours								
	Sum of Dollars								
SV	Sum of Hours								
	Sum of Dollars								
TN2	Sum of Hours								
	Sum of Dollars								
TN3	Sum of Hours								
	Sum of Dollars								
Total Direct Labor Hours									
Total Direct Labor Costs									
Travel Costs									
Subcontract									
NLR Misc									
Materials									
Burden on Non-Labor									
Total Non Labor									
Total Costs									
Fee									
Total									

64

$7,035,328.5

DO144 Revision History:	Total Cost	Reason For Revision
Original	$632,662	N/A
R1	$1,825,943	Added FY07 Sustaining Engineering requirements to both WBS 5.1 and 5.2 and additional requirements to WBS 5.2 including AN PRC-112G Survival Radio and Crew Escape Equipment Market Research and Feasibility Studies for Potential Improvement Capability.

R2	**$3,012,858**	Addition of FY08 sustaining engineering requirements for WBS 5.1. Added 5 additional PBA cylinder/reducer PIAS, added 16 additional QDMA PIAs. Addition of FY08, FY09, FY010 partial (10/09 thru 01/10) sustaining engineering requirements for WBS 5.2. Added 3 additional CELSE procedure reviews, added monthly checklist summary requirements for FY08, FY09, FY010, added new requirements for MUCU, Ice based, BIP, ICU, TELCU Maintenance overhaul/PIA reqts thru 1/2010. Partial De-scope of products for FY07 product requirements removing S1034 E and S1035 helmet acquisition requirements.
R3	**$3,582,145**	Addition of requirement to provide 200 each Flight High Performance Batteries for AN/PRC-112G Radios P/N 1794AS0953C/U per NASA specification SKD33120533, Revision A.
R4	**$3,661,414**	Addition of FY09 PBA Sustaining Engineering Requirements, WBS 5.1. WBS 5.2, 20 additional BIP assemblies added in lieu 3 SEBS PIAs which was respectively removed.
R5	**$3,905,166**	Addition of additional Sustaining Engineering to WBS 5.1 and WBS 5.2 encompassing Quality Engineering and Quality Assurance requirements for the area in FY09 and FY010(partial). Additionally WBS 5.1 added requirement for update of existing government Safety Documentation for PBA/PHA and for WBS 5.2 additional Sustaining Engineering for Thermoelectric and Individual Cooling units
R6	**$5,639,337**	WBS 5.1 extends the requirement for update of existing government Safety Documentation for PBA/PHA. Addition of additional Sustaining Engineering to WBS 5.2 through January 2013
R7	**$7,035,329**	Revision 7: extends the service for review of existing PBA/PHA safety documentation for WBS 5.1 and adds sustaining engineering services for the improved comfort Quick Don Mask Assembly proposed for STS-135. Also extends sustaining engineering services for WBS 5.2 through January 2013 including Shuttle Transition and Retirement requirements for FY2012

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ06HD57D DO 146 R7

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Alan C. Jackson
Tel. No.: (281) 792-7522 FAX: (281) 483-7890
E-Mail: alan.c.jackson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Acc ountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 04/26/2006 - 01/31/2013

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Jessica Corley**

Signtature: Jessica Corley Date: 01/25/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**DDMS Development Services**					
DO	**146 R7**					
	Est. Labor Costs	b4			b4	
	Materials/Subcontracts					
	Travel & NLR Misc					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$ 6,491,900

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ06HD57D DO146 R7

Originator: Stephen Lamkin (EA) (281) 483-8264 **TMR:** Stephen Lamkin () (281) 483-8264

Revision Summary:
Extend period of performance through 1/31/2013.

1. Title of Effort: DDMS Development Services

2. Date of Request: 12/07/2009

3. Statement of Work Task Description

a. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 7

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/01/2006 and ends 01/31/2013.

5. Product Requirements

5.1 DDMS

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall In accordance with SOW section 2.2.1, of the contract, shall develop and deliver DDMS architecture system requirements in accordance with existing DDMS templates. Requirements shall include functionality required to implement DDMS. The contractor shall also develop and deliver Engineering Directorate training materials related to the use of DDMS.

5.1.1 Architecture and Design **Project Code:** 0038

The contractor shall develop and deliver system requirements for the DDMS which implements applicable industry standards for Product Lifecycle Management (PLM). The contractor shall utilize DDMS templates as recorded in project 0038, DDMS. All products shall be developed and managed in the DDMS, 0038 project.

5.1.2 Training and Deployment **Project Code:** 0038

The contractor shall develop and deliver training material and plans associated with the deployment of the DDMS to the Engineering Directorate at JSC. The training material shall include classroom and web based training capabilities. The contractor shall provide a deployment strategy for training 500 people within 12 months that encompass all engineering projects defined as GFE/GSE in the directorate. All material shall be developed and managed in DDMS, project 0038.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-027	Configuration Management	Current

c. **Required DRDs**

5.1.1 Architecture and Design

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per quarter
105	Regular Status Report/Summary Review	1 per quarter

5.1.2 Training and Deployment

DRD #	DRD Title	Quantity/Frequency
101 Updated Rev 1	Project Schedule	1/Monthly

d. **Products**

5.1.1 Architecture and Design

Product(s)	Quantity	Delivery Date
Architecture and requirements documents set	1	12/1/2006

5.1.2 Training and Deployment

Product(s)	Quantity	Delivery Date
Classroom training material set	1	12/1/2006
Web based training material set Updated Rev 1	1	09/30/2007
Deployment strategy set	1	10/19/2006

e. **Product Verification**

5.1.1 Architecture and Design

i. Architecture and requirements documents set

- Acceptance by the NASA DDMS control board and the NASA TMR or designated representative.

5.1.2 Training and Deployment

i. Classroom training material set

- Acceptance by the NASA DDMS control board and the NASA TMR or designated representative.

ii. Web based training material set Updated Rev 1

- Acceptance by the NASA DDMS control board and the NASA TMR or designated representative. Updated Rev 1

iii. Deployment strategy set

- Acceptance by the NASA DDMS control board and the NASA TMR or designated representative.

5.2 DDMS Expansion Added Rev 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall expand the functionality of the DDMS by adding the following capabilities:
1. Mechanical Computer-Aided Design (MCAD) Configuration Management;
2. Evaluation and deployment of the FAST Enterprise Search Engine;
3. DDMS Improvement Management;
4. ESCG Project Link Prototype;
5. Migration of the Engineering Drawing Release System (EDRS) to DDMS.

The ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053) shall contain product deliverables and schedules for the contractor to meet. This document shall be maintained by the contractor and approved by the EA2 CCB. Added Rev 2

5.2.1 Mechanical Computer-Aided Design (MCAD) Configuration Management Added Rev 2 **Project Code:** 00038

The contractor shall provide MCAD configuration through the implementation of PDM Link 8.0 Windchill Aerospace and Defense Module. The contractor shall maximize out-of-the-box capabilities and limit customization of the product. Necessary training shall be provided to NASA and contractor users prior to migration.

The contractor shall develop and deploy the migration of EA and other JSC MCAD management tools to DDMS. Data presently in the existing EA IntraLink system shall be migrated to PDM Link 8.0 initially.

The contractor shall provide the capability to configuration manage the engineering facility drawings within DDMS.

5.2.2 Evaluation and Deployment of the FAST Enterprise Search Engine Added Rev 2 **Project Code:** 00038

The contractor shall evaluate the new FAST Enterprise search engine for integration into DDMS and recommend whether to deploy the capability via a temporary patch, or wait until the M040 operating system release.

5.2.3 DDMS Improvement Management Added Rev 2 **Project Code:** 00038

The contractor shall manage the improvement of the quality and usability of DDMS through a Product Improvement Team. The contractor will be responsible for DDMS User Forums, identifying product areas needing improvement, and facilitating the authoring of change requests and discrepancy reports. Changes implemented shall be verified via contractor user acceptance testing.

The contractor shall evaluate maintenance releases from PTC starting with Release 8.0, Version M030. These releases shall be integrated into the DDMS codebase and verified for compatibility with DDMS customizations via contractor led user acceptance testing.

Necessary training shall be provided to NASA and contractor users of DDMS.

5.2.4 ESCG Project Link Prototype Added Rev 2 **Project Code:** 00038

The contractor shall develop a concept and requirements specification to add Project Link capability to DDMS. This capability shall be evaluated by the contractor and reported to the NASA DDMS Project Manager.

5.2.5 Migration of the Engineering Drawing Release System (EDRS) to DDMS Added Rev 2 **Project Code:** 00038

The contractor shall provide a concept on how to move the Engineering Drawing Release System (EDRS) into DDMS, and maintain the capability to trace drawings back to the exact Computer-Aided Design (CAD) revision that produced the drawing. The concept shall describe how all reviews, whether drawing-based or model-based, will be performed in an integrated manner through DDMS.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 2	No Requirement	

0001000070 Added Rev 2	DDMS MS Project File Snapshot	Current

c. **Required DRDs**

5.2.1 Mechanical Computer-Aided Design (MCAD) Configuration Management

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 2	Project Schedule	1 Quarterly on the 3rd Thursday of Feb, May, Aug, Nov
105 Added Rev 2	Regular Status Report/Summary Review	1 Quarterly on the 3rd Thursday of Feb, May, Aug, Nov

5.2.2 Evaluation and Deployment of the FAST Enterprise Search Engine

DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

5.2.3 DDMS Improvement Management

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 2	Project Schedule	1 Quarterly on the 3rd Thursday of Feb, May, Aug, Nov
105 Added Rev 2	Regular Status Report/Summary Review	1 Quarterly on the 3rd Thursday of Feb, May, Aug, Nov

5.2.4 ESCG Project Link Prototype

DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

5.2.5 Migration of the Engineering Drawing Release System (EDRS) to DDMS

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 2	Project Schedule	1 Quarterly on the 3rd Thursday of Feb, May, Aug, Nov
105 Added Rev 2	Regular Status Report/Summary Review	1 Quarterly on the 3rd Thursday of Feb, May, Aug, Nov

d. **Products**

5.2.1 Mechanical Computer-Aided Design (MCAD) Configuration Management

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053) Added Rev 2	1	Per Schedule

5.2.2 Evaluation and Deployment of the FAST Enterprise Search Engine

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053) Added Rev 2	1	Per Schedule

5.2.3 DDMS Improvement Management

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053) Added Rev 2	1	Per Schedule

5.2.4 ESCG Project Link Prototype

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053) Added Rev 2	1	Per Schedule

5.2.5 Migration of the Engineering Drawing Release System (EDRS) to DDMS

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053) Added Rev 2	1	Per Schedule

e. **Product Verification**

5.2.1 Mechanical Computer-Aided Design (MCAD) Configuration Management

i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053)

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Added Rev 2

5.2.2 Evaluation and Deployment of the FAST Enterprise Search Engine

i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053)

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Added Rev 2

5.2.3 DDMS Improvement Management

i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053)

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Added Rev 2

5.2.4 ESCG Project Link Prototype

i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053)

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Added Rev 2

5.2.5 Migration of the Engineering Drawing Release System (EDRS) to DDMS

i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053)

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Added Rev 2

5.3 Continued DDMS Expansion Updated Rev 5

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall expand the functionality of the DDMS by examining the following capabilities:

1. Continued development for migration of the Engineering Drawing Release System (EDRS) to DDMS;
2. Management of EA project information within DDMS;
3. Propose a strategy for migrating VWAR to an electronic approval system;
4. Continued MCAD system migration;
5. ECAD Architecture Strategy using DDMS/EDSS;
6. Update current DDMS using same platform as PDM Link 8.0;
7. Training and Deployment Services;
8. Performance Tuning
9. COTR Worklist Assessment

The "Detail Requirements Document - Design and Data Management System Development" (DDMS document #0001003447), approved by the JSC DDMS Project Manager, shall provide product descriptions and schedules for the contractor to meet. Updated Rev 5

5.3.1 Continued Development of Products for Migration of EDRS to DDMS Updated Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.2 Engineering Project Website Development Updated Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.3 Virtual Work Authorization Review (VWAR) System Replacement Strategy Updated Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.4 Continuation of Mechanical CAD System Migration Updated Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.5 Electrical CAD Architecture Strategy Updated Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.6 DDMS Website Enhancements Deleted Rev 6

5.3.7 Training and Deployment Updated Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.8 Performance Tuning Updated Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.9 COTR Worklist Assessment Updated Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.10 Product Improvement Team, DDMS User Forum, & PTC Board of Customer Advisors Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.11 Mechanical CAD Support Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.3.12 Project Management Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

b. **Applicable Documents**

Document Number	Document Name	Rev.

Added Rev 4	EDRS Migration Concept	Current
DDMS #0001003447 Added REV 7	Detail Requirements Document - Design and Data Management System Development	Current

c. **Required DRDs**

5.3.1 Continued Development of Products for Migration of EDRS to DDMS

DRD #	DRD Title	Quantity/Frequency
Added Rev 4	No Requirement	

5.3.2 Engineering Project Website Development

DRD #	DRD Title	Quantity/Frequency
Added Rev 4	No Requirement	

5.3.3 Virtual Work Authorization Review (VWAR) System Replacement Strategy

DRD #	DRD Title	Quantity/Frequency
Added Rev 4	No Requirement	

5.3.4 Continuation of Mechanical CAD System Migration

DRD #	DRD Title	Quantity/Frequency
Added Rev 4	No Requirement	

5.3.5 Electrical CAD Architecture Strategy

DRD #	DRD Title	Quantity/Frequency
Added Rev 4	No Requirement	

5.3.6 DDMS Website Enhancements Deleted Rev 6

DRD #	DRD Title	Quantity/Frequency

5.3.7 Training and Deployment

DRD #	DRD Title	Quantity/Frequency
Added Rev 4	No Requirement	

5.3.8 Performance Tuning

DRD #	DRD Title	Quantity/Frequency
Added Rev 5	No Requirement	

5.3.9 COTR Worklist Assessment

DRD #	DRD Title	Quantity/Frequency
Added Rev	No Requirement	

5		

5.3.10 Product Improvement Team, DDMS User Forum, & PTC Board of Customer Advisors

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.3.11 Mechanical CAD Support

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.3.12 Project Management

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

d. **Products**

5.3.1 Continued Development of Products for Migration of EDRS to DDMS

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6	1	Per Schedule
Per Detailed Requirements Document - Design and Data Management system Development (DDMS #0001003447)	1	Per Schedule

5.3.2 Engineering Project Website Development

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6	1	Per Schedule
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)	1	Per Schedule

5.3.3 Virtual Work Authorization Review (VWAR) System Replacement Strategy

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6	1	Per Schedule
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)	1	Per Schedule

5.3.4 Continuation of Mechanical CAD System Migration

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6	1	Per Schedule
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)	1	Per Schedule

5.3.5 Electrical CAD Architecture Strategy

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6	1	Per Schedule

Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)	1	Per Schedule

5.3.6 DDMS Website Enhancements Deleted Rev 6

Product(s)	Quantity	Delivery Date

5.3.7 Training and Deployment

Product(s)	Quantity	Delivery Date
Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6	1	Per Schedule
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447) Added Rev 5	1	Per Schedule

5.3.8 Performance Tuning

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447) Added Rev 5	1	Per Schedule

5.3.9 COTR Worklist Assessment

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447) Added Rev 5	1	Per Schedule

5.3.10 Product Improvement Team, DDMS User Forum, & PTC Board of Customer Advisors

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447) Added Rev 6	1	Per Schedule

5.3.11 Mechanical CAD Support

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447) Added Rev 6	1	Per Schedule

5.3.12 Project Management

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447) Added Rev 6	1	Per Schedule

e. **Product Verification**

5.3.1 Continued Development of Products for Migration of EDRS to DDMS

i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Updated Rev 6

ii. Per Detailed Requirements Document - Design and Data Management system Development (DDMS #0001003447)

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative

5.3.2 Engineering Project Website Development

i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Updated Rev 6
ii. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative

5.3.3 Virtual Work Authorization Review (VWAR) System Replacement Strategy
i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Updated Rev 6
ii. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative

5.3.4 Continuation of Mechanical CAD System Migration
i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Updated Rev 6
ii. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative

5.3.5 Electrical CAD Architecture Strategy
i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Updated Rev 6
ii. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative

5.3.6 DDMS Website Enhancements Deleted Rev 6

5.3.7 Training and Deployment
i. Per ESCG Project Control Plan (ESCG-8000-11-06-EA2-DOC-0053 Updated Rev 6
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative. Updated Rev 6
ii. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative Added Rev 5

5.3.8 Performance Tuning
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative Added Rev 5

5.3.9 COTR Worklist Assessment
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative Added Rev 5

5.3.10 Product Improvement Team, DDMS User Forum, & PTC Board of Customer Advisors
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)
- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative Added Rev 6

5.3.11 Mechanical CAD Support

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative Added Rev 6

5.3.12 Project Management

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

- NASA Acceptance by DDMS Project Manager and NASA TMR or designated representative Added Rev 6

5.4 Pro/Engineer Training Coordination Services Deleted Rev 5

5.5 Digital Design to Manufacturing and Other Enhancements to DDMS Updated REV 7

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall expand the functionality of the DDMS by perfoming the tasks and delivering the associated products listed in the following sections. The "Detailed Requirements Document - Design and Data Management System Development" (DDMS document #0001003447) approved by the JSC DDMS Project Manager, provides specific product names and schedules for the tasks & products listed. Updated REV 7

5.5.1 MCAD Model Archiving Plan Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.2 DDMS Archive Plan Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.3 Draft Digital Rights Management Plan Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.4 Digital Design to Manufacturing Concept review & Systems Requirements Review Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.5 Performance Tuning Plan Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.6 VWAR Analysis Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.7 EDRS Training Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.8 Updated Training for PDM Link 9.1 Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.9 Web-Based Content for Self-Led Training Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.10 Master Deployment Plan (EDRS & 9.1) Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.11 EDRS/EDCC/9.1 Migration Validation Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.12 MCAD Upgrade Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.13 Strategic PLM Roadmap for Engineering Directorate Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.14 Integrated EA/IA Project Management Plan Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.15 Integrated ECAD Solution Concept Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

5.5.16 DDMS Security, Availability, and Robustness Architecture Added Rev 6 **Project Code:** 00038

See Detailed Requirements Document - Design and Data Management System Development (DDMS #0001003447)

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 6	Project Management of GFE Flight Projects	Rev D 02-04
DDMS #0001003447 Added REV 7	Detailed Requirements Document - Design and Data Management Systems Development	Current
EA-WI-027 Added Rev 6	Configuration Management	Current

c. **Required DRDs**

5.5.1 MCAD Model Archiving Plan

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.2 DDMS Archive Plan

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.3 Draft Digital Rights Management Plan

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.4 Digital Design to Manufacturing Concept review & Systems Requirements Review

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.5 Performance Tuning Plan

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.6 VWAR Analysis

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.7 EDRS Training

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.8 Updated Training for PDM Link 9.1

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.9 Web-Based Content for Self-Led Training

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.10 Master Deployment Plan (EDRS & 9.1)

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.11 EDRS/EDCC/9.1 Migration Validation

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.12 MCAD Upgrade

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.13 Strategic PLM Roadmap for Engineering Directorate

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.14 Integrated EA/IA Project Management Plan

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.15 Integrated ECAD Solution Concept

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.5.16 DDMS Security, Availability, and Robustness Architecture

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

d. **Products**

5.5.1 MCAD Model Archiving Plan

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.2 DDMS Archive Plan

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.3 Draft Digital Rights Management Plan

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.4 Digital Design to Manufacturing Concept review & Systems Requirements Review

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.5 Performance Tuning Plan

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.6 VWAR Analysis

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.7 EDRS Training

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.8 Updated Training for PDM Link 9.1

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.9 Web-Based Content for Self-Led Training

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.10 Master Deployment Plan (EDRS & 9.1)

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.11 EDRS/EDCC/9.1 Migration Validation

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.12 MCAD Upgrade

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Added Rev 6	1	Per Schedule

5.5.13 Strategic PLM Roadmap for Engineering Directorate

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.14 Integrated EA/IA Project Management Plan

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.15 Integrated ECAD Solution Concept

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Updated REV 7	1	Per Schedule

5.5.16 DDMS Security, Availability, and Robustness Architecture

Product(s)	Quantity	Delivery Date
Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447) Added Rev 6	1	Per Schedule

e. **Product Verification**

5.5.1 MCAD Model Archiving Plan

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)

- NASA Acceptance by EA IT FAM or Designated Representative

5.5.2 DDMS Archive Plan

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)

- NASA Acceptance by DDMS PM or Designated Representative

5.5.3 Draft Digital Rights Management Plan

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)

- NASA Acceptance by DDMS PM or Designated Representative

5.5.4 Digital Design to Manufacturing Concept review & Systems Requirements Review

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)

- Review by EA using pre-approved RID Process, and NASA Acceptance by EA2 Management

5.5.5 Performance Tuning Plan

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)

- NASA Acceptance by DDMS PM or Designated Representative

5.5.6 VWAR Analysis

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)

- NASA Acceptance by DDMS PM or Designated Representative

5.5.7 EDRS Training

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)

- NASA Acceptance by DDMS PM or Designated Representative

5.5.8 Updated Training for PDM Link 9.1

i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by DDMS PM or Designated Representative

5.5.9 Web-Based Content for Self-Led Training
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by DDMS PM or Designated Representative

5.5.10 Master Deployment Plan (EDRS & 9.1)
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by DDMS PM or Designated Representative

5.5.11 EDRS/EDCC/9.1 Migration Validation
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by DDMS PM or Designated Representative

5.5.12 MCAD Upgrade
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by EA IT FAM and DDMS PM or Designated Representative Added Rev 6

5.5.13 Strategic PLM Roadmap for Engineering Directorate
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by DDMS PM or Designated Representative

5.5.14 Integrated EA/IA Project Management Plan
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by DDMS PM or Designated Representative

5.5.15 Integrated ECAD Solution Concept
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by DDMS PM or Designated Representative

5.5.16 DDMS Security, Availability, and Robustness Architecture
i. Per Detailed Requirements Document - Design and Data Management System Development (DDMS # 0001003447)
- NASA Acceptance by EA IT FAM and DDMS PM or Designated Representative Added Rev 6

6.0 Cost Summary & Revision History

DO 146 R7 Summary									
SLC		CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS1									
	Sum of Hrs								
	Sum of Dollars								
AS2									

b4

	Sum of Hrs
	Sum of Dollars
BS1	
	Sum of Hrs
	Sum of Dollars
BS2	
	Sum of Hrs
	Sum of Dollars
EN3	
	Sum of Hrs
	Sum of Dollars
IT2	
	Sum of Hrs
	Sum of Dollars
IT4	
	Sum of Hrs
	Sum of Dollars
TN1	
	Sum of Hrs
	Sum of Dollars
TN3	
	Sum of Hrs
	Sum of Dollars
EN1	
	Sum of Hrs
	Sum of Dollars
EN2	
	Sum of Hrs
	Sum of Dollars
IT1	
	Sum of Hrs
	Sum of Dollars
IT3	
	Sum of Hrs
	Sum of Dollars
ET2	
	Sum of Hrs
	Sum of Dollars
PC3	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	

6,491,900

Revision History:

Rev No.	Date	Summary
REV 7	01/25/2010	Extend period of performance through 1/31/2013.
REV 7	11/18/2009	Extend tasks through 1/31/2013 and better define FY2010 products.
R1R2R3R4R5R6	01/09/2009	Missing RFP sections need to be re-inserted.
R5BP1	11/17/2008	Define work efforts and products for FY 2009.
R1R2R3R4R5	08/07/2008	RFP needs to be updated.
R4BP1	02/25/2008	Inclusion (under paragraph 5.3) of Product view and Pro/E training and the requirement to employ the use of SATERN system for training signup. To call out DDMS #0001003447 as an applicable document as the requirements document. The addition of a new product requirement (PRO/Engineer Training Coordination Services - new paragraph 5.4)
R1R2R3R4	09/19/2007	Extend period of performance through October 2007 and move product deliveries to reflect NASA-requested date changes.
R1R2R3	06/13/2007	**No change to RFP. Revision created in order to submit an Unsolicited Proposal. When approved this would be Rev 3 to DO146.**
R1R2	12/06/2006	Define DDMS requirements for FY07.
R1	09/08/2006	Extend Period of Performance into FY07 and change delivery dates of products due to other factors delaying delivery.
Original		

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ06HA94D DO 147 R15	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard.nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 02/24/2006 – 9/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: **10/03/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Exploration Systems Aerosciences and GN&C Analysis**					
DO	**147 R15**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

b4

b4

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$24,047,837.61

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ06HA94D-DO147 REV 15

Originator: Tuyen Hua (EG) (281) 483-8296 **TMR:** Tuyen Hua (EG) (281) 483-8296

Revision Summary:

The purpose of Revision 15 is:
1) Delete requirement on WBS 5.1.4 Entry, Descent, and Landing (EDL) Project for ARC UPWT Post-Test CFD Cases.
2) Delete requirement on WBS 5.2.1 CEV On-Orbit GN&C Systems Analysis for non-OFT-1 related products.
3) Delete requirement on WBS 5.2.2 CEV Ascent/Entry GN&C Systems Analysis for non-OFT-1 related products.
4) Delete requirement on WBS 5.2.5 CEV Project Engineering Services for non-OFT-1 related products.
5) Delete requirement on WBS 5.3.1 Core Trajectory Simulation (CTS) ANTARES Reuse for development of automated testing procedures and associated scripting language used to automate COMPASS final verification and testing.

Note: Effective this revision and at the end of the period of performance 9/30/2011.

1. Title of Effort: Exploration Systems Aerosciences and GN&C Analysis

2. Date of Request: 09/16/2011

3. Statement of Work Task Description

a. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

b. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

c. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 13

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/06/2006 and ends 09/30/2011.

5. Product Requirements

5.1 CEV Applied Aeroscience & CFD Analysis

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering products in aerodynamics analysis; aerothermodynamics analysis; Computational Fluid Dynamics (CFD) modeling and analysis; radiation modeling and analysis; and project management engineering services. Tasks include development of analysis methods, tool development, and application of these methods and tools.

5.1.1 CAP Engineering Services Updated REV 15
Project Code:

The contractor shall track budget, schedule, and Earned Value Metrics (EVM) for the EG division's Crew Exploration Vehicle (CEV) Aerosciences Project (CAP). Proficiency in Microsoft Project, Excel, Word, and Powerpoint is required. The contractor shall be the interface between the CAP and the Government Equipment Office (GEM) office. In addition, the contractor shall setup and coordinate CAP meetings in accordance with the Integrated CAP Master Schedule.

The contractor shall assume the role of CAP Project Integrator and Coordinator including:
- Maintaining risks by implementing Continuous Risk Management process and ensuring that all CAP risks and mitigation plans are current in the IRMA tool.
- Participating in the CEV Project Control Board (CPCB) monthly risk board.
- Monitoring the critcal path and tracking progress and making real-time adjustments and coordinating multiple dependencies between centers.
- Coordinating with other centers in the development and planning of technical cost and schedule monthly and quarterly CEV project reviews.
- Providing 3-month and a 12-month lookahead schedules on a monthly basis.
- Participating in the Program Planning and Budget Execution excercise (PPBE), & Prorgram Manager's Review (PMR).
- Tracking projects according to plan using Earned Value Management metrics.

Contractor shall provide project management and engineering services to the CEV Flight Dynamics (FD) Mode Teams, including integration and coordination of CEV FD Mode Team tasks and products. This task will require gathering and correlating data, handling and disposition of controlled documentation, and coordinating with the CEV FD Functional Area Lead (FAL) to clarify action requests and communicate action responses.

(Note: Mode Team Project Services activites moved to 5.2.5 effective Revision 3)

(Note: EVM metrics tracking deleted effective Revision 14)

5.1.2 Aerosciences Project Database and Databook
Project Code:

The Contractor shall develop data tables, program interface (API), and documentation for the CEV spacecraft aerosciences database encompassing all nominal and abort configurations. The database will cover subsonic, supersonic, hypersonic and free molecular flow regimes. The database will be developed using inputs from CFD analysis, wind tunnel test data, and other ground based testing. The CEV aerosciences API will be written to provide force and moment coefficients to various spacecraft flight simulation tools through simple subroutine or function calls and be designed for easy integration into the simulations. The database will also include

convective heating rates, radiative heating rates, and radiation equilibrium surface temperatures. Documentation products include a CEV Aerodynamics and Aerothermodynamics Design Data book, API implementation and usage information, and a Database substantiation report. Product delivery dates will be tied to CEV program milestones (SRR, PDR, CDR).

5.1.3 Aeroscience Analysis
Project Code:

The contractor shall provide aerodynamic and aerothermodynamic assessments of candidate Crew Launch Vehicle (CLV) and CEV configurations for the flight corridors provided. This will include analysis of Wind tunnel (WT) test results for the candidate configurations. Analysis will also be required to support database population. In addition, CFD cases are required in the analysis of transition from laminar to turbulent flow.

5.1.4 Entry, Descent, and Landing (EDL) Project Updated REV 15
Project Code:

The contractor shall provide validation of the Navier-Stokes Computational Fluid Dynamics (CFD) codes for Supersonic Retro-Propulsion (SRP) flowfield predictions using available wind tunnel data from past wind tunnel test programs as well as EDL Project tests. The main task will be to compare existing CFD codes (DPLR, FUN3D, OVERFLOW, and US3D) against wind tunnel data sets (surface pressure, flowfield structure, and force and moment) for a range of jet configurations, thrust coefficients, Mach numbers, and angles-of-attack. These CFD codes will eventually be used for full-scale Mars configurations, and confidence in their ability to predict aerodynamic/propulsive interactions must be established via validation exercises.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EG-CAP-07-33 Added Rev 5	54-AA CAP Launch Abort System (LAS-605-068) Trim-Alpha and Nozzle Skirt Study Pre-Test Report	Orig
EG-CAP-07-83 Added Rev 8	Pre-Test Report for the 58-AA CAP ALAS Configuration Force, Moment, and Acoustics Study	Orig
EG-WI-00015	Advanced Studies Process for EG3/Applied Aerosciences and CFD Branch Work Instruction	D
EG-WI-00353	Aeroscience Process for Supporting Flight Design	C

c. **Required DRDs**

5.1.1 CAP Engineering Services		Quantity/Frequency
DRD #	DRD Title	
101 Updated Rev 13	Project Schedule	72/Monthly
105 Updated Rev 13	Regular Status Report/Summary Review	72/Monthly

5.1.2 Aerosciences Project Database and Databook		Quantity/Frequency
DRD #	DRD Title	
215 Updated Rev 13	Software Code	13

5.1.3 Aeroscience Analysis		Quantity/Frequency
DRD #	DRD Title	
218 Updated Rev	Engineering Analysis	24

13	

5.1.4 Entry, Descent, and Landing (EDL) Project

DRD #	DRD Title	Quantity/Frequency
218 Added Rev 13	Engineering Analysis	3

d. **Products**

5.1.1 CAP Engineering Services

Product(s)	Quantity	Delivery Date
Integrated Master Schedule for CAP tasks	1/Month	9/30/11
EVM metric rollup Deleted Rev 14	1/Month	9/30/11
CAP Project Management Plan (PMP) & WBS Document	1/Quarter	Initial delivery 3/1/2006 and quarterly thereafter
CAP Meeting setup and minutes	1/week	9/30/11
Mode Team Windchill website Organizational Structure	1/week	Preliminary version 3/31/06
Consolidated FD Mode Team Design Technical Documents	2	Constellation Program Review (ICPR) due on 3/31/06 and SRR due on 8/31/06
Flight Dynamics Mode Team Schedule	1/week	Initial draft 4/15/06, updated weekly
Flight Dynamics Integration Panel Meeting Agendas & Minutes	1/week	Agenda by Tuesday COB and minutes by Monday COB
Project Action Item List	1/week	Initial action list due 4/7/06, updated weekly
3/12-Month Look Ahead Schedule	1/Month	9/30/11
CAP Risk and Mitigation Plan	1/Month	9/30/11

5.1.2 Aerosciences Project Database and Databook

Product(s)	Quantity	Delivery Date
Phase 1- Aerosciences Data Tables Updated REV 15	11	4/1/06 - SRR Release ; 9/30/06 - PDR Release; 11/1/06 Version 0.2; 5/1/07 Version 0.3, 1/5/08 Version 0.4, 6/30/08 Version 0.5, 10/31/08 Version 0.52, 9/30/09 Version 0.54, 1/31/10 Version 0.6, 12/31/10 Version 0.65, 8/1/11 Version 0.7
Aerodynamics Design Data Book Draft Updated REV 15	11	4/1/06 - SRR Release ; 9/30/06 - PDR Release; 11/1/06 Version 0.2; 5/1/07 Version 0.3, 1/5/08 Version 0.4, 6/30/08 Version 0.5, 10/31/08 Version 0.52, 9/30/09 Version 0.54, 1/31/10 Version 0.6, 912/31/10 Version 0.65, 8/1/11 Version 0.7
Preliminary API Code Design Updated REV 15	1	4/1/2006 - SRR Release
Substantiation Report Draft Updated REV 15	11	4/1/06 - SRR Release ; 9/30/06 - PDR Release; 11/1/06 Version 0.2; 5/1/07 Version 0.3, 1/5/08 Version 0.4, 6/30/08 Version 0.5, 10/31/08 Version 0.52, 9/30/09 Version 0.54, 1/31/10 Version 0.6, 12/31/10 Version 0.65, 8/1/11 Version 0.7
Preliminary API Code Documentation Updated REV 15	1	9/30/2006
Aerothermodynamics Design Data Book Draft	2	4/1/2006 - SRR Release ; 9/30/2006 - PDR Release
API Code Release , Documentation & Test Case Report	9	12/1/2006 Version 0.2; 6/1/2007 Version 0.3, 1/5/2008 Version 0.4, 6/30/2008 Version 0.5, 10/31/2008 Version 0.52, 9/30/2009 Version 0.54, 1/31/2010 Version 0.6, , 12/31/10 Version 0.65, 8/1/11 Version 0.7
CEV Aerodynamics Data Archive	5	9/30/07, 9/30/08, 9/30/09, 9/30/10, 9/30/11

5.1.3 Aeroscience Analysis

Product(s)	Quantity	Delivery Date
Aeroscience Analysis Summary Report Updated REV 15	22	6/1/06 , 9/30/06, 12/31/06, 3/31/07, 6/30/07, 9/30/07, 12/31/07, 3/31/08, 6/30/08, 9/30/08, 12/31/08, 3/31/09, 6/30/09, 9/30/09, 12/31/09, 3/31/10, 6/30/10, 9/30/10,12/31/10, 3/31/11, 6/30/11, 9/30/11
1-Set of Transonic Aerodynamic Force & Moment Coefficient Data (per EG-CAP-07-33) Added Rev 5	1	5/1/2007
1-Set of Subsonic/Transonic Aerodynamic Force & Moment Coefficient Data and Acoustics Data (per EG-CAP-07-83) Added Rev 8	1	9/30/2007

5.1.4 Entry, Descent, and Landing (EDL) Project

Product(s)	Quantity	Delivery Date
Phase 2 Historical CFD Data Summary Report Added Rev 13	1	10/31/10
LaRC UPWT Post-Test CFD Cases Added Rev 13	1	12/31/10
Phase 2 CFD Codes Assessment Report Added Rev 13	1	3/31/11
LaRC UPWT Pre-Test CFD and Model Design Summary Report Added Rev 13	1	4/30/11
ARC UPWT Pre-Test CFD Cases Added Rev 13	1	6/30/11
ARC UPWT Post-Test CFD Cases Deleted REV 15	1	9/30/11

e. **Product Verification**

5.1.1 CAP Engineering Services

i. Integrated Master Schedule for CAP tasks

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. EVM metric rollup Deleted Rev 14

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Deleted Rev 14

iii. CAP Project Management Plan (PMP) & WBS Document

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. CAP Meeting setup and minutes

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

v. Mode Team Windchill website Organizational Structure

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vi. Consolidated FD Mode Team Design Technical Documents

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vii. Flight Dynamics Mode Team Schedule

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

viii. Flight Dynamics Integration Panel Meeting Agendas & Minutes

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ix. Project Action Item List

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

x. 3/12-Month Look Ahead Schedule

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xi. CAP Risk and Mitigation Plan

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.1.2 Aerosciences Project Database and Databook

i. Phase 1- Aerosciences Data Tables

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate

ii. Aerodynamics Design Data Book Draft

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate

iii. Preliminary API Code Design

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate

iv. Substantiation Report Draft

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate

v. Preliminary API Code Documentation

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate

vi. Aerothermodynamics Design Data Book Draft

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vii. API Code Release , Documentation & Test Case Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

viii. CEV Aerodynamics Data Archive

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.1.3 Aeroscience Analysis

i. Aeroscience Analysis Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate

ii. 1-Set of Transonic Aerodynamic Force & Moment Coefficient Data (per EG-CAP-07-33)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 5

iii. 1-Set of Subsonic/Transonic Aerodynamic Force & Moment Coefficient Data and Acoustics Data (per EG-CAP-07-83)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 8

5.1.4 Entry, Descent, and Landing (EDL) Project

i. Phase 2 Historical CFD Data Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 13

ii. LaRC UPWT Post-Test CFD Cases

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 13

iii. Phase 2 CFD Codes Assessment Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 13

iv. LaRC UPWT Pre-Test CFD and Model Design Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 13

v. ARC UPWT Pre-Test CFD Cases

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 13

vi. ARC UPWT Post-Test CFD Cases Deleted REV 15

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Deleted REV 15

5.2 Constellation GN&C Analysis and Simulation Tool Development Updated Rev 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering analysis, simulation development, and documentation services to the NASA/EG CEV Project Office.

The contractor shall provide analysis of GN&C systems functional performance. Simulation tools shall be developed including the development and verification of software based GN&C prototype flight software (FSW) and environmental math models. Integration of these math models and prototype FSW into the Architecture for Exploration Studies (ARES) simulation platform shall be provided. Updated Rev 1

5.2.1 CEV On-Orbit GN&C Systems Analysis Updated Rev 14
Project Code:

The contactor shall provide simulation-based analysis of the functional performance of On-Orbit GN&C systems, and shall analyze the GN&C capability required prior to full-scale development of Constellation system elements. The services shall include:

- The design, development, and analysis of GN&C systems, methodologies, and

algorithms.
- Execution of trade studies and performance assessments required to support the definition of the CEV GN&C system.
- Provide technical documentation of GN&C analysis, requirements definition, and project planning.
- Morpheus simulation modeling and analysis
- Rapid Protoyping Lab (RPL) displays development

5.2.2 CEV Ascent/Entry GN&C Systems Analysis Updated Rev 3
Project Code:

The contactor shall provide simulation-based analysis of the functional performance of Ascent/Entry GN&C systems, and shall analyze the GN&C capability required prior to full-scale development of Constellation system elements. The contactor shall provide the development and verification of software-based environmental math models and prototype GN&C FSW. This software shall be integrated into the ARES simulation platform for the purposes of assessing GN&C designs, performing trade studies, and assessing integrated vehicle performance. The contractor shall leverage off heritage EG simulation capabilities to accomplish these tasks. Crew interaction with GN&C systems shall be provided via the integration and verification of prototype FSW displays. ARES simulation software configuration management shall be provided using the IBM ClearCase/ClearDDTS configuration management tool.

5.2.3 CEV Operator in the Loop GN&C Analysis and Tool Development Updated Rev 2
Project Code:

The contractor shall provide analysis of Operator-in-the-Loop interaction with simulated software and subsystem elements of CEV. Simulation tools shall be developed and integrated, including Operator displays and controls interfaces, graphics, and vehicle subsystem models that may impact Operator flight procedures. Developed tools shall be validated and integrated into the ARES simulation.

- Operator-in-the-Loop Performance Analysis
The contactor shall provide simulation-based analysis of the functional performance of the CEV cockpit prototype, and shall evaluate proposed cockpit designs. The services shall include:
- Evaluation of cockpit display layouts, including those from crew or human factors groups
- Evaluation of operator interaction with GN&C and Autonomous elements of the CEV
- Evaluation of candidate GN&C displays based on the Rendezvous and Proximity Operations Program (RPOP)

- Desktop Cockpit Simulation Development
The contactor shall provide the development and verification of a desktop CEV cockpit simulation. Development efforts shall provide for compatibility for interfacing with the Re-configurable Orbiter Cockpit(ROC).
Services shall include:
- Implementation of CEV Displays and Controls into ARES
- Integration of out-the-window and other graphics views
- Implementation of support services, such as fault insertion and logging of Operator inputs for replay

5.2.4 CLV Ascent Abort and Separation Analyses Added Rev 1
Project Code:

The contractor shall provide Crew Launch Vehicle (CLV) ascent tools development and analyses applicable to the abort and separation flight regimes. Events impacting that the EG CEV mode teams shall be considered. Specific tasks will include:

- Analyses including deterministic & Monte Carlo runs to analyze separation and abort mode performance, risks, and boundaries.

- Separation model development including separation aerodynamics, actuators (e.g., springs and jets), critical OML hard points for near field clearance analysis

- Attend AFSIG and technical panel meetings to keep the Ascent and Abort GN&C Panels updated on current abort and separation analysis work.

5.2.5 CEV Project Engineering Services Added Rev 3
Project Code:

The Contractor shall provide project management and engineering services to the CEV Flight Dynamics (FD) Mode Teams, including integration and coordination of CEV FD Mode Team tasks and products. This task shall require gathering and correlating data, handling and disposition of controlled documentation, and coordinating with the CEV FD Functional Area Lead (FAL) to clarify action requests and communicate action responses.

5.2.6 CEV Flight Mechanics Analysis Updated Rev 4
Project Code:

Perform ascent/entry abort analysis for candidate Crew Exploration Vehicle (CEV) configurations. Analysis shall include performing trajectory simulations to assess vehicle flight performance under various mission scenarios. CEV performance assessments for Abort to Orbit and Abort Once Around capability shall also be evaluated. Vehicle trades shall include abort loads, thermal environments, thrust/weight, and orbit inclination. The vehicles loads shall be compared to the medical limit allowable and include dispersions. Stability of entry vehicles during ascent aborts and atmospheric re-entry shall also be provided.

The contractor shall perform detailed trajectory control for the Flight Mechanics and Trajectory Design Branch by the investigation of new and old atmospheric entry guidance schemes from low Earth orbits and Lunar returns. For low Earth orbits, the contractor shall evaluate direct entry schemes, and for the Lunar Returns shall investigate both direct entries and skip entries. The contractor shall evaluate the feasability of the scheme, and schemes which appear attractive will be implemented into computer code for evaluation.

5.2.7 Orion Modeling, Simulation, Development and Integration Updated Rev 9
Project Code:

The contractor shall provide engineering services in development and management of Orion Modeling and Simulation (M&S) products and processes. Activities include: 1) requirements development, design, implementation, and testing of Orion M&S software, 2) Verification,

Validation(V&V), and Accreditation of Orion M&S products, 3) delivery of M&S data architecture products that comply with the NASA Exploration Information Ontology Model (NExIOM), 4) development of a distributed simulation capability to support multi-center and multi-contractor integrated analysis, 5) development of cockpit emulation software and human interface devices, including displays and controls interfaces, integration with graphics software, integration with input devices and other computer hardware, and 6) development of M&S process documentation including the Modeling and Simulation Support Plan (MSSP).

5.2.8 HAST Buildup Updated Rev 14
Project Code:

The objective of the task is to provide engineering services directed at buildup of a real-time simulation system for the Autonomous Landing Hazard Avoidance Technology (ALHAT) Project under the Exploration Technology Development Program (ETDP). The Hardware-in-the-loop ALHAT System Testbed (HAST) will include a real-time software and hardware architecture to perform hardware-in-the-loop testing of ALHAT systems.

Contractor shall perform the following:

1. Development and implementation of software requirement for the Test Interface Computer (TIC).
2. Design and develop software for the Test Interface Computer (TIC) using VxWork RTOS.
3. Integration services as part of the HAST facility build up activities.
4. Documentation of materials related to the design, development, integration and testing related to the TIC.
5. Develop and implement plans for insuring that facility and test operation meet facility and test requirement.
6. Operate and maintain test facility in support of ALHAT development and V&V testing.
7. Design, develop, and implement a facility data collection and display system for real-time data monitoring and data storage.
8. Develop and maintain the ALHAT project schedule, annual budget and workplan.

5.2.9 AR&D Sensor Technology Added Rev 9
Project Code:

The contractor shall provide project engineering and project management services for Exploration Technology Development Program (ETDP) Automated Rendezvous and Docking (AR&D) Sensor Technology Project.

Contractor shall provide the following:

- Project Weekly Activity Report.
- Project Monthly/quarterly Summary Report.
- Maintain Navigation Sensor Database.
- Maintain Risk Database.
- Project Schedule

5.2.10 Orion IMU and Star Tracker Independent Testing Assessment Added Rev 10
Project Code:

The contractor shall provide engineering services in IMU and Star Tracker specification reviews. This will consist of reviewing iterations of the specifications, proposals, and ICDs available for

the sensors, attending reviews and asking questions for clarification, and providing comments based upon Shuttle/Station experience. The contractor shall use these documents to determine and define the role of NASA as an independent assessor for both units to mitigate risk to the program. This will consist of determining what testing is required to characterize the performance of the units above and beyond what the vendor plans for FQT, but which NASA must verify to meet the CEV objectives and requirements. Determine what test equipment is needed to provide this testing at the ISIL(IMU) and EOL(Star Tracker) Labs. Determine the overall costs, schedule, personnel, and resources needed for this testing. Rationale should be included for number of personnel needed and the level of lab maintenance required along with shift work if needed. Provide this information in two separate documents: one for the Star Tracker, and one for the IMU. The contractor shall also provide an additional document for each sensor that determines the level of independent review that NASA should provide beyond delivery, if any at all. These documents would contain justifications and rationale for what testing should be done to each unit for the life of the CEV program as an independent assessment based upon the level of involvement expected from the vendors. Details of the testing would be given, as well as level of indenpendent review from the ISIL and EOL labs. This would include yearly costs, schedule, personnel, resources, and lab maintenance costs. If it is determined that no additional testing will be needed but that a test capability should be maintained in case of malfunction on orbit, then details of lab maintenance costs for providing this support long term should be described as well as what testing capability will be provided. (The ability to turn around a quick test in emergency situations should be described) If after review of the documentation it is unclear how much testing should be completed to mitigate risk to the program and there is more than one level of effort possible, then a description of each support option and the costs associated should be outlined.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 10	Ball Star Tracker Proposal	
	Constellation Rendezvous Proximity Operations and Docking IRD	
Added Rev 10	Honeywell IMU specification	
Added Rev 10	IMU Specification	
Added Rev 10	Star Tracker Specification	
CEV-T-035 Added Rev 10	Project Orion Internal Interface requirements Document GN&C	Baseline
CXP 70000 Added Rev 10	Cx Architecture Requirements Document (CARD)	A.2
CXP 72000 Added Rev 10	CEV SRD (System Requirements for the Orion System)	A
CXP-00001	Constellation Architecture Requirements Document (CARD)	1/6/ 2006 (Draft)
CXP-00002	Constellation Design Reference Missions	1/5/ 2006 (Draft)
CXP-00004	Constellation Operations Concept Document	CFI Draft Release
EG-WI-00177	Integrated Guidance, Navigation, and Control IGN&C Work Instructions	C
EG-WI-00181	Flight Control Design and Analysis Process	C

c. **Required DRDs**

5.2.1 CEV On-Orbit GN&C Systems Analysis

DRD #	DRD Title	Quantity/Frequency
215 Deleted Rev 1	Software Code	4/Bi-Monthly
215 Updated Rev 14	Software Code	19
218 Updated Rev 13	Engineering Analysis	26

5.2.2 CEV Ascent/Entry GN&C Systems Analysis

DRD #	DRD Title	Quantity/Frequency

215 Updated Rev 13	Software Code	24
218 Deleted Rev 1	Engineering Analysis	1
218 Updated Rev 13	Engineering Analysis	20

5.2.3 CEV Operator in the Loop GN&C Analysis and Tool Development

DRD #	DRD Title	Quantity/Frequency
215 Added Rev 1	Software Code	2/Quarterly
218 Added Rev 1	Engineering Analysis	1

5.2.4 CLV Ascent Abort and Separation Analyses

DRD #	DRD Title	Quantity/Frequency
215 Added Rev 1	Software Code	1
218 Added Rev 1	Engineering Analysis	2

5.2.5 CEV Project Engineering Services

DRD #	DRD Title	Quantity/Frequency
101 Updated Rev 13	Project Schedule	56/Monthly
105 Updated Rev 13	Regular Status Report/Summary Review	52/Monthly

5.2.6 CEV Flight Mechanics Analysis

DRD #	DRD Title	Quantity/Frequency
218 Updated Rev 13	Engineering Analysis	17/Quarterly + 2

5.2.7 Orion Modeling, Simulation, Development and Integration

DRD #	DRD Title	Quantity/Frequency
215 Updated Rev 12	Software Code	7

5.2.8 HAST Buildup

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 8	Project Schedule	1/Month
215 Updated Rev 11	Software Code	4

5.2.9 AR&D Sensor Technology

DRD #	DRD Title	Quantity/Frequency
101 Updated Rev 12	Project Schedule	28/Monthly
105 Updated Rev 12	Regular Status Report/Summary Review	28/Monthly

5.2.10 Orion IMU and Star Tracker Independent Testing Assessment

DRD #	DRD Title	Quantity/Frequency
218 Added Rev 10	Engineering Analysis	2

d. **Products**

5.2.1 CEV On-Orbit GN&C Systems Analysis

Product(s)	Quantity	Delivery Date
ARES Simulation Baseline Release Deleted Rev 1	4	Bi-Monthly
On-Orbit GN&C Systems Analysis Summary Report	22	6/1/06, 9/30/06, 12/31/06, 3/31/07, 6/30/07, 9/30/07, 12/31/07, 3/31/08, 6/30/08, 9/30/08, 12/31/08, 3/31/09, 6/30/09, 9/30/09, 12/31/09, 3/31/10, 6/30/10, 9/30/10, 12/31/10, 3/31/11, 6/30/11, 9/30/11
Copernicus Mission and Trajectory Design Tool with GUI	1	9/30/2006
ANTARES Simulation Baseline Release	4, 4 (FY09), 4 (FY10), 4 (FY11)	12/31/06, 3/31/07, 6/30/07, & 9/30/07, Quarterly (FY09), Quarterly (FY10)
Ground Based Navigation Assessment Summary Report	4	9/30/07, 9/30/08, 9/30/09, 9/30/10
Morpheus Simulation Upgrade with GPS/INS model	1	6/1/2011
RPL Simulation Displays Update	1	7/1/2011

5.2.2 CEV Ascent/Entry GN&C Systems Analysis

Product(s)	Quantity	Delivery Date
ANTARES Simulation Baseline Release	4 (FY06), 4 (FY07) , 4 (FY08), 4 (FY09), 4 (FY10), & 4 (FY11)	Bi-Monthly (FY06); Quarterly (FY07), Quarterly (FY08), Quarterly (FY09), Quarterly (FY10), Quarterly (FY11)
GN&C Cockpit Prototype Evaluation Deleted Rev 1	1	9/30/2006
Integration of Ascent Graphics into the ARES Simulation	1	8/31/2006
Validation of Common Model Library (CML) Math Models	1	9/30/2006
Ascent/Entry GN&C Systems Analysis Summary Report	16	12/31/06, 3/31/07, 6/30/07, 9/30/07, 12/31/07, 3/31/08, 6/30/08 , 9/30/08, 12/31/08, 3/31/09, 6/30/09, 9/30/09, 12/31/09, 3/31/10, 6/30/10, 9/30/10, 12/31/10, 3/31/11, 6/30/11, 9/30/11
ANTARES to OSIRIS Simulation Comparison Report Added Rev 6	1	9/30/07

5.2.3 CEV Operator in the Loop GN&C Analysis and Tool Development

Product(s)	Quantity	Delivery Date
ARES Desktop Operator in the Loop Prototype Release Added Rev 1	2	Quarterly
GN&C Cockpit Prototype Evaluation	1	12/30/2006

5.2.4 CLV Ascent Abort and Separation Analyses

Product(s)	Quantity	Delivery Date
Abort/Separation Analysis Summary Report Added Rev 1	2	6/30/2006 and 9/30/2006
ARES Separation Math Models Delivery Added Rev 1	1	9/30/2006
Technical Panel Engineering Services Added Rev 1	24	weekly

5.2.5 CEV Project Engineering Services

Product(s)	Quantity	Delivery Date
Mode Team Windchill website Organizational Structure	1/week	9/30/11
Consolidated FD Mode Team Design Technical Document Services	2/Month	9/30/11
Flight Dynamics Mode Team Schedule	1/week	9/30/11
Flight Dynamics Integration Panel Meeting Agendas & Minutes	1/week	9/30/11
Project Action Item List	1/week	9/30/11
Vehicle Systems Performance Analysis Office Project Schedule	1/month	9/30/11
Vehicle Systems Performance Analysis Office TCSR Package Integration	1/month	9/30/11

5.2.6 CEV Flight Mechanics Analysis

Product(s)	Quantity	Delivery Date
CEV Flight Mechanics Analysis Summary Report	12	12/31/06, 3/31/07, 6/30/07, 9/30/07, 12/31/07, 3/31/08, 6/30/08, 12/31/08, 3/31/09, 6/30/09, 9/30/09, 12/31/09, 3/31/10, 6/30/10, 9/30/10, 12/31/10, 3/31/11, 6/30/11, 9/30/11
Entry Guidance Scheme Assessment Report for LEO and Lunar Returns Added Rev 4	2	4/1/07 (Mid-term) and 9/30/07 (Final)
Copernicus User's Guide (1st Draft)	1	6/30/08
Copernicus Programmer's Guide (1st Draft) Added Rev 10	1	9/30/08
Copernicus User's Guide (Ver 1.0)	1	4/30/09
Copernicus Programmer's Guide (Ver 1.0)	1	9/30/09
Copernicus User's Guide (Ver 2.0) Added Rev 12	1	9/30/10

5.2.7 Orion Modeling, Simulation, Development and Integration

Product(s)	Quantity	Delivery Date
Software Delivery, and V&V Summary Report Added Rev 6	2	8/31/07 & 12/31/07
Presentation describing V&V results of ANTARES Models Added Rev 6	2	8/31/07 & 12/31/07
Data Architecture Description Document Added Rev 6	2	8/31/07 & 12/31/07
Modeling and Simulation Support Plan (MSSP) Document Added Rev 6	1	12/31/07
Phase 1 - Virtual Cockpit Displays, Preliminary User Documentation, Test and Validation Plan Added Rev 6	1	7/31/07
Phase 2 - Virtual Cockpit Displays, Final User Documentation, Test and Validation Plan Added Rev 6	1	9/30/07
ANTARES Simulation Release (Launch to ISS Docking) Added Rev 10	1	6/27/08
ANTARES Simulation Release (Launch to Landing) Added Rev 10	1	12/31/08
ANTARES Simulation Release 9.2	1	9/30/2009

5.2.8 HAST Buildup

Product(s)	Quantity	Delivery Date
Preliminary Design Concept Document Added Rev 7	1	8/1/07
Preliminary TIC Software Added Rev 7	1	9/7/07
Facility Data Collection and Display System Added Rev 7	1	1/1/08
Complete the integration of ALHAT subsystems into HAST Deleted Rev 10	1	5/1/08
Facility Certification Planning Documentation Added Rev 7	1	9/30/08
ALHAT Project Schedule and Workplan Summary Report	1/Month	9/30/09
Facility Data Collection and Display System Release for HAST R0.4	1	2/15/09
Facility Data Collection and Display System Release for HAST R0.5	1	7/15/09
Complete the integration of ALHAT subsystems into HAST R0.4	1	3/15/09
Complete the integration of ALHAT subsystems into HAST R0.5	1	8/15/09
Facility Checkout/Acceptance Procedure	1	9/30/09
ALHAT Processor Box (APB) Sampler Port ICD (1st Draft)	1	11/1/09
ALHAT Processor Box Sampler Port ICD (2nd Draft)	1	1/31/10
HAST Operational Procedures Document (Version 2)	1	11/1/09
HAST Configuration Document (Version 2) Added Rev 12	1	11/1/09
ALHAT Processor Box Sampler Port ICD (Final)	1	6/30/10
HAST Operational Procedures Document (Version 3)	1	9/30/10
HAST Configuration Document (Version 3)	1	9/30/10
Re-configured APB for closed-loop testing with HAST 0.5.	1	1/31/11
Upgraded APB for FT5	1	4/1/11
Complete System Test and Integration for FT5 Deleted Rev 14	1	6/1/11
Updated TIC for Smaller Scale Lander Architecture Deleted Rev 14	1	7/1/11
Complete Integration of M-Box into HAST Facility Deleted Rev 14	1	9/1/11

5.2.9 AR&D Sensor Technology

Product(s)	Quantity	Delivery Date
Project Weekly Activity Report	123	9/30/10

Project Monthly/Quarterly Summary Report	30	9/30/10
Navigation Sensor Database	6	9/30/10
Risk Database	6	9/30/10
Project Schedule	30	9/30/10

5.2.10 Orion IMU and Star Tracker Independent Testing Assessment

Product(s)	Quantity	Delivery Date
IMU and Star Tracker Specifications Review Summary Report	6 or more	9/30/10
IMU Independent Assessment for FQT Added Rev 10	1	9/30/2008
Star Tracker Independent Assessment for FQT Added Rev 10	1	9/30/2008
IMU Lab Long Term Plan Added Rev 10	1	9/30/2008
Star Tracker Lab Long Term Plan Added Rev 10	1	9/30/2008

e. **Product Verification**

5.2.1 CEV On-Orbit GN&C Systems Analysis

i. ARES Simulation Baseline Release Deleted Rev 1

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Deleted Rev 1

ii. On-Orbit GN&C Systems Analysis Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iii. Copernicus Mission and Trajectory Design Tool with GUI

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. ANTARES Simulation Baseline Release

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

v. Ground Based Navigation Assessment Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vi. Morpheus Simulation Upgrade with GPS/INS model

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vii. RPL Simulation Displays Update

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.2.2 CEV Ascent/Entry GN&C Systems Analysis

i. ANTARES Simulation Baseline Release

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. GN&C Cockpit Prototype Evaluation Deleted Rev 1

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Deleted Rev 1

iii. Integration of Ascent Graphics into the ARES Simulation

- - Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. Validation of Common Model Library (CML) Math Models

- - Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

v. Ascent/Entry GN&C Systems Analysis Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vi. ANTARES to OSIRIS Simulation Comparison Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

5.2.3 CEV Operator in the Loop GN&C Analysis and Tool Development

i. ARES Desktop Operator in the Loop Prototype Release

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 1

ii. GN&C Cockpit Prototype Evaluation

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.2.4 CLV Ascent Abort and Separation Analyses

i. Abort/Separation Analysis Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 1

ii. ARES Separation Math Models Delivery

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 1

iii. Technical Panel Engineering Services

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 1

5.2.5 CEV Project Engineering Services

i. Mode Team Windchill website Organizational Structure

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Consolidated FD Mode Team Design Technical Document Services

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iii. Flight Dynamics Mode Team Schedule

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. Flight Dynamics Integration Panel Meeting Agendas & Minutes

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

v. Project Action Item List

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vi. Vehicle Systems Performance Analysis Office Project Schedule

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vii. Vehicle Systems Performance Analysis Office TCSR Package Integration

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.2.6 CEV Flight Mechanics Analysis

i. CEV Flight Mechanics Analysis Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Entry Guidance Scheme Assessment Report for LEO and Lunar Returns

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 4

iii. Copernicus User's Guide (1st Draft)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. Copernicus Programmer's Guide (1st Draft)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 10

v. Copernicus User's Guide (Ver 1.0)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vi. Copernicus Programmer's Guide (Ver 1.0)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vii. Copernicus User's Guide (Ver 2.0)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 12

5.2.7 Orion Modeling, Simulation, Development and Integration

i. Software Delivery, and V&V Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

ii. Presentation describing V&V results of ANTARES Models

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

iii. Data Architecture Description Document

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

iv. Modeling and Simulation Support Plan (MSSP) Document

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

v. Phase 1 - Virtual Cockpit Displays, Preliminary User Documentation, Test and Validation Plan

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

vi. Phase 2 - Virtual Cockpit Displays, Final User Documentation, Test and Validation Plan

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 6

vii. ANTARES Simulation Release (Launch to ISS Docking)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 10

viii. ANTARES Simulation Release (Launch to Landing)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 10

ix. ANTARES Simulation Release 9.2

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.2.8 HAST Buildup

i. Preliminary Design Concept Document

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 7

ii. Preliminary TIC Software

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 7

iii. Facility Data Collection and Display System

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 7

iv. Complete the integration of ALHAT subsystems into HAST Deleted Rev 10

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Deleted Rev 10

v. Facility Certification Planning Documentation

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 7

vi. ALHAT Project Schedule and Workplan Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

vii. Facility Data Collection and Display System Release for HAST R0.4

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

viii. Facility Data Collection and Display System Release for HAST R0.5

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ix. Complete the integration of ALHAT subsystems into HAST R0.4

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

x. Complete the integration of ALHAT subsystems into HAST R0.5

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xi. Facility Checkout/Acceptance Procedure

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xii. ALHAT Processor Box (APB) Sampler Port ICD (1st Draft)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xiii. ALHAT Processor Box Sampler Port ICD (2nd Draft)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xiv. HAST Operational Procedures Document (Version 2)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xv. HAST Configuration Document (Version 2)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 12

xvi. ALHAT Processor Box Sampler Port ICD (Final)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xvii. HAST Operational Procedures Document (Version 3)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xviii. HAST Configuration Document (Version 3)

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xix. Re-configured APB for closed-loop testing with HAST 0.5.

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xx. Upgraded APB for FT5

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

xxi. Complete System Test and Integration for FT5 Deleted Rev 14

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Deleted Rev 14

xxii. Updated TIC for Smaller Scale Lander Architecture Deleted Rev 14

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Deleted Rev 14

xxiii. Complete Integration of M-Box into HAST Facility Deleted Rev 14

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Deleted Rev 14

5.2.9 AR&D Sensor Technology

i. Project Weekly Activity Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Project Monthly/Quarterly Summary Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iii. Navigation Sensor Database

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. Risk Database

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

v. Project Schedule

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

5.2.10 Orion IMU and Star Tracker Independent Testing Assessment
i. IMU and Star Tracker Specifications Review Summary Report
- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.
ii. IMU Independent Assessment for FQT
- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 10
iii. Star Tracker Independent Assessment for FQT
- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 10
iv. IMU Lab Long Term Plan
- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 10
v. Star Tracker Lab Long Term Plan
- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 10

5.3 Core Trajectory Simulation (CTS) ANTARES Reuse Added Rev 12

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering analysis, simulation development, and documentation services to provide enhancements to the ANTARES simulation to support NASA/MOD Core Trajectory Subsystem (CTS) simulation tool requirements. Added Rev 12

5.3.1 Core Trajectory Subsystem (CTS) Ares 1-Y Range Safety Enhancements Updated Rev 14
Project Code:

The contractor shall provide enhancements to the ANTARES ascent simulation to meet NASA/MOD CTS Ares 1-Y range safety analysis requirements. The task will include the implementation, integration, and validation of core simulation capabilities along with enhancements to environmental and hardware math models. Ares 1-Y Guidance, Navigation, and Control (GN&C) Flight Software (FSW) shall be integrated into the CTS architecture and validated against NASA/MSFC provided Ares 1-Y simulated flight performance data. Trade studies and performance assessments will be provided to assess overall CTS capability to achieve range safety tool requirements. CTS simulation software configuration management shall be provided using the IBM ClearQuest configuration management tool.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CXP-00001 Added Rev 12	Cx Architecture Requirements Document (CARD)	A2
CXP-00002 Added Rev 12	Constellation Design Reference Missions	1/5/2006
CXP-00004 Added Rev 12	Constellation Operations Concept Document	CFI Draft Release
EA-WI-025 Added Rev 12	GFE Flight Project Software and Firmware Dev	C

c. **Required DRDs**

5.3.1 Core Trajectory Subsystem (CTS) Ares 1-Y Range Safety Enhancements

DRD #	DRD Title	Quantity/Frequency
215 Updated Rev 13	Software Code	6/Quarterly
218 Added Rev 14	Engineering Analysis	2/Quarterly

d. **Products**

5.3.1 Core Trajectory Subsystem (CTS) Ares 1-Y Range Safety Enhancements

Product(s)	Quantity	Delivery Date
CTS Simulation tool release	4 (FY10), 2 (FY11)	3/31/11
CTS Simulation & Modeling Summary Report Added Rev 14	2	6/30/11 & 9/30/11

e. **Product Verification**

5.3.1 Core Trajectory Subsystem (CTS) Ares 1-Y Range Safety Enhancements

i. CTS Simulation tool release

- - Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. CTS Simulation & Modeling Summary Report

- - Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 14

6.0 Cost Summary and Revision History

SLC	Type	CY2	CY3	CY4	CY5	CY6	CY7	G Total
AS1	Sum of Hours							
	Sum of Dollars							
AS2	Sum of Hours							
	Sum of Dollars							
BS1	Sum of Hours							
	Sum of Dollars							
BS2	Sum of Hours							
	Sum of Dollars							
BS3	Sum of Hours							
	Sum of Dollars							
EN1	Sum of Hours							
	Sum of Dollars							
EN2	Sum of Hours							
	Sum of Dollars							
EN3	Sum of Hours							
	Sum of Dollars							
EN4	Sum of Hours							
	Sum of Dollars							
ESS	Sum of Hours							
	Sum of Dollars							
IT2	Sum of Hours							
	Sum of Dollars							
IT3	Sum of Hours							
	Sum of Dollars							
IT4	Sum of Hours							
	Sum of Dollars							
MGR	Sum of Hours							
	Sum of Dollars							
Total Direct Labor Hours								
Total Direct Labor Costs								
Travel Costs								
Subcontract								
NLR Misc								
Materials								
Burden on Non-Labor								
Total Non Labor								
Total Costs								
Fee								
Total								$24,047,837.61

b4

DO147 Revision History	Total cost	Reason for revision
Original	1,151,458	Original
Rev. 1	1,235,974	1. Add scope to 5.1.1 for Flight Dynamics Mode Team Engineering Services 2. Adjust WBS for section 5.2 to better track products vs ITAs/funding sources
Rev. 2	1,300,975	1. Add Product 5.2.1 - GN&C Systems Analysis 2. Add Products to 5.2.2 - ARES Simulation Department 3. Extend period of performance to rephrase work on 5.2.3.
Rev. 3	4,047,465	1. Add scope and extend period of performance thru FY07 2. Rename WBS 5.1.1 to CAP Engineering Services 3. Rename WBS 5.2.1 to CEV On-orbit GN&C Systems Analysis 4. Rename WBS 5.2.1 to CEV Ascent/Entry GN&C Systems Analysis 5. Create new WBS 5.2.5 for CEV Project Engineering Services 6. Create new WBS 5.2.6 for CEV Flight Mechanics Analysis
Rev. 4	4,142,602	1. Add scope for conducting entry guidance scheme assessments for LEO and Lunar returns
Rev. 5	4,312,821	1. Add product to WBS 5.1.3 "1-Set of Transonic Aerodynamic Force & Moment Coefficient Data (per EG-CAP-07-33)" 2. Add product to WBS 5.2.1 "Ground Based Navigation Assessment Summary Report"
Rev. 6	4,694,067	1. Add new deliverable to WBS 5.2.2 "ANTARES to OSIRIS Simulation Comparison Report" 2. Add new scope and WBS 5.2.7 "Orion Modeling, Simulation, Development and Integration"
Rev. 7	4,928,730	1. Add new Scope WBS 5.2.8 for Hardware-in-the-loop ALHAT System Testbed (HAST) Buildup.
Rev. 8	5,524,969	1. Add product to WBS 5.1.3 "1-Set of Subsonic/Transonic Aerodynamic Force & Moment Coefficient Data and Acoustics Data (per EG-CAP-07-83)". 2. Add scope to WBS 5.2.8 to Hardware-in-the-loop ALHAT System Testbed (HAST) Build-up for project engineering services.
Rev. 9	9,810,389	1) Add scope and extend period of performance thru FY08. 2) Create new WBS 5.2.9 for AR&D sensor technology.
Rev. 10	10,039,868	1) Add new scope and deliverable to WBS 5.1.1 - CAP Engineering Services. 2) Add new deliverables to WBS 5.2.6 - CEV Flight Mechanics Analysis. 3) Extend period of performance and add deliverables to WBS 5.2.7 - Orion Modeling, Simulation, Development and Integration. 4) Delete deliverable on WBS 5.2.8 - HAST Buildup that is no longer required. 5) Add new WBS 5.2.10 - Orion IMU and Star Tracker Independent Testing Assessment
Rev. 11	13,994,366	1) Add products and extend period of performance thru FY09.
Rev. 12	20,124,712	1) Add new deliverables to WBS's 5.1 and 5.2. 2) Add new WBS 5.3 - CTS ANTARES Reuse. 3) Extend period of performance thru 9/30/2010.
Rev. 13	23,958,543	1) Re-phase and add new deliverables to WBS's 5.1, 5.2, and 5.3 due to Constellation Program re-direction. 2) Add new WBS 5.1.4 for EDL CFD Analysis. 4) Extend period of performance thru 9/30/2011.
Rev. 14	24,345,826	1) Delete EVM tracking requirement on WBS 5.1.1 CAP Engineering Services. 2) Add new products on WBS 5.2.1 CEV On-Orbit GN&C Systems Analysis. 3) Delete FT5 requirements on WBS 5.2.8 HAST Buildup. 4) Add product and extend period of performance on WBS 5.3.1 Core. Trajectory Simulation (CTS) ANTARES Reuse thru 9/30/2011.
Rev. 15	24,047,838	1) Delete requirement on WBS 5.1.4 Entry, Descent, and Landing (EDL) Project for ARC UPWT Post-Test CFD Cases. 2) Delete requirement on WBS 5.2.1 CEV On-Orbit GN&C Systems Analysis for non-OFT-1 related products.

		3) Delete requirement on WBS 5.2.2 CEV Ascent/Entry GN&C Systems Analysis for non-OFT-1 related products. 4) Delete requirement on WBS 5.2.5 CEV Project Engineering Services for non-OFT-1 related products. 5) Delete requirement on WBS 5.3.1 Core Trajectory Simulation (CTS) ANTARES Reuse for development of automated testing procedures and associated scripting language used to automate COMPASS final verification and testing. Note: Effective this revision and at the end of the period of performance 9/30/2011 this DO will be closed.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ06HA95D DO 148 R7

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 4/07/2006 – 1/31/2013

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: **Ray DeVall**

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: **11/16/2010**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**EA2 Infrastructure Services**					
DO	**148 R7**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel/NLR Misc					
	Est. M&T Burden					
	Subtotal					
	Fee					

b4 b4

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$3,939,860

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ06HA95D-DO148 REV. 7

Originator: Stephen Lamkin (EA) (281) 483-8264 **TMR:** Stephen Lamkin (EA2) (281) 483-8264

Revision Summary:
Revise DO to reflect scope changes for FY 2011 and FY 2012.

1. Title of Effort: EA2 Infrastructure Services

2. Date of Request: 09/21/2010

3. Statement of Work Task Description

a. **2.1.4 Website Development**
The contractor shall design, develop, modify, test and install Websites. The contractor shall provide configuration documentation and training on new and modified websites.

b. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

c. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 6

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/01/2006 and ends 01/31/2013.

5. Product Requirements

5.1 Engineering Directorate Resource Analyses Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall collect and annotate metric data necessary to produce EA resource analyses. Prepare directorate integrated responses to Program Planning, Budgeting, and Execution (PPBE) calls.

These services will be identified in the EA25 Master Schedule, located at Click Here.

EFFECTIVE WITH REV 5, THIS TASK IS COMBINED INTO 5.3. Updated Rev 6

5.1.1 QMR, TCSR, PPBE and CDM Reports

Project Code:

The contractor shall collect and annotate and analyze metric data necessary to produce the EA management reviews(QMR), Technical, Cost and Schedule Reviews (TCSR) and Center Director Metrics (CDM) reports. The contractor shall prepare Engineering Directorate's integrated response to PPBE calls.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	Detailed Requirements Document for EA Infrastructure Services	Current
	EA25 Master Schedule	Current

c. **Required DRDs**

5.1.1 QMR, TCSR, PPBE and CDM Reports

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
101	Project Schedule	8/Quarterly

d. **Products**

5.1.1 QMR, TCSR, PPBE and CDM Reports

Product(s)	Quantity	Delivery Date
Quarterly Management Review (QMR) i.a.w. EA25 Master Schedule	5	iaw EA Infrastructure Services Requirements Document
Technical, Cost, and Status Review (TCSR)	36	1 per month starting 4/07
Center Director Metrics Reports(JMC), i.a.w. EA25 Master Schedule	13	iaw EA Infrastructure Services Requirements Document
EA Integrated Response to PPBE Calls, i.a.w. required dates as noted in various Programs PPBE08 and PPBE09 calls	4	Per EA25 Master Schedule - by 1/31/2010
Directorate Management Review	8	1 bi-monthly starting 3/08

e. **Product Verification**

5.1.1 QMR, TCSR, PPBE and CDM Reports

i. Quarterly Management Review (QMR) i.a.w. EA25 Master Schedule

- NASA acceptance by NASA TMR or designated representative.

ii. Technical, Cost, and Status Review (TCSR)

- NASA acceptance by NASA TMR or designated representative.

iii. Center Director Metrics Reports(JMC), i.a.w. EA25 Master Schedule

- NASA acceptance by NASA TMR or designated representative.

iv. EA Integrated Response to PPBE Calls, i.a.w. required dates as noted in various Programs PPBE08 and PPBE09 calls

- NASA acceptance by NASA TMR or designated representative

v. Directorate Management Review

- NASA acceptance by NASA TMR or designated representative

5.2 SBIR, STRR, and CDDF Status Reports Deleted Rev 1

5.3 EA Technical Integration Services Updated Rev 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide technical integration services for Engineering Directorate management. The contractor shall develop and maintain EA technical integration products, collect, analyze and annotate metric data necessary to produce EA resource analyses, and prepare directorate integrated responses to Program Planning, Budgeting, and Execution (PPBE) calls. Updated Rev 6

5.3.1 EA Technical Integration Services Updated Rev 6

Project Code:

The contractor shall provide technical integration and assessment services to directorate management.

These products will be identified in DDMS # 0001003907 Detailed Delivery Requirements - EA2 Infrastructure Services.

The contractor shall develop and maintain EA technical integration products. The contractor shall collect and annotate and analyze metric data necessary to produce monthly/quarterly Technical, Cost and Schedule Reviews (TCSR) and other resource reviews for the Engineering Directorate. The contractor shall prepare Engineering Directorate's integrated response to PPBE call.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	
DDMS # 0001003907 Added Rev 6	Detailed Delivery Requirements - EA2 Infrastructure Services	Current

c. **Required DRDs**

5.3.1 EA Technical Integration Services

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
Added Rev 1	No Requirement	

d. **Products**

5.3.1 EA Technical Integration Services

Product(s)	Quantity	Delivery Date
EA Technical Integration Databases	6	iaw Detailed Delivery Requirements - EA2 Infrastructure Services
Updates to EA Technical Integration Databases	3	iaw Detailed Delivery Requirements - EA2 Infrastructure Services
Assessment of Data Products	84	iaw Detailed Delivery Requirements - EA2 Infrastructure Services
Metrics Report Updated REV. 7	15	iaw Detailed Delivery Requirements - EA2 Infrastructure Services
Technical, Cost, and Schedule Review (TCSR) Updated REV. 7	60	iaw Detailed Delivery Requirements - EA2 Infrastructure Services
EA Integrated Response to PPBE Calls; i.a.w. required dates as noted in various annual Program PPBE calls Updated REV. 7	10	iiaw Detailed Delivery Requirements - EA2 Infrastructure Services

e. **Product Verification**

5.3.1 EA Technical Integration Services

i. EA Technical Integration Databases

- NASA acceptance by NASA TMR or designated representative.

ii. Updates to EA Technical Integration Databases

- NASA acceptance by NASA TMR or designated representative.

iii. Assessment of Data Products

- NASA acceptance by NASA TMR or designated representative.

iv. Metrics Report

- NASA acceptance by NASA TMR or designated representative.

v. Technical, Cost, and Schedule Review (TCSR)

- NASA acceptance by NASA TMR or designated representative.

vi. EA Integrated Response to PPBE Calls; i.a.w. required dates as noted in various annual Program PPBE calls

- NASA acceptance by NASA TMR or designated representative.

5.4 ITA Tool Support Updated REV. 7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall process requests for user access and training materials on use of the Engineering Directorate Electronic ITA (eITA) Tool.

THIS TASK IS COMPLETED AS OF 9/30/2010. Updated REV. 7

5.4.1 ITA Tool Access Requests (SRs) Updated REV. 7
Project Code:

The Contractor shall prepare and submit SRs for access rights to the Engineering Directorate ITA Tool. This shall include providing help to users who are having problems accessing the eITA tool or other issues with utilizing the tool. An electronic record of who has current access to the eITA tool (and when access was requested and granted) shall be maintained and available for online review by the TMR. Activities shall be summarized in a monthly status report that includes access requested, access granted, user issues, etc.

5.4.2 ITA Tool User Guide and Training Added Rev 2
Project Code:

The contractor shall prepare a short (to the point and easy to follow) instruction for processing SRs requesting user access to the Engineering electronic Internal Task Agreement (eITA).

b. **Applicable Documents**

Document Number	Document Name	Rev.
DDMS # 0001003907 Added Rev 6	Detailed Delivery Requirements - EA2 Infrastructure Services	Current

c. **Required DRDs**

5.4.1 ITA Tool Access Requests (SRs)

DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

5.4.2 ITA Tool User Guide and Training

DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

d. **Products**

5.4.1 ITA Tool Access Requests (SRs)

Product(s)	Quantity	Delivery Date
User Access Requests Updated REV. 7	41	iaw Detailed Delivery Requirements - EA2 Infrastructure Services
Monthly User Access Status Report Updated REV. 7	40	iaw Detailed Delivery Requirements - EA2

		Infrastructure Services

5.4.2 ITA Tool User Guide and Training

Product(s)	Quantity	Delivery Date
Work instructions for processing SRs requesting user access to the eITA tool	1	iiaw Detailed Delivery Requirements - EA2 Infrastructure Services

e. **Product Verification**

5.4.1 ITA Tool Access Requests (SRs)

i. User Access Requests

- The new user receiving access rights

ii. Monthly User Access Status Report

- Reviewed and accepted by NASA TMR or designated representative.

5.4.2 ITA Tool User Guide and Training

i. Work instructions for processing SRs requesting user access to the eITA tool

- Reviewed and accepted by the NASA TMR or designated representative.

5.5 EA2 Resource Automation Tools Updated Rev 6

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall develop tools to facilitate automation of resources data integration for Engineering Directorate resource and technical analyses.

Note that many of the products will not be delivered into DDMS, but rather into SharePoint. Refer the Detailed Requirements Document - EA2 Infrastructure Services, DDMS #0001003907, for delivery venue details. In addition, the due dates on Task 5 are noted as follows: The deliverable dates listed in the EA2 Infrastructure Services Detailed Requirements Document, DDMS #0001003907, superceded all dates listed in previous RFP versions. This revision (R5) to the proposal removes the metrics module from Task 5. Once requirements are defined, the metrics module will be added back in and worked as a Project Directive (PD) under Task 5.5.4. Updated Rev 6

5.5.1 PPBE Resource Automation Tool Development Updated Rev 6
Project Code:

The contractor shall provide an integrated web-based tool to facilitate automation of the PPBE (Planning, Programming & Budget Execution) process

Phase 1:

This system shall provide for the capture, roll-up, analysis of data, and production of aggregate reports appropriate for the various levels of management and customers. The management process and collection of data shall be coordinated with existing management practices, projects, divisions, and the directorate. The system shall provide configuration management of captured data.

Phase 2:

Phase 2 shall provide periodic modifications and upgrades to the functionality of the tool. These modifications are the product of customer request as well as feedback from user community.

5.5.2 TCSR Automation Tool Development Updated Rev 6
Project Code:

The contractor shall provide an integrated web-based tool to facilitate automation of the TCSR (Technical Cost Schedule Review) reporting process.

Phase 1:

This system shall provide for the capture, roll-up, analysis of data, and production of aggregate reports appropriate for the various levels of management and customers. The management process and collection of data shall be coordinated with existing

management practices, projects, divisions, and the directorate. The system shall provide configuration management of captured data.

Phase 2:

Phase 2 shall provide periodic modifications and upgrades of the tool. These modifications are the product of customer request as well as feedback from user community.

5.5.3 Portal Access Updated Rev 6
Project Code:

The contractor shall provide an integrated web-based tool to facilitate JSC user community with access to all available tools (PPBE DPIT tool, TSCR tool, Metrics tool).

Phase 1:

This portal shall provide user community access to different automated tools depending on the user's role. It shall provide news, calendar of events (meetings, provide charts), bulletin board.

Phase 2:

Phase 2 shall provide periodic modifications and upgrades to the functionality of the tool. These modifications are the product of customer request as well as feedback from user community.

5.5.4 Metrics Automation Tool Development Updated Rev 6
Project Code:

Reserved - Deleted in Revision 5, but it may be reworked later.

5.5.5 Supplementary Tool Development Updated Rev 6
Project Code:

The contractor shall develop additional modules to the original set of Resource Automation Tools as requested.

Each new module development shall be documented on a EA2 or ET2 CCB Approved Project Directive (PD), and in DDMS #0001003907 Detailed Delivery Requirements - EA2 Infrastructure Services.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 3	No Requirement	
DDMS #0001003907 Added Rev 6	Detailed Delivery Requirements - EA2 Infrastructure Services	Current

c. **Required DRDs**

5.5.1 PPBE Resource Automation Tool Development

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
215 Updated Rev 6	Software Code	iaw Detailed Requirements Document - EA2 Infrastructure Services

5.5.2 TCSR Automation Tool Development

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 4	Project Schedule	Monthly
215 Updated Rev 6	Software Code	iaw Detailed Requirements Document - EA2 Infrastructure Services
316 Added Rev 6	Software Design Document	iaw Detailed Requirements Document - EA2 Infrastructure Services
323 Added Rev 6	Verification and Validation Document	iaw Detailed Requirements Document - EA2 Infrastructure Services

5.5.3 Portal Access

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 4	Project Schedule	Monthly
215 Updated Rev 6	Software Code	iaw Detailed Requirements Document - EA2 Infrastructure Services
316 Added Rev 6	Software Design Document	iaw Detailed Requirements Document - EA2 Infrastructure Services
323 Added Rev 6	Verification and Validation Document	iaw Detailed Requirements Document - EA2 Infrastructure Services

5.5.4 Metrics Automation Tool Development

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	
101 Deleted Rev 6	Project Schedule	Monthly
215 Deleted Rev 6	Software Code	iaw Detailed Requirements Document - EA2 Infrastructure Services

5.5.5 Supplementary Tool Development

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 5	Project Schedule	Monthly
215 Updated Rev 6	Software Code	As documented in PD - Effective 2/1/2010
316 Added Rev 6	Software Design Document	As documented in PD - Effective 2/1/2010
323 Added Rev 6	Verification and Validation Document	As documented in PD - Effective 2/1/2010

d. **Products**

5.5.1 PPBE Resource Automation Tool Development

Product(s)	Quantity	Delivery Date
Deployment Plan (including schedule, training materials, etc.)	1	iaw Detailed Requirements Document - EA2 Infrastructure Services

5.5.2 TCSR Automation Tool Development

Product(s)	Quantity	Delivery Date
Deployment Plan (including schedule, training material, etc.)	1	iaw Detailed Requirements Document - EA2 Infrastructure Services
TSCR Software Application loaded onto a JSC Server	1	iaw Detailed Requirements Document - EA2 Infrastructure Services
Software Requirements Document	1	iaw Detailed Requirements Document - EA2 Infrastructure Services
Software Design Document	1	iaw Detailed Requirements Document - EA2 Infrastructure Services
Verification and Validation Plan	1	iaw Detailed Requirements Document - EA2

	Infrastructure Services

5.5.3 Portal Access

Product(s)	Quantity	Delivery Date
Deployment Plan (including schedule, training material, etc.	1	iaw Detailed Requirements Document - EA2 Infrastructure Services
Portal Software Application loaded onto a JSC Server Deleted Rev 6	iaw Detailed Requirements Document - EA2 Infrastructure Services	iaw Detailed Requirements Document - EA2 Infrastructure Services
Software Requirements Document Deleted Rev 6	iaw Detailed Requirements Document - EA2 Infrastructure Services	iaw Detailed Requirements Document - EA2 Infrastructure Services
Verification and Validation Plan Deleted Rev 6	iaw Detailed Requirements Document - EA2 Infrastructure Services	iaw Detailed Requirements Document - EA2 Infrastructure Services
Software Design Document Deleted Rev 6	iaw Detailed Requirements Document - EA2 Infrastructure Services	iaw Detailed Requirements Document - EA2 Infrastructure Services
Portal Software Application loaded onto a JSC Server, Valid through 1/31/2010	iaw Detailed Requirements Document - EA2 Infrastructure Services	iaw Detailed Requirements Document - EA2 Infrastructure Services
Software Requirements Document, Valid through 1/31/2010	iaw Detailed Requirements Document - EA2 Infrastructure Services	iaw Detailed Requirements Document - EA2 Infrastructure Services
Verification and Validation Plan, Valid through 1/31/2010	iaw Detailed Requirements Document - EA2 Infrastructure Services	iaw Detailed Requirements Document - EA2 Infrastructure Services
Software Design Document, Valid through 1/31/2010	iaw Detailed Requirements Document - EA2 Infrastructure Services	iaw Detailed Requirements Document - EA2 Infrastructure Services

5.5.4 Metrics Automation Tool Development

Product(s)	Quantity	Delivery Date
Deployment Plan (including schedule, training material, etc.) Deleted Rev 5	1	Sept. 1, 2008
Metrics Software Application loaded onto a JSC Server Deleted Rev 5	1	Oct. 1, 2008
This section is reserved. It was deleted in Revision 5, and will be reworked later as a EA2 Project Directive (PD).	per Approved PD	per Approved PD

5.5.5 Supplementary Tool Development

Product(s)	Quantity	Delivery Date
Supplementary Tool Requirements Document Deleted Rev 6	1 per Approved PD	per Approved PD
Deployment Plan (including schedule, training materials, maintenance, upgrades, etc)	1 per approved PD	per Approved PD
Software Application and Code Releases loaded on JSC EA Server Deleted Rev 6	per Approved PD	per Approved PD
Software Application V&V Plan Deleted Rev 6	1 per Approved PD	per Approved PD
Software Design Document Deleted Rev 6	Per Approved PD	per Approved PD
Supplementary Tool Requirements Document, Valid through 1/31/2010 Added Rev 6	1 per Approved PD	per Approved PD
Software Application and Code Releases loaded on JSC EA Server, Valid through 1/31/2010 Added Rev 6	1 per Approved PD	per Approved PD
Software Application V&V Plan, Valid through 1/31/2010 Added Rev 6	1 per Approved PD	per Approved PD
Software Design Document, Valid through 1/31/2010 Added Rev 6	1 per Approved PD	per Approved PD

e. **Product Verification**

5.5.1 PPBE Resource Automation Tool Development

i. Deployment Plan (including schedule, training materials, etc.)

- Review and acceptance by NASA PM and NASA TMR.

5.5.2 TCSR Automation Tool Development

i. Deployment Plan (including schedule, training material, etc.)

- Review and acceptance by NASA PM and NASA TMR

ii. TSCR Software Application loaded onto a JSC Server

- Operational on a JSC Server and Verification of Application's accuracy by TM

iii. Software Requirements Document

- Review and acceptance by NASA PM and NASA TMR

iv. Software Design Document

- Review and acceptance by NASA PM and NASA TMR

v. Verification and Validation Plan

- Review and acceptance by NASA PM and NASA TMR

5.5.3 Portal Access

i. Deployment Plan (including schedule, training material, etc.

- Review and acceptance by NASA PM and NASA TMR

ii. Portal Software Application loaded onto a JSC Server Deleted Rev 6

- Operation on a JSC Server and Verification of Application's accuracy by NASA TM Deleted Rev 6

iii. Software Requirements Document Deleted Rev 6

- Review and acceptance by NASA PM and NASA TMR Deleted Rev 6

iv. Verification and Validation Plan Deleted Rev 6

- Review and acceptance by NASA PM and NASA TMR Deleted Rev 6

v. Software Design Document Deleted Rev 6

- Review and acceptance by NASA PM and NASA TMR Deleted Rev 6

vi. Portal Software Application loaded onto a JSC Server, Valid through 1/31/2010

- Review and acceptance by NASA PM and NASA TMR

vii. Software Requirements Document, Valid through 1/31/2010

- Review and acceptance by NASA PM and NASA TMR

viii. Verification and Validation Plan, Valid through 1/31/2010

- Review and acceptance by NASA PM and NASA TMR

ix. Software Design Document, Valid through 1/31/2010

- Review and acceptance by NASA PM and NASA TMR

5.5.4 Metrics Automation Tool Development

i. Deployment Plan (including schedule, training material, etc.) Deleted Rev 5

- Review and acceptance by TM and NASA TMR Deleted Rev 5

ii. Metrics Software Application loaded onto a JSC Server Deleted Rev 5

- Operation on a JSC Server and Verification of Application's accuracy by TM Deleted Rev 5

iii. This section is reserved. It was deleted in Revision 5, and will be reworked later as a EA2 Project Directive (PD).

- Review and acceptance by NASA PM and NASA TMR

5.5.5 Supplementary Tool Development

i. Supplementary Tool Requirements Document Deleted Rev 6

- Review and Acceptance by NASA PM and NASA TMR Deleted Rev 6

ii. Deployment Plan (including schedule, training materials, maintenance, upgrades, etc)

- Review and Acceptance by NASA PM and NASA TMR

iii. Software Application and Code Releases loaded on JSC EA Server Deleted Rev 6

- Operation on a JSC EA Server and Verification of Application's accuracy by NASA PM and NASA TMR Deleted Rev 6

iv. Software Application V&V Plan Deleted Rev 6

- Review and Acceptance by NASA PM and NASA TMR Deleted Rev 6

v. Software Design Document Deleted Rev 6

- Review and Acceptance by NASA PM and NASA TMR Deleted Rev 6

vi. Supplementary Tool Requirements Document, Valid through 1/31/2010

- Review and acceptance by NASA PM and NASA TMR Added Rev 6

vii. Software Application and Code Releases loaded on JSC EA Server, Valid through 1/31/2010

- Review and acceptance by NASA PM and NASA TMR Added Rev 6

viii. Software Application V&V Plan, Valid through 1/31/2010

- Review and acceptance by NASA PM and NASA TMR Added Rev 6

ix. Software Design Document, Valid through 1/31/2010

- Review and acceptance by NASA PM and NASA TMR Added Rev 6

6.0 Cost/Price and Revision Summary

DO 148 R7 Summary									
SLC		CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS2									
	Sum of Hrs								
	Sum of Dollars								
BS1									
	Sum of Hrs								
	Sum of Dollars								
BS2									
	Sum of Hrs								
	Sum of Dollars								
BS3									
	Sum of Hrs								
	Sum of Dollars								
ESS									
	Sum of Hrs								
	Sum of Dollars								
IT2									
	Sum of Hrs								
	Sum of Dollars								
IT3									
	Sum of Hrs								
	Sum of Dollars								
MGR									
	Sum of Hrs								
	Sum of Dollars								
SV									
	Sum of Hrs								
	Sum of Dollars								
PC2									
	Sum of Hrs								
	Sum of Dollars								
PC3									
	Sum of Hrs								
	Sum of Dollars								
EN1									
	Sum of Hrs								
	Sum of Dollars								
IT4									
	Sum of Hrs								

92 6,028

Sum of Dollars	
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**3,939,860**

Revision History:

DO148 Revision History	Total Cost	Reason for Revision
Original	$815,924	Original DO
Revision 1	$817,903	Revised Sections 5.1 and 5.3 to reflect changing priorities within EA2.
Revision 2	$867,210	Added services for preparation of responses to Program Planning, Budgeting, and Execution (PPBE) calls. Added services for preparation of ITA Tool access requests and training material for ITA Tool users.
Revision 3	$1,917,351	Extended period of performance from 1/31/2008 to 1/31/2010; moved performance Metrics section to separate EA2 Infrastructure Services Project Control Plan; reduced scope of work for deliverables under Subtask 5.4.3; and added Subtask 5.5 "EA2 Automation Tools".
Revision 4	$2,070,242	Added Phase II to Subtask 5.5.1 "PPBE Automation Tool" and added three new subtasks: 5.5.2 "TCSR Automation Tool", 5.5.3 "Portal Access", and 5.5.4 "Metrics Automation Tool Development". Estimate for this new effort in FY08 = $234,062. Made a downward adjustment in April 2007 of $81,171 to better reflect resources actually spent and how they were spent on the different tasks.
Revision 5	$2,596,739	Removed Module Metrics from Task 5.5. Will be reworked later via Project Directive. Extended the period of performance for Task 5.5, EA2 Automation Tools to the end of Jan 2010 and added Subtask 5.5.5, "Supplementary ETT Tool Development". Added materials to Task 5 for text editor procurement and for training. Made adjustments for changes in SLCs. Moved resources from Task 3 to Task 5 for documentation assistance. Net change: $526,497.
Revision 6	$4,554,337	Extended period of performance from 1/31/2010 to 1/31/2013. Consolidated TCSR and PPBE tasks from Section 5.1 into Section 5.3. Added scope of work to Section 5.3 to perform assessments and prepare additional metric reporting for the Directorate. Made a negative adjustment in CY06 for Task 5.1 to reflect underruns and efficiencies realized during the past several months. Added estimate in Section 5.5 for additional EA Resource Automation Tools.
Revision 7	$3,939,860	Modified Section 1.0 to reflect DO148R7 proposal. Updated Section 3.0 to include a current summary of revision changes. Modified Section 5.3 to reflect reductions in product deliverables for Task 5.3 effective

		10/01/2010 due to programmatic funding. Modified Section 5.4 to reflect reductions in product deliverables and scope of work and completion of work performance for Task 5.4 through 09/30/2010 due to ITA System automation. Updated Section 8.3 to reflect updated plans to execute risk mitigations. Updated Table 9.1-1 in Section 9.1.1 to reflect closure of ESCG cost accounts for Task 5.4 effective 09/30/2010. Updated Table 9.1-1 in Section 9.1.1 to reflect addition of ESCG cost accounts for Task 5.5. Updated Section 9.1.3 to reflect updates to types of skill mix required to perform Tasks 5.3 and 5.4 effective 10/01/2010. Made negative adjustment to the CY07 cost estimates for Task 5.3 to reflect underruns realized due to reductions in work scope and subsequent reassignment of workforce, as well as efficiencies realized during the year. Made positive adjustment to the CY07 cost estimate for Task 5.5 to reflect minor modifications to work scope and resources required to perform tasks.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ06HA92D-DO 151 R4	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 483-7890
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 02/17/2006 – 01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.

Name:

Signature: _____ Date: _____

10. Name: **J.R. Carpentier**

Signtature: **J.R. Carpentier** Date: **12/28/2009**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Communication and Hardware Curator					
DO	151 R4		64			
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				64	
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference.					

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$ 1,511,045

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ06HA92D-DO151 Rev 4

Originator: Nancy Munoz (EA2) (281) 483-9015 **TMR:** Nancy Munoz (EA) (281) 483-9015

Revision Summary:
Extend the period of performance through 1/31/2013. This change extends the same work products throughout the new period. This proposal revision adds $678,303 to provide the additional requested services.

1. Title of Effort: Communication and Hardware Curator

2. Date of Request: 09/29/2009

3. Statement of Work Task Description

a. **2.1-Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 4

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/15/2006 and ends 01/31/2013.

5. Product Requirements

5.1 Engineering Directorate Communication Coordinator

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall develop strategies and products, implement initiatives and coordinate events which establish better internal employee morale and external communications for the Engineering Directorate and other JSC organizations. The contractor shall create, obtain, distribute and archive both informational and promotional products and develop strategies to promote NASA engineering projects.

5.1.1 Prepare photo collages and displays and distribute information.
Project Code:

The contractor shall develop information packets (e.g., including photo collages, fact sheets) for use in both creating better internal employee morale and providing information (concerning Engineering projects) to organizations both internal and external to NASA.

5.1.2 Web site Designs
Project Code:

The contractor shall provide recommendations as to material (including photos and promotional information) to be uploaded onto the Engineering Web site(s) and configuration/layout of and options available (e.g., pointers to other web sites of informational databases) on the Engineering Web site(s).

5.1.3 Technical Writing Added Rev 3
Project Code:

The contractor shall prepare written descriptions of significant EA projects or mission success stories for NASA-internal use. Typical products shall be to initiate technical discussion between JSC Engineering and other NASA organizations.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01

c. **Required DRDs**

5.1.1 Prepare photo collages and displays and distribute information.

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/Monthly

5.1.2 Web site Designs

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/Monthly

5.1.3 Technical Writing

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 3	Regular Status Report/Summary Review	1/Month

d. **Products**

5.1.1 Prepare photo collages and displays and distribute information.

Product(s)	Quantity	Delivery Date
Photo Collages and informational/facts sheets or displays	1 set	Engineering Project Documents, DDMS #0001012380

5.1.2 Web site Designs

Product(s)	Quantity	Delivery Date
Photos, information to uploaded onto the Engineering Directorate web site(s) included as part of activity status report	1 set	Engineering Project Documents, DDMS #0001012380

5.1.3 Technical Writing

Product(s)	Quantity	Delivery Date
Written description of significant EA project or mission success story. Added Rev 3	1 set	Engineering Project Documents, DDMS #0001012380

e. **Product Verification**

5.1.1 Prepare photo collages and displays and distribute information.

i. Photo Collages and informational/facts sheets or displays

- Review, approved and accepted by the NASA TMR, or designated representative.

5.1.2 Web site Designs

i. Photos, information to uploaded onto the Engineering Directorate web site(s) included as part of activity status report

- Review, approved and accepted by the NASA TMR, or designated representative.

5.1.3 Technical Writing

i. Written description of significant EA project or mission success story.

- Review, approved and accepted by the NASA TMR, or designated representative. Added Rev 3

5.2 Hardware Curator Services Updated Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide curation of X-38 excess hardware (presently located on site at JSC by maintaining configuration control and inventory of the hardware and complying with Center property control procedures and/or agreements. Contractor shall all oversee removal of, preparation of ownership transfer documents, and shipment of hardware. This requirement ends with revision 2. Updated Rev 3

5.2.1 X-38 Hardware Curation Updated Rev 3
Project Code:

The contractor shall coordinate the final disposition of the X-38 Hardware as noted in 5.2.a. This requirement ends with revision 2.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	
JB15W-20	Management of Controlled Equipment	
JB9W-12	JSC Personal Property/ Equipment Instructions for Excess and Disposal	

c. **Required DRDs**

5.2.1 X-38 Hardware Curation

DRD #	DRD Title	Quantity/Frequency
105 Deleted Rev 3	Regular Status Report/Summary Review	1/month
105 Added Rev 3	Regular Status Report/Summary Review	1/month thru 9/30/2006

d. **Products**

5.2.1 X-38 Hardware Curation

Product(s)	Quantity	Delivery Date
Status report as to Hardware disposition (what has been transfer, excess, remaining) Updated Rev 3	1	bi-weekly
Hardware curation services & hardware disposition Deleted Rev 3	1	9/30/06
Hardware curation services & hardware disposition Added Rev 3	1	9/30/06

e. **Product Verification**

5.2.1 X-38 Hardware Curation

i. Status report as to Hardware disposition (what has been transfer, excess, remaining) Updated Rev 3

- Presented to, reviewed, and accepted by NASA TMR or designated representative. Updated Rev 3

ii. Hardware curation services & hardware disposition Deleted Rev 3
- TMR or designated representative will review and determine if acceptable contractor evidence that all X-38 hardware has been dispositioned. Deleted Rev 3
iii. Hardware curation services & hardware disposition
- TMR or designated representative will review and determine if acceptable contractor evidence that all X-38 hardware has been dispositioned. Added Rev 3

6.0 Cost Summary and Revision History

DO 151 R4 Summary									
SLC		CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS2									
	Sum of Hrs								
	Sum of Dollars								
BS2									
	Sum of Hrs								
	Sum of Dollars								
ESS									
	Sum of Hrs								
	Sum of Dollars								
PC2									
	Sum of Hrs								
	Sum of Dollars								
SV									
	Sum of Hrs								
	Sum of Dollars								
EN1									
	Sum of Hrs								
	Sum of Dollars								
EN2									
	Sum of Hrs								
	Sum of Dollars								
MGR									
	Sum of Hrs								
	Sum of Dollars								
Total Direct Labor Hrs									
Total Direct Labor Cost									
Subcontract									
Material									
Travel									
NLR Misc									
Burden on Non-Labor									
Total Non-Labor									
Total Costs									
Fee (100% of Pool)									
Total									**1,511,045**

64

Revision History:

Rev No.	Date	Summary
Rev 4	09/16/2009	Extend the period of performance through 1/31/2013. This change extends the same work products throughout the new period. This proposal revision adds $678,303 to provide the additional requested services.
Rev 3	03/31/2008	Extend period of performance to 1/31/2010 and to add technical writing requirements.
Rev 2	08/13/2007	To extend the period of performance to 9/30/2008.
Rev 1	08/01/2006	To extend the period of performance to end 9/30/2007. To closed out task 5.2, "Hardware Curator Service"' as being completed by 9/30/2006. Thus extending only the task 5.1, "Engineering Directorate Communication Coordinator."
Original		

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ06HD60D DO 160 Rev 7	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/Chris Gaspard

Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 06/01/06 – 09/30/2012

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.

Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: 09/23/11
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**ISS Avionics & Software Office Tasks**					
DO	**160 R7**		64			
	Est. Labor Costs				64	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. The orders requirements however take precedence over the contractors proposal

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$3,706,363.79

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ06HD60D-DO160 REV 7

Originator: Robin Osborn (Jacobs) (281) 333-6807 **TMR:** Larry Moon (EA) (281) 483-8178

Revision Summary:
Adds scope for FY12.

1. Title of Effort: ISS Avionics & Software Office Tasks

2. Date of Request: 09/07/2011

3. Statement of Work Task Description

a. **2.1-Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 7

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 06/01/2006 and ends 09/30/2012.

5. Product Requirements

5.1 ISS Avionics & Software Office Services Updated Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Perform the tasks defined in the ISS Avionics & Software Project Plan, OD-2005-001, dated December 1, 2009. Updated Rev 3

5.1.1 ISS Avionics & Software Office Products Updated REV 7

Project Code:

ISS Avionics & Software Office Products as defined in the ISS Avionics & Software Project Plan, OD-2005-001, dated December 1, 2009. All efforts on this Deliver Order will be considered completed to date, except for Computer Resources Systems Engineering services that are required through September 2012. All other future tasks are being transferred either to other contracts or to DO325.

b. **Applicable Documents**

Document Number	Document Name	Rev.
SSP 50287 Added Rev 3	Hardware/Software Acceptance Process	Rev A 05-01
OD-2005-001 Added Rev 3	ISS Avionics & Software Project Plan	G
SSP 50175	ISS Program Risk Management Plan	Most Recent
SSP 50484 Added Rev 3	ISS Avionics & Software Office COFR Implementation Plan	Most Recent

c. **Required DRDs**

5.1.1 ISS Avionics & Software Office Products

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	1/Month
105 Deleted REV 7	Regular Status Report/Summary Review	1/6 Weeks

d. **Products**

5.1.1 ISS Avionics & Software Office Products

Product(s)	Quantity	Delivery Date
6 Weeks Status Report - Covered under DRDs - Future deliveries will be under DO325 Updated REV 7	1/6 weeks	09/15/2010
SPN Status to SPN Manager - Activites completed with Revision 3 Updated REV 7	1/day	01/01/2010
SPN Database Updates - Activites completed with Revision 3 Updated REV 7	1/week	01/01/2010
COFR Endorsements - Activites completed with Revision 3 Updated REV 7	1/bi-monthly	01/01/2010
HSI Summary of Test Activities and Results - Future deliveries will be under DO325 Updated REV 7	1/week	Final delivery on 9/15/2010
C&DH Computer Resources Summary Updated REV 7	1/week	Final delivery on 9/15/2012
SIF Summary Updated REV 7	1/week	Final delivery on 9/15/2012
IDD, PIRN, Hwr Procurement Specification Summary Updated REV 7	1/week	Final delivery on 9/15/2012
COFR, FRR, SORR Endorsement Summary - Activites completed with Revision 4	1/6 weeks	Final delivery on 9/15/2010
COFR Implementation Plan Updates - Activites completed with Revision 3	1/year	01/01/2010
SW Metrics/Predictions Summary - Activites completed with Revision 3	1/month	01/01/2010
IRMA Risk Assessment Summary - Activites completed with Revision 4 Updated REV 7	1/6 weeks	Final delivery on 9/15/2010
ASCB Risk Summary - Activites completed with Revision 3 Updated REV 7	1/week	01/01/2010
PRAB Risk Summary - Activites completed with Revision 3 Updated REV 7	1/6 weeks	01/01/2010
SW Transition Approval Summary - Activites completed with Revision 3 Updated REV 7	1/month	01/01/2010
FCA/PCA Audit Summary - Activites completed with Revision 3 Updated REV 7	22	01/01/2010
IP SIF Summary - Activites completed with Revision 4 Updated REV 7	1/week	Final delivery on 9/15/2010

Delivery Integration Summary - Activites completed with Revision 4	1/week	Final delivery on 9/15/2010
Chit Summary List - Activites completed with Revision 3 Updated REV 7	1/month	01/01/2010
Co-Chair Action Item Database Summary - Activites completed with Revision 3 Updated REV 7	1/week	01/01/2010
SCR Database Summary - Activites completed with Revision 3	1/week	01/01/2010

e. **Product Verification**

5.1.1 ISS Avionics & Software Office Products

i. 6 Weeks Status Report - Covered under DRDs - Future deliveries will be under DO325
- Avionics & Software Manager Review

ii. SPN Status to SPN Manager - Activites completed with Revision 3
- SPN Manager Review

iii. SPN Database Updates - Activites completed with Revision 3
- SPN Manager Review

iv. COFR Endorsements - Activites completed with Revision 3
- SPN Manager Review

v. HSI Summary of Test Activities and Results - Future deliveries will be under DO325
- HSI Manager Review

vi. C&DH Computer Resources Summary
- C&DH Compurter Resources Manager Review

vii. SIF Summary
- C&DH Compurter Resources Manager Review

viii. IDD, PIRN, Hwr Procurement Specification Summary
- C&DH Computer Resources Manager Review

ix. COFR, FRR, SORR Endorsement Summary - Activites completed with Revision 4
- Schedule Integration Manager Review

x. COFR Implementation Plan Updates - Activites completed with Revision 3
- Schedule Integration Manager Review

xi. SW Metrics/Predictions Summary - Activites completed with Revision 3
- Schedule Integration Manager Review

xii. IRMA Risk Assessment Summary - Activites completed with Revision 4
- Technical Assistant Review

xiii. ASCB Risk Summary - Activites completed with Revision 3
- Technical Assistant Review

xiv. PRAB Risk Summary - Activites completed with Revision 3
- Technical Assistant Review

xv. SW Transition Approval Summary - Activites completed with Revision 3
- Avionics & Software Manager Review

xvi. FCA/PCA Audit Summary - Activites completed with Revision 3
- Avionics & Software Manager Review

xvii. IP SIF Summary - Activites completed with Revision 4
- IP Integration Manager Review

xviii. Delivery Integration Summary - Activites completed with Revision 4
- Schedule Integration Manager Review

xix. Chit Summary List - Activites completed with Revision 3
- SPN Manager Review

xx. Co-Chair Action Item Database Summary - Activites completed with Revision 3
- SPN Manager Review

xxi. SCR Database Summary - Activites completed with Revision 3
- Schedule Integration Manager Review

6.0 Cost Summary and Revision History

SLC	Type	CY2	CY3	CY4	CY5	CY6	CY7	CY8	G Total
AS3	Sum of Hours				64				

	Sum of Dollars
EN3	Sum of Hours
	Sum of Dollars
EN4	Sum of Hours
	Sum of Dollars
ESS	Sum of Hours
	Sum of Dollars
IT3	Sum of Hours
	Sum of Dollars
IT4	Sum of Hours
	Sum of Dollars
PC1	Sum of Hours
	Sum of Dollars
PC2	Sum of Hours
	Sum of Dollars
SC1	Sum of Hours
	Sum of Dollars
SC3	Sum of Hours
	Sum of Dollars
SCS	Sum of Hours
	Sum of Dollars
SQM	Sum of Hours
	Sum of Dollars
Total Direct Labor Hours	
Total Direct Labor Costs	
Travel Costs	
Subcontract	
NLR Misc	
Materials	
Burden on Non-Labor	
Total Non Labor	
Total Costs	
Fee	
Total	

64

$3,706,363.79

DO 160 revision history	Total cost	Reason for revision
Original	3,357,875	Original
Revision 1	3,046,547	Updates to requirements and deliverable products
Revision 2	3,044,853	Additional updates to requirements and deliverable products
Revision 3	4,481,718	Reduction in scope and contract extension
Revision 4	3,372,006	Rescope for work completed or transferred to DO325
Revision 5	3,467,721	Rescope for work extended to the end of June, 2011.
Revision 6	3,514,856	Rescope for work extended to the end of September, 2011
Revision 7	3,706,364	Rescope for work extended to the end of September, 2012

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ06HD65D DO 180 R7

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 09/13/2006 – 01/31/2013

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: **03/02/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Constellation Program Technical Analysis and IT Services	64			64	
DO	180 R7					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel /NLR Misc					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference.
However the orders requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
☐COMP ☐PART
Requisition No.: PPC: BC
Reissue To:

13. Total
$ 2,292,142

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ06HD65D-DO180 R7-DO180 REV.7

Originator: Robin Osborn (Jacobs) (281) 333-6807 **TMR:** Larry Moon (EA4) (281) 483-8178

Revision Summary:
Next revision needed for scope change.

1. FROM Title of Effort: Constellation Program Technical Analysis and IT Services Updated REV.7
1. Title of Effort: Spacecraft Conceptual Design Office Services

2. Date of Request: 02/01/2011

3. Statement of Work Task Description

a. **2.1-Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV.7
The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2006 and ends 01/31/2013.

5. Product Requirements

5.1 Technical Analysis Updated REV.7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide advanced system design and engineering services through modeling and simulation development. The contractor shall develop space element concepts through the use of CAD/ProE software for real time integrated design conferences-workshops for the Exploration Mission Systems Office (EMSO). Updated REV.7

5.1.1 Modeling and Simulation Tool Development Updated REV.7
Project Code: ZX

The contractor shall provide advanced system design and engineering services in the development, integration, and validation of various advanced system, design, modeling and simulation tools. This includes planning software development activities, integration of analysis tools obtained from various subject matter experts, and performing VV&A (validation, verification, and accreditation) of the tools. Tool types under consideration include in-space vehicle sizing and performance tools, lunar surface campaign analysis tools, lunar surface rover sizing and performance tools, as well as a host of future system sizers including habitats, power systems, ISRU, etc. For each tool the contractor will develop the appropriate model, perform verification, validation, and accreditation of the tool (as necessary), provide documentation of the VV&A activity, develop a User's Guide, and provide training of the proper operation of the tool.

Products under this subtask are completed with approval of Revision 6.

5.1.2 Rapid CAD Design, Integration & Prototyping Updated REV.7
Project Code: ZL

The contractor shall develop computer aided design models for future exploration systems. The contractor shall provide electronic geometry model parts and assemblies, engineering drawings, and engineering analysis and trade reports and presentation materials. CAD models to be delivered include both vehicle level subsystems layout and configuration models as well as more detailed subsystem assemblies and internal layouts. The contractor shall complete the implementation of the new CAD configuration management system that will reduce the amount of unimportant metadata and correct the process for transitioning from preliminary data to authorized final data.

5.1.3 Lunar Catalog Development Updated REV.7
Project Code: ZX

The contractor shall continue development of a Lunar Concepts Catalog - a publishable document containing all lunar lander concepts developed from the Apollo Lunar Module to the present

Products under this subtask are completed with approval of Revision 6

5.1.4 eXtensible Information Model (XIM) Development Updated REV.7
Project Code: ZL

This modeling database provides access to a central repository of design data used to support engineering design cycles; however, it can be extended to far broader studies. The contractor shall develop and deliver XIM products, including core functional capabilities and user applications. Verification and documentation thereof shall be performed by the contractor on an on-going basis as tools are created. The contractor shall also assist XIM users with operations. This includes training, real-time user support, trouble-shooting, and debugging.

5.1.5 Altair Vehicle Engineering Services Updated REV.7
Project Code: ZX

The contractor shall provide the Altair Vehicle Engineering Manager with documentation of engineering studies, performing limited independent technical studies, including assessments from meetings and technical forums. Contractor shall perform technical trade studies related to lunar lander performance, configuration, and integration to the Constellation transportation architecture. Contractor shall perform documentation of Altair vehicle engineering studies. Contractor shall prepare technical presentations for Altair, Constellation, and public audiences. Contractor shall organize and maintain a database of Altair lander configurations.

Products under this subtask are completed with approval of Revision 6

b. **Applicable Documents**

Document Number	Document Name	Rev.
NASA-STD-2101-91	NASA Software Documentation Standard	7-91
NASA TN D-7045	A Mathematical Procedure for Predicting the Touchdown Dynamics of a Soft-Landing Vehicle	

c. **Required DRDs**

5.1.1 Modeling and Simulation Tool Development

DRD #	DRD Title	Quantity/Frequency
105 Updated Rev 4	Regular Status Report/Summary Review	1 Monthly
215 Updated Rev 4	Software Code	IAW Master Schedule

5.1.2 Rapid CAD Design, Integration & Prototyping

DRD #	DRD Title	Quantity/Frequency
102 Updated REV.7	Engineering Drawings and Model Files	1 set
105 Added Rev 4	Regular Status Report/Summary Review	1 Monthly

5.1.3 Lunar Catalog Development

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 4	Regular Status Report/Summary Review	1 Monthly

5.1.4 eXtensible Information Model (XIM) Development

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 4	Regular Status Report/Summary Review	1 Monthly

5.1.5 Altair Vehicle Engineering Services

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 4	Regular Status Report/Summary Review	1 Monthly
218 Added Rev 5	Engineering Analysis	1

d. **Products**

5.1.1 Modeling and Simulation Tool Development

Product(s)	Quantity	Delivery Date
Source Code, User's Manual, and the functional piece of software Updated REV.7	1	Sept. 1, 2007
Modeling and Simulation Tool Updated REV.7	1	Sept. 1, 2007

5.1.2 Rapid CAD Design, Integration & Prototyping

Product(s)	Quantity	Delivery Date
Analysis/design reports Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
Trade study report and presentation materials Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
Design Analysis Cycle CAD model Updated REV.7	2 per year	IAW Management Plans and Data, DDMS # 0001012160

5.1.3 Lunar Catalog Development

Product(s)	Quantity	Delivery Date
Lunar Catalog Update Updated REV.7	1 set	IAW Management Plans and Data, DDMS #

	0001012160

5.1.4 eXtensible Information Model (XIM) Development

Product(s)	Quantity	Delivery Date
Core functional capability & user applications Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
Matlab scripts to read XIM reports (in Excel format) and output mass property calculations into an Excel workbook for MEL/XIM integration Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
Verification plans and reports Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
User support materials and reports Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
Maintenance releases Updated REV.7	1 update per year	IAW Management Plans and Data, DDMS # 0001012160

5.1.5 Altair Vehicle Engineering Services

Product(s)	Quantity	Delivery Date
Document and organize results of Altair BAA Contractor studies (organize Windchill site, prepare presentation materials documenting follow-on configuration and technical studies for Altair LDAC-5 planning) Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
Trade study and vehicle engineering study documentation/reports Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
Technical presentations for Altair, Constellation, and public audiences Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160
Database of Altair lander configurations Updated REV.7	1 set	IAW Management Plans and Data, DDMS # 0001012160

e. **Product Verification**

5.1.1 Modeling and Simulation Tool Development

i. Source Code, User's Manual, and the functional piece of software

- Written material reviewed and accepted by the NASA Task Technical Manager along with the NASA Task Technical Manager running and verifying the source code

ii. Modeling and Simulation Tool

- Verified (by running a case study) and acceptance by the NASA Task Technical Manager

5.1.2 Rapid CAD Design, Integration & Prototyping

i. Analysis/design reports

- Reviewed and approved by the NASA Task Technical Manager.

ii. Trade study report and presentation materials

- Reviewed and approved by the NASA Task Technical Manager.

iii. Design Analysis Cycle CAD model

- Reviewed and approved by the NASA Task Technical Manager.

5.1.3 Lunar Catalog Development

i. Lunar Catalog Update

- Reviewed and approved by the NASA Task Technical Manager. Updated REV.7

5.1.4 eXtensible Information Model (XIM) Development

i. Core functional capability & user applications

- Test results reviewed and approved by the NASA Task Technical Manager. Updated REV.7

ii. Matlab scripts to read XIM reports (in Excel format) and output mass property calculations into an Excel workbook for MEL/XIM integration

- Test results reviewed and approved by the NASA Task Technical Manager.

iii. Verification plans and reports

- Reviewed and approved by the NASA Task Technical Manager

iv. User support materials and reports

- Reviewed and approved by the NASA Task Technical Manager

v. Maintenance releases

- Reviewed and approved by the NASA Task Technical Manager

5.1.5 Altair Vehicle Engineering Services

i. Document and organize results of Altair BAA Contractor studies (organize Windchill site, prepare presentation materials documenting follow-on configuration and technical studies for Altair LDAC-5 planning)

- Reviewed and approved by the NASA Task Technical Manager. Updated REV.7

ii. Trade study and vehicle engineering study documentation/reports

- Reviewed and approved by the NASA Task Technical Manager. Updated REV.7

iii. Technical presentations for Altair, Constellation, and public audiences

- Reviewed and approved by the NASA Task Technical Manager. Updated REV.7

iv. Database of Altair lander configurations

- Reviewed and approved by the NASA Task Technical Manager. Updated REV.7

5.2 Information Technical Services Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall 1) design/develop/maintain Constellation Web site(s), 2)provide coordination & integration for Systems Engineering ICE applications/tools, 3) ensure IT Security compliance, and 4) provide general IT hardware and software trouble shooting and resolution of NASA personnel IT issues.

Engineering products and services are completed with approval of this Revision 4. Updated Rev 5

5.2.1 Systems Engineering (SE) Services and Systems Engineering Database Management (support under this effort is no longer required) Updated Rev 3

Project Code: ZF/ZB

the contractor shall provide systems engineering (SE) services and SE database management to Constellation Program Systems Engineering and Integration organization by providing:

* database schema management and control, coordination & integration for SE ICE applications/tools, and CMMI coordination, including SE process definition and deployment

* SE process improvement, and SE metrics development

* SE modeling software services using the CRADLE and/or MS Visio software tool(s)

* SE schema deployment services using Protege

* Assessments of design and management software applications including recommendations for any upgrades and/.or implementation of new applications.

5.2.2 General IT (hardware/software) services provided to NASA personnel Updated Rev 3

Project Code: ZB

The contractor shall provide general IT hardware and software trouble shooting and resolution of NASA personnel IT issues. Specifically, the contractor shall set up non-ODIN, NASA owned PC and/or laptop work/analysis stations, load various applications, and trouble shoot operational issues. A record and status of all non-ODIN, ODIN, and NASA owned IT hardware/software shall be maintained. Contractor shall maintain a loaner pool and provide for requesting this equipment. This shall include maintaining proper paperwork for checking out equipment, wipe and reloads of workstations, and assistance in setting up e-mail and dial-in.

5.2.3 Constellation Web Site Development and Maintenance Updated Rev 3
Project Code: ZB

The contractor shall maintain existing Constellation web content in Sharepoint sites and provide the migration into the Constellation Program approved software tool (e.g., Vignette). This shall include backup of existing data and assistance in migrating data into current team sites. The Constellation Program will provide the information to be put onto the Web Site(s). The Web Site(s) shall be uploaded and maintained on a NASA server or ODIN-provided server. The contractor shall avoid duplication of information with other Program-related sites unless specifically directed by the Technical Monitor.

5.2.4 IT Security Updated Rev 3
Project Code: ZB

The contactor ensure the Constellation Program Office meets NASA IT security requirements, protect computer from viruses, and performed security validation for both IT hardware and software in addition to web sites. The contractor shall respond to quarterly request from the Constellation Program Chief Information Officer (EA CIO) as to the status of any security violations (if any) incured and corrective action(s) taken.

5.2.5 Video-Audio Conference Services Updated Rev 5
Project Code: ZB

The contractor shall provide maintenance and operation of conference rooms 1064 and 1066 in Bldg. 17 including scheduling of the rooms using an Outlook Schedule that is available to the technical monitor for evaluation of room usage. The contractor shall coordinate the set up and running of WebEx, Video conferencing, collaborative meetings in bldg. 17 only. WebEx sessions will be scheduled through use of pooled CxPO-provided seat IDs. Any requests for services in other conference rooms shall be approved by the Technical Monitor.

Effective Revision 3, this service is complete.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPD 2800.4	JSC Information Technology (IT) Program Management	03-01
JPG 2800.3	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
NPR 2810.1	Security of Information Technology	08-99

c. **Required DRDs**

5.2.1 Systems Engineering (SE) Services and Systems Engineering Database Management (support under this effort is no longer required)

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/monthly

5.2.2 General IT (hardware/software) services provided to NASA personnel

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/monthly

5.2.3 Constellation Web Site Development and Maintenance

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/monthly

5.2.4 IT Security

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/monthly

5.2.5 Video-Audio Conference Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/Monthly

d. **Products**

5.2.1 Systems Engineering (SE) Services and Systems Engineering Database Management (support under this effort is no longer required)

Product(s)	Quantity	Delivery Date
Status report as to accomplishments along with recommendation concerning inprovements to SE database management and use of appropriate applications/tools	1	Monthly
Development and implementation of software applications/tools	1 set	8/31/07

5.2.2 General IT (hardware/software) services provided to NASA personnel

Product(s)	Quantity	Delivery Date
Database of the IT hardware/software (item/user/location/condition) used by a Constellation personnel	1	Always available on line for NASA Technical Manager to review and to be updated once a month

5.2.3 Constellation Web Site Development and Maintenance

Product(s)	Quantity	Delivery Date
Web Site loaded on a NASA server	1	First version within one month after start of effort and updated bimonthly. Bimonthly Report identifying updated/modified content to web site.

5.2.4 IT Security

Product(s)	Quantity	Delivery Date
Quarterly Constellation CIO Status Report	1	Quarterly, IAW Management Plans and Data, DDMS # 0001012160

5.2.5 Video-Audio Conference Services

Product(s)	Quantity	Delivery Date
Schedule of rooms usage which shall be maintained using Outlook Schedule that is available to the Technical Manager	1	update daily or as needed

e. **Product Verification**

5.2.1 Systems Engineering (SE) Services and Systems Engineering Database Management (support under this effort is no longer required)

i. Status report as to accomplishments along with recommendation concerning improvements to SE database management and use of appropriate applications/tools

- Reviewed and approved by NASA Task Technical Manager

ii. Development and implementation of software applications/tools

- Reviewed and approved by NASA Task Technical Manager

5.2.2 General IT (hardware/software) services provided to NASA personnel

i. Database of the IT hardware/software (item/user/location/condition) used by a Constellation personnel

- Availability on a NASA/JSC server, reviewed and approved by NASA Task Technical Manager

5.2.3 Constellation Web Site Development and Maintenance

i. Web Site loaded on a NASA server

- Being available on a NASA Server, reviewed and approved by the NASA Task Technical Manager

5.2.4 IT Security

i. Quarterly Constellation CIO Status Report

- Report may be in the form of an E-mail (using the recommended JSC CIO format) to the Nasa Task Technical Manager and JSC CIO and accepted by the NASA Technical Manager.

5.2.5 Video-Audio Conference Services

i. Schedule of rooms usage which shall be maintained using Outlook Schedule that is available to the Technical Manager

- Schedule of room usage available via Outlook Scheduling being reviewed and approved by NASA Technical Manager

6.0 Cost Summary & Revision History

DO 180 R7 Summary									
SLC		CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
BS1									
	Sum of Hrs								
	Sum of Dollars								
CM1									
	Sum of Hrs								
	Sum of Dollars								
EN1									
	Sum of Hrs								
	Sum of Dollars								
EN3									
	Sum of Hrs								
	Sum of Dollars								
EN4									
	Sum of Hrs								
	Sum of Dollars								
ESS									
	Sum of Hrs								
	Sum of Dollars								
IT2									
	Sum of Hrs								
	Sum of Dollars								
IT4									
	Sum of Hrs								
	Sum of Dollars								
PC2									
	Sum of Hrs								
	Sum of Dollars								
PC3									
	Sum of Hrs								
	Sum of Dollars								
TN2									
	Sum of Hrs								
	Sum of Dollars								
TN3									
	Sum of Hrs								

Sum of Dollars	
EN2	
Sum of Hrs	
Sum of Dollars	
IT1	
Sum of Hrs	
Sum of Dollars	
IT3	
Sum of Hrs	
Sum of Dollars	
MGR	
Sum of Hrs	
Sum of Dollars	
ZP0	
Sum of Hrs	
Sum of Dollars	
ZP1	
Sum of Hrs	
Sum of Dollars	
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**2,292,142**

b4

Revision History:

DO 180 revision history	Total cost	Reason for revision
Original	666,907	Original Version

Revision 1	548,412	To stop work on subtask 5.2.1 and 5.3.1 "Systems Engineering (SE) Services and SE Database Management" and to add Linux system administration services and the ability to purchase IT hardware or software elements, to be specified at a future date, to subtask 5.2.2 "General IT (hardware/software) services provided to NASA personnel."
Revision 2	745,419	To extend the period of performance through 1/30/2008.
Revision 3	857,119	To extend the period of performance of the work in section 5.1 (Technical Analysis) through 9/30/2008. To update the services to be provided under paragraph 5.2 (Information Technology [IT] Services) and to extend the period of performance for that work through 3/31/2008.
Revision 4	1,568,591	To extend the period of performance of the work in section 5.1 (Technical Analysis) through 1/31/2010. To update the services to be provided under paragraph 5.1 (Technical Analysis) to include three new subtasks: Lunar Catalog Development, eXtensible Information Model (XIM) Development, and Altair Vehicle Engineering Services.
Revision 5	2,495,609	To extend the period of performance through 1/31/2013
Revision 6	1,844,691	To adjust the workload and products for the remainder of the DO.
Revision 7	2,292,142	To adjust the workload and products and extend the period of performance back to 1/31/2013.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ06HD68D DO190 Rev 6

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 09/26/2006 - 01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: **Ray DeVall**

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signature: Adrian D. Clayton Date: **10/28/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**ISS Payloads Office Research Services**					
DO	**190 Rev 6**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total
$21,786,236.01

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ06HD68D-DO190 REV 6

Originator: Robin Osborn (Jacobs) (281) 333-6807 **TMR:** Larry Moon () (281) 483-8178

Revision Summary:
Add comments for changes in Rev. 6

1. Title of Effort: ISS Payloads Office Research Services

2. Date of Request: 10/03/2011

3. Statement of Work Task Description

a. **2.1.4 Website Development**
The contractor shall design, develop, modify, test and install Websites. The contractor shall provide configuration documentation and training on new and modified websites.

b. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

c. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

d. **2.5 Education, Commercialization, and Technology Outreach**
The contractor shall plan and implement educational, commercialization, and technology outreach activities including special projects, curriculum development, demonstrations, displays, seminars, and presentations.

The contractor shall develop outreach materials including brochures, multi-media products, exhibit materials, and newsletters. These materials shall be disseminated through activities including web based and educational forums, and other public events.

e. **2.6 Payload and Research Integration Services**
The contractor shall provide payload and research integration products and services associated with the International Space Station (ISS) which include: strategic-level research planning; tactical-level planning and payload manifesting; and execution-level planning and implementation through console operations and documentation of ISS payload mission accomplishments. The contractor shall produce promotional and educational products related to ISS payloads and research.

f. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 3

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2006 and ends 01/31/2013.

5. Product Requirements

5.1 Research Planning Office Services Updated Rev 3

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide Payload and Research Integration services and deliverables for the International Space Station. Updated Rev 3

5.1.1 Research Planning Updated Rev 4

Project Code: Research Planning

Provide Payload and Research Integration services and deliverables as research program office advocates for program-level issues for the International Space Station. Activities include tactical-level planning and payload manifesting as well as execution-level planning and implementation through console operations and documentation of accomplishments for all payloads flying on the ISS. Provide impact assessments of ISS mission requirements, design and development, and implementations that affect payloads or research utilization as they are presented to ISS Boards.

5.1.2 ISS Payload Planning and Analysis Added Rev 3

Project Code:

Provide Payload Planning and Analysis services and deliverables. Activities include collection, integration, design, and presentation of ISS research status data associated with monthly ISS Research Accommodations Status charts.

5.1.3 Research Execution Services Added Rev 3

Project Code:

Provide real-time mission science management services and deliverables as advocates for the research community.

5.1.4 Postflight Processing of Imagery Products from ISS/Imagery Working Group Added Rev 3

Project Code:

Participate in the review and cataloging of imagery, (US or IP) video and stills (film media or electronic) received from the ISS and distribute relevant research imagery products to the identified owners. Activities include inspection of all ISS imagery to identify and catalog payload imagery and distribution of proprietary and non-restricted imagery per the PIRaTE report.

5.1.5 Customer Helpline Added Rev 3

Project Code:

Man the NASA Payloads Office Customer Service Telephone Hotline by providing answers to ISS process-related questions from Payload Developers, and coordinating engineering and science-related question with the appropriate expertise within the ISS Program.

b. **Applicable Documents**

Document Number	Document Name	Rev.
OZ4-2005-0001 Added Rev 3	Work Instruction for NNJ-BH4-HA7-4-001P	C

c. **Required DRDs**

5.1.1 Research Planning

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
105 Updated Rev 3	Regular Status Report/Summary Review	Weekly

5.1.2 ISS Payload Planning and Analysis

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
105 Added Rev 3	Regular Status Report/Summary Review	Weekly

5.1.3 Research Execution Services

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
105 Added Rev 3	Regular Status Report/Summary Review	Weekly

5.1.4 Postflight Processing of Imagery Products from ISS/Imagery Working Group

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
105 Added Rev 3	Regular Status Report/Summary Review	Weekly

5.1.5 Customer Helpline

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
105 Added Rev 3	Regular Status Report/Summary Review	Weekly

d. **Products**

5.1.1 Research Planning

Product(s)	Quantity	Delivery Date
Integration Services Deleted Rev 2	32 Months	1/31/2010
Research Planning Spreadsheet	4/yr	Per WI OZ4-2005-0001
Increment Payload Candidates Spreadsheet	4/yr	Per WI OZ4-2005-0001
CEF Database Reports Added Rev 2	1/wk	Monday
Research Planning Working Group Website Update	5/wk	Per WI OZ4-2005-0001
CR Database Reports Added Rev 2	1/wk	Monday
RPWG Agendas Added Rev 2	1/wk	Monday
ESA RPWG Agendas	1/wk	Per WI OZ4-2005-0001
JAXA RPWG Agendas	1/wk	Per WI OZ4-2005-0001
Multilateral RPWG Agendas	1/wk	Per WI OZ4-2005-0001
OZ4 Weekly Reports Deleted Rev 3	1/wk	Monday
Postflight Report Database Update Deleted Rev 3	4/yr	iaw OZ4 CCB
OZ4 CR Database Update	1/wk	Per WI OZ4-2005-0001
OZ4 CEF Database Update	1/wk	Per WI OZ4-2005-0001
Console Logs Deleted Rev 3	5/wk	Daily
Daily Science Reports Deleted Rev 3	5/wk	Daily
Weekly Science Summary Deleted Rev 3	1/wk	iaw OZ4 CCB
Crew Time Tracking Reports Deleted Rev 3	1/wk	iaw OZ4 CCB

Increment Contact List Deleted Rev 3	1/Incr	iaw OZ4 CCB
Increment Crew Briefing Presentation Deleted Rev 3	1/Incr	iaw OZ4 CCB
Voluntary Science OCRs Deleted Rev 3	1/wk	iaw OZ4 CCB
Voluntary Science OCA Message Deleted Rev 3	1/wk	iaw OZ4 CCB
OCR Table/Report Deleted Rev 3	5/wk	Daily
LIS Rep Simulation Console Log/Report Deleted Rev 3	2/mo	iaw OZ4 CCB
LIS Console Tool Database Archive Deleted Rev 3	1/Incr	iaw OZ4 CCB
Multilateral Agreements Database	2/yr	Per WI OZ4-2005-0001
Multilateral Agreement Revisions	1/yr	Per WI OZ4-2005-0001
Program Manager's Review Package Deleted Rev 3	2/yr	iaw OZ4 CCB
Increment-based POST Report	1/Incr	Per WI OZ4-2005-0001
STS Return Science Video DVDs Deleted Rev 3	10/flt	iaw OZ4 CCB
Increment-based Still Image DVDs Deleted Rev 3	1/Incr	iaw OZ4 CCB
IWG Status Report	1/mo	Per WI OZ4-2005-0001
MIWG Status Reports	2/yr	Per WI OZ4-2005-0001
BCAT DVDs Deleted Rev 3	2/yr	iaw OZ4 CCB
SOMD Research Program Inputs Added Rev 3	1/mo	Per WI OZ4-2005-0001
ASI Payload Inputs Added Rev 3	1/mo	Per WI OZ4-2005-0001
International Partner Checklists Database updates Added Rev 3	2/yr	Per WI OZ4-2005-0001

5.1.2 ISS Payload Planning and Analysis

Product(s)	Quantity	Delivery Date
ISS Research Accommodation Status chart updates Added Rev 3	1/mo	Per WI OZ4-2005-0001
ISS Monthly Program Review Inputs Added Rev 3	1/mo	Per WI OZ4-2005-0001

5.1.3 Research Execution Services

Product(s)	Quantity	Delivery Date
Console Logs Added Rev 3	5/week	Daily
Postflight Report Database Update Added Rev 3	4/year	Per WI OZ4-2005-0001
Daily Science Reports Added Rev 3	5/week	Daily
Weekly Science Summary Added Rev 3	1/week	Per WI OZ4-2005-0001
Crew Time Tracking Reports Added Rev 3	1/week	Per WI OZ4-2005-0001
Increment Contact List Added Rev 3	1/Incr	Per WI OZ4-2005-0001
Voluntary Science OCRs Added Rev 3	1/week	Per WI OZ4-2005-0001
Voluntary Science OCA Message Added Rev 3	1/week	Per WI OZ4-2005-0001
OCR Table/Report Added Rev 3	5/week	Daily
LIS Rep Simulation Console Log/Report Added Rev 3	2/month	Per WI OZ4-2005-0001
LIS Console Tool Database Archive Added Rev 3	1/Incr	Per WI OZ4-2005-0001

5.1.4 Postflight Processing of Imagery Products from ISS/Imagery Working Group

Product(s)	Quantity	Delivery Date
BCAT DVDs Added Rev 3	2/yr	Per WI OZ4-2005-

		0001
STS Return Science Video DVDs Added Rev 3	10/flight	Per WI OZ4-2005-0001
Increment-based Still Image DVDs Added Rev 3	1/increment	Per WI OZ4-2005-0001
Increment-based POST Report Added Rev 3	1/Incr	Per WI OZ4-2005-0001

5.1.5 Customer Helpline		
Product(s)	**Quantity**	**Delivery Date**
Customer Helpline Logs Added Rev 3	1/week	Monday

e. **Product Verification**

5.1.1 Research Planning

i. Integration Services Deleted Rev 2
- Monthly status reporting and weekly tag-ups Deleted Rev 2

ii. Research Planning Spreadsheet
- Reviewed and accepted by OZ4 Lead

iii. Increment Payload Candidates Spreadsheet
- Reviewed and accepted by OZ4 Lead

iv. CEF Database Reports
- Reviewed and accepted by OZ4 Lead Added Rev 2

v. Research Planning Working Group Website Update
- Reviewed and accepted by OZ4 Lead

vi. CR Database Reports
- Reviewed and accepted by OZ4 Lead Added Rev 2

vii. RPWG Agendas
- Reviewed and accepted by OZ4 Lead Added Rev 2

viii. ESA RPWG Agendas
- Reviewed and accepted by OZ4 Lead

ix. JAXA RPWG Agendas
- Reviewed and accepted by OZ4 Lead

x. Multilateral RPWG Agendas
- Reviewed and accepted by OZ4 Lead

xi. OZ4 Weekly Reports Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xii. Postflight Report Database Update Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xiii. OZ4 CR Database Update
- Reviewed and accepted by OZ4 Lead

xiv. OZ4 CEF Database Update
- Reviewed and accepted by OZ4 Lead

xv. Console Logs Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xvi. Daily Science Reports Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xvii. Weekly Science Summary Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xviii. Crew Time Tracking Reports Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xix. Increment Contact List Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xx. Increment Crew Briefing Presentation Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xxi. Voluntary Science OCRs Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3

xxii. Voluntary Science OCA Message Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3
xxiii. OCR Table/Report Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3
xxiv. LIS Rep Simulation Console Log/Report Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3
xxv. LIS Console Tool Database Archive Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3
xxvi. Multilateral Agreements Database
- Reviewed and accepted by OZ4 Lead
xxvii. Multilateral Agreement Revisions
- Reviewed and accepted by OZ4 Lead
xxviii. Program Manager's Review Package Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3
xxix. Increment-based POST Report
- Reviewed and accepted by OZ4 Lead
xxx. STS Return Science Video DVDs Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3
xxxi. Increment-based Still Image DVDs Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3
xxxii. IWG Status Report
- Reviewed and accepted by OZ4 Lead
xxxiii. MIWG Status Reports
- Reviewed and accepted by OZ4 Lead
xxxiv. BCAT DVDs Deleted Rev 3
- Reviewed and accepted by OZ4 Lead Deleted Rev 3
xxxv. SOMD Research Program Inputs
- Reviewed and accepted by OZ4 Lead Added Rev 3
xxxvi. ASI Payload Inputs
- Reviewed and accepted by OZ4 Lead Added Rev 3
xxxvii. International Partner Checklists Database updates
- Reviewed and accepted by OZ4 Lead Added Rev 3

5.1.2 ISS Payload Planning and Analysis

i. ISS Research Accommodation Status chart updates
- Reviewed and accepted by OZ4 Lead Added Rev 3
ii. ISS Monthly Program Review Inputs
- Reviewed and accepted by OZ4 Lead Added Rev 3

5.1.3 Research Execution Services

i. Console Logs
- Reviewed and accepted by OZ4 Lead Added Rev 3
ii. Postflight Report Database Update
- Reviewed and accepted by OZ4 Lead Added Rev 3
iii. Daily Science Reports
- Reviewed and accepted by OZ4 Lead Added Rev 3
iv. Weekly Science Summary
- Reviewed and accepted by OZ4 Lead Added Rev 3
v. Crew Time Tracking Reports
- Reviewed and accepted by OZ4 Lead Added Rev 3
vi. Increment Contact List
- Reviewed and accepted by OZ4 Lead Added Rev 3
vii. Voluntary Science OCRs
- Reviewed and accepted by OZ4 Lead Added Rev 3
viii. Voluntary Science OCA Message
- Reviewed and accepted by OZ4 Lead Added Rev 3

ix. OCR Table/Report
- Reviewed and accepted by OZ4 Lead Added Rev 3
x. LIS Rep Simulation Console Log/Report
- Reviewed and accepted by OZ4 Lead Added Rev 3
xi. LIS Console Tool Database Archive
- Reviewed and accepted by OZ4 Lead Added Rev 3

5.1.4 Postflight Processing of Imagery Products from ISS/Imagery Working Group
i. BCAT DVDs
- Reviewed and accepted by OZ4 Lead Added Rev 3
ii. STS Return Science Video DVDs
- Reviewed and accepted by OZ4 Lead Added Rev 3
iii. Increment-based Still Image DVDs
- Reviewed and accepted by OZ4 Lead Added Rev 3
iv. Increment-based POST Report
- Reviewed and accepted by OZ4 Lead Added Rev 3

5.1.5 Customer Helpline
i. Customer Helpline Logs
- Reviewed and accepted by OZ4 Lead Added Rev 3

5.2 ISS Payload Planning and Analysis - TERMINATED Updated Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide ISS related Payload planning and analysis services and deliverables.

ALL ACTIVITIES CONTAINED IN THIS SECTION HAVE BEEN REDISTRIBUTED TO OTHER SECTIONS WITHIN THE DELIVERY ORDER. Updated Rev 3

5.2.1 Planning and Analysis services for 32 months Updated Rev 1
Project Code:

32 months of services

b. **Applicable Documents**

Document Number	Document Name	Rev.
OZ-2005-0001 Added Rev 2	Work Instruction for NNJ-BH4-HA7-4-001P	c

c. **Required DRDs**

5.2.1 Planning and Analysis services for 32 months

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Monthly

d. **Products**

5.2.1 Planning and Analysis services for 32 months

Product(s)	Quantity	Delivery Date
Planning and Analysis Services Deleted Rev 2	32 Months	1/31/2010
Activity Report Added Rev 2	1/wk	As Required
IMPR Inputs	1/mo	As Required
ISS Resource Capabilities Major Update	4/yr	As Required
ISS Resource Capabilities Minor Update	150/yr	As Required
Special Study Reports	15/yr	As Required

External NASA Outreach Activities	15/yr	As Required
ESRT Special Studies Added Rev 2	15/yr	As Required
SOMD Research Program Inputs Added Rev 2	1/mo	As Required

e. **Product Verification**

5.2.1 Planning and Analysis services for 32 months

i. Planning and Analysis Services Deleted Rev 2

- Monthly status reporting and weekly tag-ups Deleted Rev 2

ii. Activity Report

- Review and acceptance by OZ4 lead Added Rev 2

iii. IMPR Inputs

- Review and acceptance by Business Office lead

iv. ISS Resource Capabilities Major Update

- Review and acceptance by Program Scientist

v. ISS Resource Capabilities Minor Update

- Review and acceptance by Program Scientist

vi. Special Study Reports

- Review and acceptance by Requesting NASA lead

vii. External NASA Outreach Activities

- Review and acceptance by Program Scientist

viii. ESRT Special Studies

- Review and acceptance by OZ4 lead Added Rev 2

ix. SOMD Research Program Inputs

- Review and acceptance by OZ4 lead Added Rev 2

5.3 ISS Program Scientist Communication Tools Updated REV 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Develop and maintain information on ISS research used within the NASA community, by NASA Headquarters, and Congress.

Effective Revision 6, sections 5.3 is separated into two sections 5.3 and a new section 5.8. "Deleted" content after approval is now covered under section 5.8.
Summary of changes:
In 5.3.3, the Pre and Postflight ISS Research Summaries were moved to Section 5.8. Updated REV 6

5.3.1 Database of ISS Research Objectives Updated REV 6
Project Code:

Develop, maintain and revise the Database of ISS Research objectives of all investigations.

5.3.2 ISS Program Scientist Toolbox Updated REV 6
Project Code:

Develop, maintain and revise the ISS Program Scientist Toolbox.

5.3.3 Public Communications Updated REV 6
Project Code:

Develop draft presentations, social media products, research overviews, and scientific articles, and edit products and coordinate approvals of these products, appropriate to a variety of target audiences.

5.3.4 ISS Science Information on the NASA Web Portal Updated R5BP1
Project Code:

Develop and maintain extracts of the Database of ISS research to provide updated Web page content on ISS research on the public NASA Web Portal. Provide story writing and Web content development for headquarters redesign of NASA.gov and NASA press kits.

5.3.5 Strategic Utilization Planning Updated REV 6

Project Code:

Provide numerical tools and processes to ensure that the ISS resources are modeled, and that limiting resources are identified, and characterized. Provide routine maintenance, upgrades consistent with industry standard software improvements, and on-going performance enhancements for the numerical tools and processes that are developed. Produce ISS research capability and status briefings for internal ISS use, external NASA outreach activities, and in response to specific questions and actions from various government oversight and advisory committees. Conduct surveys and impact assessments across numerous research agencies and programs in order to develop an integrated information package. Conduct special studies of relevant issues, requirements and processes that affect Payloads Office interests by working with the user community, appropriate Space Station working groups or teams, and user sponsors. Produce white papers, study reports and publications that delineate the study results.

5.3.6 Research Capability and Status Briefings - COMBINED WITH 5.3.5 Updated REV 6

Project Code:

Produce ISS research capability and status briefings for internal ISS use, external NASA outreach activities, and in response to specific questions and actions from various government oversight and advisory committees. Conduct surveys and impact assessments across numerous research agencies and programs in order to develop an integrated information package.

5.3.7 Special Studies - COMBINED WITH 5.3.5 Updated REV 6

Project Code:

Conduct special studies of relevant issues, requirements and processes that affect Payloads Office interests by working with the user community, appropriate Space Station working groups or teams, and user sponsors. Produce white papers, study reports and publications that delineate the study results.

5.3.8 Presentation Material - COMBINED WITH 5.3.3 Updated REV 6

Project Code:

Provide specific overviews and presentation material or press briefings.

5.3.9 International Research Products Added R5BP1

Project Code:

Provide services to the Program Science Forum (PSF) to coordinate communication meetings, conferences, product development and implementation.

b. **Applicable Documents**

Document Number	Document Name	Rev.
OZ4-2005-0001 Added Rev 3	Work Instruction for NNJ-BH4-HA7-4-001P	C
SSP 50450 Added Rev 3	Multi-Increment Resupply and Outfitting Manifest	A

c. **Required DRDs**

5.3.1 Database of ISS Research Objectives

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly

105 Updated Rev 3	Regular Status Report/Summary Review	Weekly

5.3.2 ISS Program Scientist Toolbox

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
105 Updated Rev 3	Regular Status Report/Summary Review	Weekly

5.3.3 Public Communications

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 3	No Requirement	
101 Added Rev 3	Project Schedule	Monthly
105 Added Rev 3	Regular Status Report/Summary Review	Weekly

5.3.4 ISS Science Information on the NASA Web Portal

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
105 Added Rev 3	Regular Status Report/Summary Review	Weekly

5.3.5 Strategic Utilization Planning

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly
105 Added Rev 3	Regular Status Report/Summary Review	Weekly

5.3.6 Research Capability and Status Briefings - COMBINED WITH 5.3.5

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 3	Regular Status Report/Summary Review	Weekly

5.3.7 Special Studies - COMBINED WITH 5.3.5

DRD #	DRD Title	Quantity/Frequency
Added Rev 3	No Requirement	

5.3.8 Presentation Material - COMBINED WITH 5.3.3

DRD #	DRD Title	Quantity/Frequency
Added Rev 3	No Requirement	

5.3.9 International Research Products

DRD #	DRD Title	Quantity/Frequency
101 Added R5BP1	Project Schedule	Monthly
105 Added R5BP1	Regular Status Report/Summary Review	Weekly

d. **Products**

5.3.1 Database of ISS Research Objectives

Product(s)	Quantity	Delivery Date
Database Updates Deleted Rev 2	1	Weekly
Database Update - Major - MOVED TO 5.3.2 Updated REV 6	2/Incr	Per WI OZ4-2005-0001
Database Update - Minor critical - MOVED TO 5.3.2 Updated REV 6	250/yr	Per WI OZ4-2005-0001
Database Update - Minor - MOVED TO 5.3.2 Updated REV 6	100/yr	Per WI OZ4-2005-0001
Workflow tracking of pending updates	1	Weekly
IT Development Plan - MOVED TO 5.3.2 Updated REV 6	1/yr	Per WI OZ4-2005-0001
OZ Common Fields Products	1/Incr	Per WI OZ4-2005-0001
Social Media/ Communication Products - MOVED TO 5.3.3 Updated REV 6	2/week	Per WI OZ4-2005-0001
Twitter Account tweets - MOVED TO 5.3.3 Updated REV 6	3/week	Per WI OZ4-2005-0001
Russian Science Summaries reviewed in the Russian database Updated R5BP1	2/yr	Per WI OZ4-2005-0001
Research Priorities Product Compliation Updated R5BP1	1/Incr	Per WI OZ4-2005-0001
Coordinate development of presentation material for crew briefing - MOVED TO 5.3.3 Added R5BP1	2/yr	Per WI OZ4-2005-0001
Provide content for LIS Crew briefings - MOVED TO 5.3.3 Added R5BP1	2/yr	Per WI OZ4-2005-0001

5.3.2 ISS Program Scientist Toolbox

Product(s)	Quantity	Delivery Date
Website Updates Deleted Rev 2	1	Weekly
Experiment and Facility Summaries - MOVED TO 5.3.1 Updated REV 6	30/Incr	Per WI OZ4-2005-0001
Press Briefing Presentations Deleted Rev 3	4/yr	Per WI OZ4-2005-0001
Crew-based Briefing Presentation Deleted Rev 3	2/yr	Per WI OZ4-2005-0001
Increment-based Research Summaries Deleted Rev 3	1/yr	Per WI OZ4-2005-0001
Science Conference Papers Deleted Rev 3	2/yr	Per WI OZ4-2005-0001
Program Science Summaries Deleted Rev 3	1/wk	Per WI OZ4-2005-0001
ISS Science Highlights - MOVED TO 5.3.3 and 5.3.4 Updated REV 6	10/yr	Per WI OZ4-2005-0001
Program Science Forum Face-to-face - MOVED TO 5.3.9 Updated REV 6	2/yr	Per WI OZ4-2005-0001
Program Science Telecon - MOVED TO 5.3.9 Updated REV 6	1/mo	Per WI OZ4-2005-0001
Publication Search and Research Results Update - MOVED TO 5.8 Updated REV 6	2/mo	Per WI OZ4-2005-0001
Science Imagery Review and posting to Toolbox Updated REV 6	2/mo	Per WI OZ4-2005-0001
Science Video Review and posting to Toolbox Updated REV 6	2/mo	Per WI OZ4-2005-0001
ISS Science Facts Update	1/yr	Per WI OZ4-2005-0001
Russian Science Summary Database Update - MOVED TO 5.3.1 Updated REV 6	2/yr	Per WI OZ4-2005-0001
Postflight Report Review Deleted Rev 3	4/yr	Per WI OZ4-2005-0001
Post Increment Priorities to Toolbox Updated REV 6	1/Incr	Per WI OZ4-2005-0001
Disposition of MCB and SSCB actions to Program Science Forum - MOVED TO 5.3.9 Updated REV 6	6/yr	Per WI OZ4-2005-0001

IT Development Plan Updated R5BP1	1/yr	Per WI OZ4-2005-0001
Database Update - Major Updated R5BP1	2/Incr	Per WI OZ4-2005-0001
Database Update - Minor critical Updated R5BP1	250/yr	Per WI OZ4-2005-0001
Database Update - Minor Updated R5BP1	100/yr	Per WI OZ4-2005-0001

5.3.3 Public Communications

Product(s)	Quantity	Delivery Date
ISS Research Summary (Preflight) - MOVED TO 5.8 Updated REV 6	1/Incr	Before each increment
ISS Research Summary (Postflight) - MOVED TO 5.8 Updated REV 6	1/Incr	After each increment
NASA Technical Papers - MOVED TO 5.8 Updated REV 6	1/1.5 yrs	Per WI OZ4-2005-0001
Conference Publications Added Rev 3	2/yr	Per WI OZ4-2005-0001
Metrics Charts Updated REV 6	2/yr	Per WI OZ4-2005-0001
Crew-based Briefing Presentation (moved to section 5.3.8)	2/yr	Per WI OZ4-2005-0001
Twitter Accounts Tweets Updated R5BP1	3/week	Per WI OZ4-2005-0001
Blog Entries on NASA.gov ISS Research & Technology Pages Updated R5BP1	2/month	Per WI OZ4-2005-0001
Post New Web Stories for NASA.gov ISS Research & Technology Pages Updated R5BP1	1/week	Per WI OZ4-2005-0001
Coordinate web stories with other centers and agencies Updated R5BP1	2/week	Per WI OZ4-2005-0001
PAO Press Kit Inputs Updated R5BP1	1/Incr and 1/Launch	Per WI OZ4-2005-0001
Posting of Bulletin Boards in OZ regarding science activities on ISS Updated R5BP1	1/week	Per WI OZ4-2005-0001
Processing photo/video requests Updated R5BP1	2/month	Per WI OZ4-2005-0001
Provide weekly digest to LIS (based on week's stories) Updated R5BP1	1/week	Per WI OZ4-2005-0001
Maintenance of Toolbox Astronaut Communications Page Updated R5BP1	1/week	Per WI OZ4-2005-0001
Tracking Matrix of PAO stories Updated R5BP1	1/month	Per WI OZ4-2005-0001
Compile materials for press briefings Updated R5BP1	1/Incr	Per WI OZ4-2005-0001
Coordinate development of presentation material for crew briefings Updated R5BP1	2/yr	Per WI OZ4-2005-0001

5.3.4 ISS Science Information on the NASA Web Portal

Product(s)	Quantity	Delivery Date
Website Update - Major Added Rev 3	4/yr	Per WI OZ4-2005-0001
Website Update - Minor Added Rev 3	150/yr	Per WI OZ4-2005-0001
Web content update of 4 pages or stories	Monthly	Per WI OZ4-2005-0001
Posting of updated ISS Database Research Summaries to NASA.gov Updated R5BP1	weekly	Per WI OZ4-2005-0001

5.3.5 Strategic Utilization Planning

Product(s)	Quantity	Delivery Date
Statistical Models of Resource Use and Limits Added Rev 3	2/yr	Per WI OZ4-2005-0001

5.3.6 Research Capability and Status Briefings - COMBINED WITH 5.3.5

Product(s)	Quantity	Delivery Date
ISS Resource Capabilities - Major Update - MOVED TO 5.3.5 Updated REV 6	1/yr	Per WI OZ4-2005-0001
ISS Resource Capabilities - Minor Update - MOVED TO 5.3.5 Updated REV 6	2/yr	Per WI OZ4-2005-0001
Updates to SSP50450 - MOVED TO 5.3.5 Updated REV 6	1/yr	Per WI OZ4-2005-0001
Updates to Consolidated Operations and Usage Plan - MOVED TO 5.3.5 Updated REV 6	1/yr	Per WI OZ4-2005-0001
External NASA Outreach Activities - MOVED TO 5.3.3 Updated REV 6	15/yr	Per WI OZ4-2005-0001

5.3.7 Special Studies - COMBINED WITH 5.3.5

Product(s)	Quantity	Delivery Date
Special study white paper - MOVED TO 5.3.5 Updated REV 6	1/yr	Per WI OZ4-2005-0001
Reports, bulletin boards, specialized metrics - MOVED TO 5.3.3 Updated REV 6	1/month	Per WI OZ4-2005-0001

5.3.8 Presentation Material - COMBINED WITH 5.3.3

Product(s)	Quantity	Delivery Date
Press briefings - MOVED TO 5.3.3 Updated REV 6	2/yr	Per WI OZ4-2005-0001
Crew-based Briefing Presentation - MOVED TO 5.3.3 Updated REV 6	2/yr	Per WI OZ4-2005-0001
Increment-based Research Summary - MOVED TO 5.3.3 Updated REV 6	1/Yr	Per WI OZ4-2005-0001

5.3.9 International Research Products

Product(s)	Quantity	Delivery Date
MCB and SSCB requested products and actions from PSF Added R5BP1	6/yr	Per WI OZ4-2005-0001
PSF Meeting Agenda development and dissemination Added R5BP1	1/month	Per WI OZ4-2005-0001
Compilation and dissemination of PSF Meeting Minutes and Actions Added R5BP1	1/month	Per WI OZ4-2005-0001
Maintain PSF Website pages Added R5BP1	1/month	Per WI OZ4-2005-0001
Metrics Validation With International Partners Added R5BP1	2/yr	Per WI OZ4-2005-0001

e. **Product Verification**

5.3.1 Database of ISS Research Objectives

i. Database Updates Deleted Rev 2

- Database information will be periodically checked for quality and timeliness Deleted Rev 2

ii. Database Update - Major - MOVED TO 5.3.2

- Review and acceptance by Program Scientist

iii. Database Update - Minor critical - MOVED TO 5.3.2

- Review and acceptance by Program Scientist

iv. Database Update - Minor - MOVED TO 5.3.2

- Review and acceptance by Program Scientist

v. Workflow tracking of pending updates

- Review and acceptance by Program Scientist

vi. IT Development Plan - MOVED TO 5.3.2

- Review and acceptance by Program Scientist

vii. OZ Common Fields Products
- Review and acceptance by Program Scientist
viii. Social Media/ Communication Products - MOVED TO 5.3.3
- Review and acceptance by Program Scientist
ix. Twitter Account tweets - MOVED TO 5.3.3
- Review and acceptance by Program Scientist
x. Russian Science Summaries reviewed in the Russian database
- Review and acceptance by Program Scientist Updated R5BP1
xi. Research Priorities Product Compliation
- Review and acceptance by Program Scientist Updated R5BP1
xii. Coordinate development of presentation material for crew briefing - MOVED TO 5.3.3
- Review and acceptance by Program Scientist Added R5BP1
xiii. Provide content for LIS Crew briefings - MOVED TO 5.3.3
- Review and acceptance by Program Scientist Added R5BP1

5.3.2 ISS Program Scientist Toolbox

i. Website Updates Deleted Rev 2
- Database updates are incorporated into the website within 24 hours. Site remains online and accessible during regular business hours. Deleted Rev 2

ii. Experiment and Facility Summaries - MOVED TO 5.3.1
- Review and acceptance by Program Scientist

iii. Press Briefing Presentations Deleted Rev 3
- Review and acceptance by Program Scientist Deleted Rev 3

iv. Crew-based Briefing Presentation Deleted Rev 3
- Review and acceptance by Program Scientist Deleted Rev 3

v. Increment-based Research Summaries Deleted Rev 3
- Review and acceptance by Program Scientist Deleted Rev 3

vi. Science Conference Papers Deleted Rev 3
- Review and acceptance by Program Scientist Deleted Rev 3

vii. Program Science Summaries Deleted Rev 3
- Review and acceptance by Program Scientist Deleted Rev 3

viii. ISS Science Highlights - MOVED TO 5.3.3 and 5.3.4
- Review and acceptance by Program Scientist

ix. Program Science Forum Face-to-face - MOVED TO 5.3.9
- Review and acceptance by Program Scientist

x. Program Science Telecon - MOVED TO 5.3.9
- Review and acceptance by Program Scientist

xi. Publication Search and Research Results Update - MOVED TO 5.8
- Review and acceptance by Program Scientist

xii. Science Imagery Review and posting to Toolbox
- Review and acceptance by Program Scientist

xiii. Science Video Review and posting to Toolbox
- Review and acceptance by Program Scientist

xiv. ISS Science Facts Update
- Review and acceptance by Program Scientist

xv. Russian Science Summary Database Update - MOVED TO 5.3.1
- Review and acceptance by Program Scientist

xvi. Postflight Report Review Deleted Rev 3
- Review and acceptance by Program Scientist Deleted Rev 3

xvii. Post Increment Priorities to Toolbox
- Review and acceptance by Program Scientist

xviii. Disposition of MCB and SSCB actions to Program Science Forum - MOVED TO 5.3.9
- Review and acceptance by Program Scientist

xix. IT Development Plan
- Review and acceptance by Program Scientist Updated R5BP1

xx. Database Update - Major
- Review and acceptance by Program Scientist Updated R5BP1

xxi. Database Update - Minor critical

- Review and acceptance by Program Scientist Updated R5BP1

xxii. Database Update - Minor

- Review and acceptance by Program Scientist Updated R5BP1

5.3.3 Public Communications

i. ISS Research Summary (Preflight) - MOVED TO 5.8

- Review and acceptance by Program Scientist Updated REV 6

ii. ISS Research Summary (Postflight) - MOVED TO 5.8

- Review and acceptance by Program Scientist Updated REV 6

iii. NASA Technical Papers - MOVED TO 5.8

- Review and acceptance by Program Scientist

iv. Conference Publications

- Review and acceptance by Program Scientist Added Rev 3

v. Metrics Charts

- Review and acceptance by Program Scientist

vi. Crew-based Briefing Presentation (moved to section 5.3.8)

- Review and acceptance by Program Scientist

vii. Twitter Accounts Tweets

- Review and acceptance by Program Scientist Updated R5BP1

viii. Blog Entries on NASA.gov ISS Research & Technology Pages

- Review and acceptance by Program Scientist Updated R5BP1

ix. Post New Web Stories for NASA.gov ISS Research & Technology Pages

- Review and acceptance by Program Scientist Updated R5BP1

x. Coordinate web stories with other centers and agencies

- Review and acceptance by Program Scientist Updated R5BP1

xi. PAO Press Kit Inputs

- Review and acceptance by Program Scientist Updated R5BP1

xii. Posting of Bulletin Boards in OZ regarding science activities on ISS

- Review and acceptance by Program Scientist Updated R5BP1

xiii. Processing photo/video requests

- Review and acceptance by Program Scientist Updated R5BP1

xiv. Provide weekly digest to LIS (based on week's stories)

- Review and acceptance by Program Scientist Updated R5BP1

xv. Maintenance of Toolbox Astronaut Communications Page

- Review and acceptance by Program Scientist Updated R5BP1

xvi. Tracking Matrix of PAO stories

- Review and acceptance by Program Scientist Updated R5BP1

xvii. Compile materials for press briefings

- Review and acceptance by Program Scientist Updated R5BP1

xviii. Coordinate development of presentation material for crew briefings

- Review and acceptance by Program Scientist Updated R5BP1

5.3.4 ISS Science Information on the NASA Web Portal

i. Website Update - Major

- Review and acceptance by Program Scientist Added Rev 3

ii. Website Update - Minor

- Review and acceptance by Program Scientist Added Rev 3

iii. Web content update of 4 pages or stories

- Review and acceptance by Program Scientist

iv. Posting of updated ISS Database Research Summaries to NASA.gov

- Review and acceptance by Program Scientist Updated R5BP1

5.3.5 Strategic Utilization Planning

i. Statistical Models of Resource Use and Limits

- Review and acceptance by Program Scientist Added Rev 3

5.3.6 Research Capability and Status Briefings - COMBINED WITH 5.3.5

i. ISS Resource Capabilities - Major Update - MOVED TO 5.3.5

- Review and acceptance by Program Scientist

ii. ISS Resource Capabilities - Minor Update - MOVED TO 5.3.5

- Review and acceptance by Program Scientist

iii. Updates to SSP50450 - MOVED TO 5.3.5

- Review and acceptance by Program Scientist

iv. Updates to Consolidated Operations and Usage Plan - MOVED TO 5.3.5

- Review and acceptance by Program Scientist

v. External NASA Outreach Activities - MOVED TO 5.3.3

- Review and acceptance by Program Scientist

5.3.7 Special Studies - COMBINED WITH 5.3.5

i. Special study white paper - MOVED TO 5.3.5

- Review and acceptance by Program Scientist

ii. Reports, bulletin boards, specialized metrics - MOVED TO 5.3.3

- Review and acceptance by Program Scientist

5.3.8 Presentation Material - COMBINED WITH 5.3.3

i. Press briefings - MOVED TO 5.3.3

- Review and acceptance by Program Scientist

ii. Crew-based Briefing Presentation - MOVED TO 5.3.3

- Review and acceptance by Program Scientist

iii. Increment-based Research Summary - MOVED TO 5.3.3

- Review and acceptance by Program Scientist

5.3.9 International Research Products

i. MCB and SSCB requested products and actions from PSF

- Review and acceptance by Program Scientist Added R5BP1

ii. PSF Meeting Agenda development and dissemination

- Review and acceptance by Program Scientist Added R5BP1

iii. Compilation and dissemination of PSF Meeting Minutes and Actions

- Review and acceptance by Program Scientist Added R5BP1

iv. Maintain PSF Website pages

- Review and acceptance by Program Scientist Added R5BP1

v. Metrics Validation With International Partners

- Review and acceptance by Program Scientist Added R5BP1

5.4 National Laboratory Office Services Updated Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall assess and define Payload services and deliverables required by Lab users and provide recommendations in resolving program-level issues for the International Space Station. Updated Rev 3

5.4.1 National Lab Research Services Updated Rev 3
Project Code:

For National Lab payloads, coordinate and integrate data from user sponsors, payload developers, and users toward development of integrated payload data necessary for inclusion into the payload planning and integration process.

5.4.2 National Lab Payload Integrated Data Added Rev 3
Project Code:

For DoD and Education payloads, coordinate and integrate data from with user sponsors, payload developers and users to develop integrated payload data necessary for inclusion into the payload planning and integration process.

b. **Applicable Documents**

Document Number	Document Name	Rev.
OZ4-2005-0001 Added Rev 2	Work Instruction for NNJ-BH4-HA7-4-001P	C

c. **Required DRDs**

5.4.1 National Lab Research Services

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 3	No Requirement	
101 Added Rev 3	Project Schedule	1/mo
105 Added Rev 3	Regular Status Report/Summary Review	1/wk

5.4.2 National Lab Payload Integrated Data

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	1/mo
105 Added Rev 3	Regular Status Report/Summary Review	1/wk

d. **Products**

5.4.1 National Lab Research Services

Product(s)	Quantity	Delivery Date
Payload Development Tracking List Updates	2/mo	per WI OZ4-2005-0001
Payload Implementation Matrix Updates Added Rev 3	2/mo	per WI OZ4-2005-0001

5.4.2 National Lab Payload Integrated Data

Product(s)	Quantity	Delivery Date
Payload Candidate List Updates Added Rev 3	1/incr	per WI OZ4-2005-0001
Payload Tactical Plan Updates Added Rev 3	1/Incr	per WI OZ4-2005-0001

e. **Product Verification**

5.4.1 National Lab Research Services

i. Payload Development Tracking List Updates

- Review and approval by OZ National Lab lead

ii. Payload Implementation Matrix Updates

- Review and approval by OZ National Lab lead Added Rev 3

5.4.2 National Lab Payload Integrated Data

i. Payload Candidate List Updates

- Review and approval by NASA lead Added Rev 3

ii. Payload Tactical Plan Updates

- Review and approval by NASA lead Added Rev 3

5.5 Business Office Services Updated Rev 3

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall Provide overall management of all services provided to the ISS Payloads Office, including management of contract schedule and cost. Updated Rev 3

5.5.1 Status Reporting Updated Rev 3
Project Code:
Report to the customer the status of all aspects of work tasks comprising the elements performed as functions of project management.

5.5.2 Customer Feedback Interviews Added Rev 3
Project Code:
Perform telephone interview with Principal Investigators and Payload Developers who had research on the most recent ISS Increment. Maintain raw results, compile simple statistical analysis of results and develop a report and presentation for each Increment summary.

b. **Applicable Documents**

Document Number	Document Name	Rev.
OZ4-2005-0001 Added Rev 2	Work Instruction for NHJ-BH4-HA7-4-001P	C

c. **Required DRDs**

5.5.1 Status Reporting

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	1/mo
105 Updated Rev 3	Regular Status Report/Summary Review	1/mo

5.5.2 Customer Feedback Interviews

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	1/mo
105 Added Rev 3	Regular Status Report/Summary Review	1/wk

d. **Products**

5.5.1 Status Reporting

Product(s)	Quantity	Delivery Date
Presentation to OZ Management Deleted Rev 3	1/ISS Increment	within 6 weeks of End of Increment
Increment Customer Satisfaction Report Deleted Rev 3	1/ISS Incr	within 8 weeks of End of Incr

5.5.2 Customer Feedback Interviews

Product(s)	Quantity	Delivery Date
Increment Customer Satisfaction Report Added Rev 3	1/Inc	within 8 weeks of End of Incr
Presentation to OZ Management Added Rev 3	1/Inc	within 6 weeks of End of Increment

e. **Product Verification**

5.5.1 Status Reporting

i. Presentation to OZ Management Deleted Rev 3
- Preview and acceptance by Business Office lead Deleted Rev 3

ii. Increment Customer Satisfaction Report Deleted Rev 3
- Acceptance by Business Office lead Deleted Rev 3

5.5.2 Customer Feedback Interviews

i. Increment Customer Satisfaction Report

- Review and acceptance by Business Office lead Added Rev 3

ii. Presentation to OZ Management

- Review and acceptance by Business Office lead Added Rev 3

5.6 High School Students United with NASA to Create Hardware (HUNCH) Updated REV 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall shall develop a project plan for OZ implementation of the HUNCH Program, which shall include hardware and soft goods development, prototype design concepts development (beginning in FY12), and national lab experiment projects.

Material dollars shall be required for the acquisition of raw stock materials, both metallic and non-metallic. Material dollars shall also be used for the offsite manufacture and assembly of component parts to be integrated into assemblies for developmental testing and upgrade for flight deliveries. Updated REV 6

5.6.1 HUNCH Planning Updated REV 6
Project Code:

The project plan shall include consideration and coordination with HUNCH selected schools' administration and teachers assigned to oversee HUNCH projects to ensure class capabilities and NASA requirements are met. The contractor shall also identify the materials, consumables, fabrication aids and documentation (drawings, 881 ....) that each project will require.

5.6.2 HUNCH Implementation Updated Rev 5
Project Code:

Upon approval of the HUNCH project plan, the contractor shall implement the HUNCH project plan to meet OZ educational outreach objectives for the HUNCH Program.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 4	HUNCH Quality Plan	
A-A-50195A Added Rev 4	Commercial Item Description Thread, ARAMID	A
CSD-A-533 Added Rev 4	Inspection and Acceptance Criteria for Stitches, Seams and Stitching	B
D6193-97 Added Rev 4	Standard Practice for Stitches and Seams	97
DD1149 Added Rev 4	Requisition and Invoice/Shipping Document	
JF1225C Added Rev 4	Task Performance Sheet	
JF290 Added Rev 4	Shipping Document	

c. **Required DRDs**

5.6.1 HUNCH Planning

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 4	Project Schedule	1/month/project

5.6.2 HUNCH Implementation

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 4	Regular Status Report/Summary Review	1/month/project

d. **Products**

5.6.1 HUNCH Planning

Product(s)	Quantity	Delivery Date
Project Plan Updated REV 6	1/project	Sept 20
Prototype Concepts Development Plan Added Rev 5	1/project	Sept 20

5.6.2 HUNCH Implementation

Product(s)	Quantity	Delivery Date
Activity Report Updated REV 6	1	weekly as agreed w/ NASA
School Year Start-up Metrics Updated REV 6	1	September 20 each year
School Year Conclusion Metrics Updated REV 6	1	May 6 each year
List of participating students and teacher names/Teacher contact information Updated REV 6	1/project	September 20 each year
Photo release for each student and teacher Updated REV 6	1/participant	September 20
HUNCH Impact story Updated REV 6	5/year	iaw HUNCH Project Plan
Student HUNCH Project Plan Updated REV 6	1/project	May 1
Quality Paper Work, 1149, TPS, 290, 881 ... Updated REV 6	1 set/proj	iaw HUNCH Project Plan
Arrange NASA Tour for each class Added Rev 4	1/class	November 20
Prototype Concept Presentation Added Rev 5	1/project	iaw HUNCH Project Plan
Prototype Documentation Added Rev 5	1/project	Upon concept approval

e. **Product Verification**

5.6.1 HUNCH Planning

i. Project Plan

- Review and acceptance by HUNCH Program manager

ii. Prototype Concepts Development Plan

- Acceptance of plan by HUNCH Program manager Added Rev 5

5.6.2 HUNCH Implementation

i. Activity Report

- Review and acceptance by HUNCH Program manager

ii. School Year Start-up Metrics

- Review and acceptance by HUNCH Program manager

iii. School Year Conclusion Metrics

- Review and acceptance by HUNCH Program manager

iv. List of participating students and teacher names/Teacher contact information

- Review and acceptance by HUNCH Program manager

v. Photo release for each student and teacher

- Review and acceptance by HUNCH Program manager

vi. HUNCH Impact story

- Review and acceptance by HUNCH Program manager

vii. Student HUNCH Project Plan

- Review and acceptance by HUNCH Program manager

viii. Quality Paper Work, 1149, TPS, 290, 881 ...

- Review and acceptance by HUNCH Program manager and NASA Quality and Flight Equipment

ix. Arrange NASA Tour for each class

- Acceptance of plan by HUNCH Program manager Added Rev 4

x. Prototype Concept Presentation

- Acceptance of plan by HUNCH Program manager Added Rev 5

xi. Prototype Documentation

- Acceptance of plan by HUNCH Program manager Added Rev 5

5.7 ISS High Definition Earth Viewing (HDEV) Payload Development and Integration Updated R5B1P2

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall Integrate multiple COTS HD cameras (up to 4) onto a Columbus External Payload Adapter (CEPA) as a payload to provide continuous video downlink and evaluate the longevity of the COTS cameras to support NASA-OD HDTV development.

The following requirments apply to the development of the HDEV hardware.

Design
? The contractor shall conduct at least two design reviews at the appropriate time utilizing contractor process and format.
? The contractor shall provide all required information to the Payload Safety Review Panel (PSRP) to document hazards, controls and verifications to meet PSRP requirements.
Drafting
? The contractor shall utilize JPR 8500.4 as a guideline only and capture all drawings that baseline the design within the Engineering Drawing System.
? The contractor shall utilize reduced dimension mechanical drawings, but as a minimum, all dimensions affecting interfaces and/or hazard controls shall be defined.
? The contractor shall utilize EDCC for control of drawings. It is acceptable for the contractor to utilize a redline review and approval process during design, manufacturing, and assembly. All redlines shall be incorporated after hardware testing is completed.

Documentation
? The contractor shall utilize a unique contractor document numbering system.
? The contractor shall utilize internal processes for configuration control. All documentation shall be maintained and controlled on an internal project collaboration site. All changes after the beginning of the certification test program shall be approved by the contractor management team. All non-conformances against project hardware, software, or firmware shall be tracked via internally controlled project documentation

Procurement
? The contractor shall procure EEE parts from an approved supplier, when possible.
? The contractor shall procure all safety critical parts with a CofC. Safety critical parts are those components, materials, or piece parts (i.e. thermostats, electrical power wire, circuit protection devices, fasteners, structural components.) implemented in the design as hazard controls and that require verification of the function and/or design to ensure safety.
? All procurements other than safety critical items shall not require traceability. Any trace data provided by the vendor will be maintained by the project.
? The contractor shall utilize internal specialists for guidance and recommendations of electronics parts selection and de-rating. All electrical wire and size 8 or greater fasteners external to COTS assemblies shall be lot tested at the Receiving Inspection and Test Facility (RITF)

Manufacturing, Fabrication & Assembly
? The contractor shall utilize the build-to-model process where applicable.
? The contractor shall internal Quality Assurance for inspection of critical dimensions and safety critical installations. These include but are not limited to interfaces to the Columbus External Payload Adapter (CEPA), fabrication/assembly of safety critical components and piece parts, and other inspection points as determined necessary by the project.
? All assembly shall be conducted using internally controlled project documentation. Internal in-line Quality Assurance shall verify the configuration is built per print.
? All assembly specific information, including torque values, shall be documented on a Subassembly Process Sheet with participation by contractor quality assurance
? Lot traceability shall be maintained, if available, throughout the assembly process. The project shall document all parts used for the build in the appropriate work authorization document.
? Changes to the configuration after the beginning of the certification test program shall require approval by the contractor management team.

Hardware and Firmware Platform
? The end item shall be identified with a nameplate or marking containing the drawing number (top-level assembly and serial number). A Contractor Parts Tag shall be affixed to major hardware assemblies as identified by the project.
? The hardware, firmware and software deliverables shall be classified as a payload at delivery.
? Configuration management shall be achieved using internally controlled project documentation.
? Serial numbers shall be assigned and certified by JSC Engineering Drawing Control Center.
? The project hardware shall be kept in limited access areas and in access controlled storage lockers.

Software and Firmware Code
? Payload software and firmware code shall be identified through the contents of the project configuration document.
? The configuration document shall record the controlled versions of each Computer Software Configuration Item (CSCI) that may be loaded on the end item.
? The hardware assembly drawing with the end item containing the software shall include a reference to the project configuration document for tracking software versions to the end item. The project configuration document is updated each time a new version of a CSCI is updated and released to describe the changes from the previous release.
? Configuration control and accounting of software configuration items begins no later than the start of certification testing. Prior to the certification testing, software configuration control is at the discretion of the contractor. Changes to software and/or firmware code after the software has been baselined, are identified, tracked, and processed through the project configuration document.
? A unique software release or version number shall be used to identify each version or revision of the software.
? Any modifications to the software installed on the payload unit shall be approved by the contactor.
? Identification of electronic files shall be performed by annotating the file with a unique title (can be same as file name) and date.
? Controlled electronic files shall be saved on a file server in an area where only the configuration manager has access to update the file. Release of files shall be accomplished by saving the latest approved copy on the server.

Testing
? Contractor Quality Assurance shall be utilized when performing certification testing and any system level safety related testing.
Verifications

? The safety related, program level, and project levied requirement verification approach shall be approved by the contractor, and OZ project management.
? The contractor shall produce verification definition sheets to detail completion of all verifications.
? The HDEV payload shall undergo a system functional performance test prior to integration with the CEPA. Hardware shall be upgraded to flight upon successful completion of this testing.

Delivery
? The contractor shall deliver the HDEV Payload Unit on a Material Inspection and Receiving Report Form DD250.
? Project documentation shall be delivered in the Design & Data Management System (DDMS), including but not limited to:
o A data package consisting of project generated verification definition sheets with supporting documentation, mechanical models and the Safety Data Package.
? Drawings shall be available in EDCC.

Unless specified as Applicable to this subtask, the documents listed in the Applicable Documents section below are considered Not Applicable for this subtask. NASA has considered the requirements in these documents as Not Applicable for development of the HDEV hardware.

NASA is responsible for the COFR and all follow-on activities once the hardware has been delivererd. The Government Furnished Parts (ie. CEPA) shall be delivered to the contractor per the Integrated Master Schedule. The CEPA shall be controlled to retain that flight status during the integration of the HDEV hardware to the CEPA. Certification of the CEPA is dependent on NASA Certification. Updated R5B1P2

5.7.1 Certify Payload Camera Hardware Accessories Added Rev 5
Project Code:

Contractor shall provide engineering, analysis, and drawings to certify camera hardware accessories to meet payload operation and certification.

5.7.2 Acceptance test, configure, and deliver payload and engineering hardware Updated R5B1P2
Project Code:

Contractor shall perform acceptance test, assembly, configure and deliver hardware for payload operations.

5.7.3 Integration processing Updated R5B1P2
Project Code:

The contractor shall perform preventive maintenance, integration processing, and delivery of the hardware for the HDEV Payload per the approved payload processing plan as called out in the applicable documents section.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added R5BP1	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-025 Added R5BP1	GFE Flight Project Software and Firmware Development	Rev A 11-01
JSC 26549 Added R5BP1	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 28035 Added R5BP1	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 61360 Added R5BP1	Engineering Directorate Certified Parts Approval Process	Revi A
MIL-STD-973 Added R5BP1	Configuration Control	Notice 4
NPR 8735.1 Added R5BP1	Procedures for Exchanging Parts, Materials, and Safety Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories	Rev A 08-02
SSP 30423 Added R5BP1	Space Stations Approved Electrical, Electronic, and Electromechanical Parts List	Rev F 11-95
SSP 30524 Added R5BP1	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
SSP 30695 Added R5BP1	Acceptance Data Package Requirements Specification	Rev A 01-95

SSP 50287 Added R5BP1	Hardware/Software Acceptance Process	Rev A 05-01
COL-RIBRE-SPE-0165 Added R5BP1	Columbus External Payloads Interface Requirements Document - APPLICABLE	Issue 1B
ESCG-4107-11-PMGAS-DOC-0060 Added R5BP1	High Definition Earth Viewing (HDEV) Payload Processing Plan - APPLICABLE	
JPR 8500.4 Added R5B1P2	Engineering Drawing System Manual	
NT-CWI-001 Added R5B1P2	Task Performance Sheet (TPS)	
NT-CWI-003 Added R5B1P2	Quality Assurance Record Center Discrepancy Reporting and Tracking	
OZ4-2005-0001 Added R5BP1	Work Instruction for NNJ-BH4-HA7-4-001P - APPLICABLE	D
SSP57012 Added R5B1P2	ISS FRAM Based Payload Common Launch Interface Requirements Document - APPLICABLE	

c. **Required DRDs**

5.7.1 Certify Payload Camera Hardware Accessories

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 5	Project Schedule	Monthly
102 Added Rev 5	Engineering Drawings and Model Files	1 set
105 Added Rev 5	Regular Status Report/Summary Review	Monthly
206 Deleted R5BP1	Flight Products Interface Control Document (ICD)	1
218 Added Rev 5	Engineering Analysis	1 set
235 Added Rev 5	Space Station Payload Safety Data Package	1

5.7.2 Acceptance test, configure, and deliver payload and engineering hardware

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 5	Project Schedule	Monthly
105 Added Rev 5	Regular Status Report/Summary Review	Monthly

5.7.3 Integration processing

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 5	Project Schedule	Monthly
105 Added Rev 5	Regular Status Report/Summary Review	Monthly

d. **Products**

5.7.1 Certify Payload Camera Hardware Accessories

Product(s)	Quantity	Delivery Date
Engineering Drawings and Model Files Updated R5B1P2	1 set	Per the Integrated Master Schedule
Verification Matrix Updated R5B1P2	1	Per the Integrated Master Schedule
Payload Data Package Updated R5B1P2	1	Per the Integrated Master Schedule
Project Requirements Document Updated R5B1P2	1	Per the Integrated Master Schedule
HDEV Payload Processing Plan Updated R5B1P2	1	Per the Integrated Master Schedule
HDEV Structural Verification Plan Updated R5B1P2	1	Per the Integrated Master Schedule
HDEV Payload Safety Data Package Updated R5B1P2	1	Per the Integrated Master Schedule

5.7.2 Acceptance test, configure, and deliver payload and engineering hardware

Product(s)	Quantity	Delivery Date
Camera Assembly Updated R5B1P2	2 sets of each camera selected	Per the Integrated Master Schedule
Encoder/Electronics Assembly Updated R5B1P2	2 each	Per the Integrated Master Schedule

5.7.3 Integration processing

Product(s)	Quantity	Delivery Date
Certified HDEV Payload Hardware Updated R5B1P2	1 set	Per the Integrated Master Schedule
CEPA Integration Hardware Added Rev 5	1 set	Per the Integrated Master Schedule

e. **Product Verification**

5.7.1 Certify Payload Camera Hardware Accessories

i. Engineering Drawings and Model Files

- Approval/signature by responsible NASA project manager

ii. Verification Matrix

- Approval/signature by responsible NASA project manager

iii. Payload Data Package

- Approval/signature by responsible NASA project manager

iv. Project Requirements Document

- Approval/signature by responsible NASA project manager

v. HDEV Payload Processing Plan

- Approval/signature by responsible NASA project manager Updated R5B1P2

vi. HDEV Structural Verification Plan

- Approval/signature by responsible NASA project manager Updated R5B1P2

vii. HDEV Payload Safety Data Package

- Approval/signature by responsible NASA project manager and approval by JSC Payload Safety Review Panel Updated R5B1P2

5.7.2 Acceptance test, configure, and deliver payload and engineering hardware

i. Camera Assembly

- Approval/signature by responsible NASA project manager

ii. Encoder/Electronics Assembly

- Approval/signature by responsible NASA project manager

5.7.3 Integration processing

i. Certified HDEV Payload Hardware

- Approval/signature by responsible NASA project manager on 1027

ii. CEPA Integration Hardware

- Approval/signature by responsible NASA project manager on 1027 Added Rev 5

5.8 Database of ISS Research Results Tracking Added R5BP1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Perform ongoing active surveys for new and missing results and publications from experiments operated on ISS and vehicles to and from ISS. Work with investigators to edit and prepare layman?s summary of investigation results for posting in the ISS Database, and document the citation and bibliometric information for each identified article within the ISS Database. Prepare content for the NASA Results Technical Papers and publications related to ISS results. Added R5BP1

5.8.1 Database of ISS Research Results Tracking Added R5BP1

Project Code:

The contractor shall perform ongoing active surveys for new and missing results and publications from experiments operated on ISS and vehicles to and from ISS. The contractor shall work with investigators to edit and prepare layman's summary of investigation results for posting in the ISS Database, and document the citation and bibliometric information for each identified article within the ISS

Database. The contractor shall prepare content for the NASA Results Technical Papers and publications related to ISS results.

b. **Applicable Documents**

Document Number	Document Name	Rev.
OZ4-2005-0001 Added R5BP1	Work Instruction for NNJ-BH4-HA7-4-001P	C
SSP50450 Added R5BP1	Multi-Increment Resuppy and Outfitting Manifest	A

c. **Required DRDs**

5.8.1 Database of ISS Research Results Tracking

DRD #	DRD Title	Quantity/Frequency
101 Added R5BP1	Project Schedule	Monthly
105 Added R5BP1	Regular Status Report/Summary Review	Weekly

d. **Products**

5.8.1 Database of ISS Research Results Tracking

Product(s)	Quantity	Delivery Date
Workflow tracking of pending updates Added R5BP1	1	weekly
Technical Publication Summary of Research Results Added R5BP1	1	every 2 years
Research Benefits Publication Added R5BP1	1	year
Citation Database Deliverables Added R5BP1	1	month
Investigation Close-out report of unsuccessful investigations Added R5BP1	1	year
Results summaries updated in the ISS Database for individual investigations Added R5BP1	120	year

e. **Product Verification**

5.8.1 Database of ISS Research Results Tracking

i. Workflow tracking of pending updates

- Review and acceptance by Program Scientist Added R5BP1

ii. Technical Publication Summary of Research Results

- Review and acceptance by Program Scientist Added R5BP1

iii. Research Benefits Publication

- Review and acceptance by Program Scientist Added R5BP1

iv. Citation Database Deliverables

- Review and acceptance by Program Scientist Added R5BP1

v. Investigation Close-out report of unsuccessful investigations

- Review and acceptance by Program Scientist Added R5BP1

vi. Results summaries updated in the ISS Database for individual investigations

- Review and acceptance by Program Scientist Added R5BP1

6.0 Cost Summary and Revision History

SLC	Type	CY2	CY3	CY4	CY5	CY6	CY7	CY8	G Total
AS1	Sum of Hours								
	Sum of Dollars								
AS2	Sum of Hours								
	Sum of Dollars								
AS3	Sum of Hours								
	Sum of Dollars								
BS1	Sum of Hours								
	Sum of Dollars								
BS2	Sum of Hours								
	Sum of Dollars								
EN1	Sum of Hours								
	Sum of Dollars								
EN2	Sum of Hours								
	Sum of Dollars								
EN3	Sum of Hours								
	Sum of Dollars								
EN4	Sum of Hours								
	Sum of Dollars								
ESS	Sum of Hours								
	Sum of Dollars								
ET3	Sum of Hours								
	Sum of Dollars								
IT1	Sum of Hours								
	Sum of Dollars								
IT2	Sum of Hours								
	Sum of Dollars								
IT3	Sum of Hours								
	Sum of Dollars								
IT4	Sum of Hours								
	Sum of Dollars								
MGR	Sum of Hours								
	Sum of Dollars								
PC1	Sum of Hours								
	Sum of Dollars								
PC2	Sum of Hours								
	Sum of Dollars								
PS1	Sum of Hours								
	Sum of Dollars								
PS2	Sum of Hours								
	Sum of Dollars								
QA1	Sum of Hours								
	Sum of Dollars								
QA2	Sum of Hours								
	Sum of Dollars								
QE1	Sum of Hours								
	Sum of Dollars								
QE3	Sum of Hours								
	Sum of Dollars								
SC1	Sum of Hours								
	Sum of Dollars								
SC2	Sum of Hours								
	Sum of Dollars								
SC3	Sum of Hours								
	Sum of Dollars								
SC4	Sum of Hours								
	Sum of Dollars								
SCS	Sum of Hours								
	Sum of Dollars								
SQ1	Sum of Hours								
	Sum of Dollars								

SQ2	Sum of Hours	
	Sum of Dollars	
SV	Sum of Hours	
	Sum of Dollars	
TN2	Sum of Hours	
	Sum of Dollars	
TN3	Sum of Hours	
	Sum of Dollars	
Total Direct Labor Hours		
Total Direct Labor Costs		
Travel Costs		
Subcontract		
NLR Misc		
Materials		
Burden on Non-Labor		
Total Non Labor		
Total Costs		
Fee		
Total		$21,786,236.01

b4

DO 190 revision history	Total cost	Reason for revision
Original	3,474,240	Original Release
Rev 1	6,211,606	Added requirements for FY08 and out. Extended period of performance to end of contract.
Rev 2	6,990,429	Increased scope of work, to include re-establishment of two shift operations, and expand Program Science activities.
Rev 3	15,438,343	No change in scope, rearrangement to match order of future management and reporting. Also extends DO to current end of ESCG contract.
Rev 4	18,903,740	Addition of HUNCH program requirements, increase in Program Science activities, and adjustment of LIS representative quantities.
Rev. 5	21,599,695	Addition of HUNCH program requirements, increase in Program Science activities, and addition of HDTV Continuous Downlink Experiment activities.
Rev. 6	21,852,413	Revised sections 5.3 and 5.7 and added section 5.8

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ06HI47D - DO 191 Rev 8

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2006 - 01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: **05/25/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Cold Stowage Systems Development, Operations, & Sustaining Engineering**					
DO	**191 R8**					
	Est. Labor Costs		bf		bf	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$11,705,221.95

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ06HI47D-DO191 REV 8

Originator: Sharon Campana (EC2) (281) 244-5508 **TMR:** Marie Kowal (EC) (281) 483-8875

Revision Summary:

Add support of STS flights in FY11. Eliminate SpaceX Flight support in FY11. Add design, fabrication, and delivery of Mini-Coldbag in FY11. Add fabrication and delivery of Ice Bricks in FY12.

1. Title of Effort: Cold Stowage Systems Development, Operations, and Sustaining Engineering

2. Date of Request: 02/03/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

e. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

f. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

g. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

h. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as

an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 7

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2006 and ends 01/31/2013.

5. Product Requirements

5.1 Sustaining Engineering of Double Coldbag, Icepacs, and GN2 Dewars Updated Rev 5

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall perform flight operations and maintenance of the Coldbags, Icepacs, Glacier, GN2 Dewars, and Minus Eighty Laboratory Freezer for ISS (MELFI). Contractor shall provide development of flight hardware activities associated with Glacier, Coldbag, Icepacs, MERLIN, and Utilization Hardware. Updated Rev 5

5.1.1 Flight Processing Updated Rev 5

Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall configure flight items, conduct required pre-flight acceptance tests, and perform pre and post flight processing. For FY08 contractor shall conduct crew training, participate as hardware developer and demonstrate hardware function at bench reviews and hardware verification reviews. Post flight processing includes de-integration of the Coldbags and other Cold Stowage hardware. Contractor shall provide the same products in the event of alternate landing at Dryden and White Sands. NASA Quality or DCMA will be used at launch and landing locations if available. Contractor shall provide temperature controlled transportation of experiments from shuttle landing location to JSC.

5.1.2 Flight Verification Updated Rev 5

Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall provide verifications necessary for COFR, participate in COFR meetings, conduct crew training, participate as hardware developer and demonstrate hardware function at bench reviews and hardware verification reviews, and perform Integrated Safety Assessments and submit to PSRP (Payload Safety Review Panel) for approval as required.

For FY08, contractor shall conduct crew training, participate as hardware developer and demonstrate hardware function at bench reviews and hardware verification reviews was moved to 5.1.1.

5.1.3 Flight Operations and Maintenance Updated Rev 5

Project Code:

Contractor shall provide console staffing for real-time engineering assessments, track limited life items, and refurbish cold stowage hardware as necessary to maintain sufficient inventory.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
SSP 30524	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
JSC 47982	Statement of Work for CTSD Cold Stowage and GFE Hardware Development and Operations	Baseline
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	E
JPR 8500.4 Added Rev 5	Engineering Drawing System Manual	K
JSC 21937 Added Rev 5	Verification Matrix for the Cellular Biotechnology Cryodewar	Baseline 9-00
JSC 28970	ARM for the Cellular Biotechnology Cryodewar	Rev C
JSC 60361	Icepac Applicable Requirements Matrix (ARM)	Rev B
JSC 62003	Icepac to Payload Experiment Interface Definition Document	Baseline
JSC 62040	ARM for the Cold Stowage Insulated Sample Bag	Rev B
JSC 62108	Coldbag to Payload Interface Definition Document	Baseline
JSC 62196	Icepac Verification Matrix	Rev B
JSC 62268	Verification Matrix for the Cold Stowage Insulated Sample Bag	Rev B

JSC 62395 Added Rev 5	Ground Processing and Handling Requirements and Constraints for the RCC Crack Repair Material (CRM)	Rev D 2-07
JSC 65119	Cold Stowage Sustaining Engineering Plan	Rev A
JSC 65404 Added Rev 5	Generic Ground Processing and Handling Requirements and Constraints for Cold Stowage	Rev B 10-07
NT-CWI-001 Added Rev 5	Task Performance Sheet (TPS)	C
SSP 57932	Payload Integration Agreement for the Icepac Capsules	Baseline
SSP 57932 DCN Added Rev 5	Payload Integration Agreement for the Icepac Capsules	B/L DCN 002, 10-06
SSP 57934	Payload Integration Agreement for the Coldbag	Baseline
SSP 57934 DCN Added Rev 5	Payload Integration Agreement for the Coldbag	B/L DCN 002, 03-06

c. **Required DRDs**

5.1.1 Flight Processing

DRD #	DRD Title	Quantity/Frequency
230 Deleted Rev 5	Acceptance Data Package	3

5.1.2 Flight Verification

DRD #	DRD Title	Quantity/Frequency
235 Updated Rev 5	Space Station Payload Safety Data Package	12
235 Added Rev 5	Space Station Payload Safety Data Package	Up to 1 per launch (FY08)

5.1.3 Flight Operations and Maintenance

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
230 Added Rev 5	Acceptance Data Package	10
230 Added Rev 5	Acceptance Data Package	FY08, up to 1 per limited life expiration

d. **Products**

5.1.1 Flight Processing

Product(s)	Quantity	Delivery Date
1027	11	9/30/2007
PIA Task Performance Sheet (TPS)	17	9/30/2007
Flight Processing TPS	12	9/30/2007
Landing Processing TPS	12	9/30/07
Generic Ground Processing and Handling Requirements and Constraints for Cold Stowage	1 Rev	3/27/07
1027 (FY08)	Up to 2 per launch	9/30/08
PIA Task Performance Sheet (TPS) (FY08)	Up to 2 per launch	9/30/08
Flight Processing TPS (FY08)	Up to 3 per launch	9/30/08
Landing Processing TPS (FY08)	Up to 3 per launch	9/30/08
Generic Ground Processing and Handling Requirements and Constraints for Cold Stowage (FY08)	2 Rev.	9/30/08
Ground Processing and Handling Requirements and Constraints for the RCC Crack Repair Material (CRM) (FY08)	2 Rev.	9/30/08

5.1.2 Flight Verification

Product(s)	Quantity	Delivery Date

Verification Certificate of Compliance	12	9/30/2007
COFR Endorsements	6	9/30/2007
Integrated Safety Assessments (reflight Series Assessment)	12	9/30/2007
Technical Data Sheet for Cold Stowage Hardware on Russian Flights	3 flights	9/30/07
Passport for Progress Flights for Cold Stowage Hardware on Russian Flights	3 flights	9/30/07
Verification Certificate of Compliance (FY08)	Up to 2 per launch	9/30/08
CoFR Endorsements (FY08)	Up to 1 per launch	9/30/08
Integrated Safety Assessments (Reflight Series Assessment) (FY08)	Up to 2 per launch	9/30/08
Technical Data Sheet for Cold Stowage Hardware on Russian Flights (FY08) Added Rev 5	Up to 2 per launch	9/30/08
Passport for Progress Flights for Cold Stowage Hardware on Russian Flights	Up to 1 per launch	9/30/08

5.1.3 Flight Operations and Maintenance

Product(s)	Quantity	Delivery Date
Packing Diagrams Deleted Rev 5	4	9/30/2007
Updated with shelf life Double Coldbag Acceptance Data Package Added Rev 5	10	9/30/07
Updated with shelf life Double Coldbag Acceptance Data Package (FY08) Added Rev 5	Up to 1 per limited life expiration	9/30/08

e. **Product Verification**

5.1.1 Flight Processing

i. 1027

- QARC number assigned

ii. PIA Task Performance Sheet (TPS)

- EC2 Branch review of deliverable

iii. Flight Processing TPS

- EC2 Branch review of deliverable

iv. Landing Processing TPS

- EC2 Branch review of deliverable

v. Generic Ground Processing and Handling Requirements and Constraints for Cold Stowage

- EC2 Branch review of deliverable

vi. 1027 (FY08)

- EC2 Branch review of deliverable

vii. PIA Task Performance Sheet (TPS) (FY08)

- EC2 Branch review of deliverable

viii. Flight Processing TPS (FY08)

- EC2 Branch review of deliverable

ix. Landing Processing TPS (FY08)

- EC2 Branch review of deliverable

x. Generic Ground Processing and Handling Requirements and Constraints for Cold Stowage (FY08)

- EC2 Branch review of deliverable

xi. Ground Processing and Handling Requirements and Constraints for the RCC Crack Repair Material (CRM) (FY08)

- EC2 Branch review of deliverable

5.1.2 Flight Verification

i. Verification Certificate of Compliance

- PE&I Review

ii. COFR Endorsements

- EC2 Branch review of deliverable

iii. Integrated Safety Assessments (reflight Series Assessment)

- PSRP approval

iv. Technical Data Sheet for Cold Stowage Hardware on Russian Flights

- EC2 Branch review of deliverable

v. Passport for Progress Flights for Cold Stowage Hardware on Russian Flights

- EC2 Branch review of deliverable

vi. Verification Certificate of Compliance (FY08)

- PE&I Review

vii. CoFR Endorsements (FY08)

- EC2 Branch review of deliverable

viii. Integrated Safety Assessments (Reflight Series Assessment) (FY08)

- PSRP Approval

ix. Technical Data Sheet for Cold Stowage Hardware on Russian Flights (FY08)

- EC2 Branch review of deliverable Added Rev 5

x. Passport for Progress Flights for Cold Stowage Hardware on Russian Flights

- EC Branch acceptance review of deliverable

5.1.3 Flight Operations and Maintenance

i. Packing Diagrams Deleted Rev 5

- EC2 Branch review of deliverable Deleted Rev 5

ii. Updated with shelf life Double Coldbag Acceptance Data Package

- EC2 Branch review of deliverable Added Rev 5

iii. Updated with shelf life Double Coldbag Acceptance Data Package (FY08)

- EC2 Branch review of deliverable Added Rev 5

5.2 Cold Stowage Flight Hardware Development and First Flight Integration Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide flight hardware development and certification products for ISS payload cold stowage. Updated Rev 5

5.2.1 Glacier Updated Rev 5
Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall provide certification processing activities for Glacier. This task includes review and processing of Glacier certification products and activities including safety and design packages. Contractor shall alos attend operations planning meetings and/or attend checkout and integration test at MSFC and KSC. The contractor shall also provide integration and systems for real time operations.

5.2.2 Icepac
Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall assemble, test, and certify new Icepac Capsules. The contractor shall present the new design to the Payload Safety Review Panel and close out issues associated with previous design of Icepacs.

5.2.3 Experiment Support and Utilization Hardware Updated Rev 5
Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall design, test, and certify experiment ground processing and/or test support systems, and utilization hardware as required. The contractor shall certify Cryogloves, Data Loggers, Vial Bags, and Ziploc Bags.

5.2.4 MERLIN Updated Rev 5
Project Code:

The contractor shall perform series reflight and integrated safety assessments, utilizing MERLIN Phase III SDP (Safety Data Package). The contractor shall conduct weekly and quarterly meetings with the MERLIN vendor and NASA JSC. The contractor shall provide MERLIN specific ground logistics for launch and landing, and will provide monitoring of system performance at the Tele-Science Center as required.

5.2.5 Coldbag Added Rev 5
Project Code:

Contractor shall design, fabricate, and conduct engineering evaluation tests of an improved Double Coldbag. The goal is to obtain a hold time at or below -20 ^{o}C for 144 hours.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	E
JSC 60334	Project Technical Requirements Specifications for the General Laboratory Active Cryogenic ISS Experiment Refrigerator (GLACIER)	Rev B
JSC 60361	Icepac Applicable Requirements Matrix (ARM)	Rev B
JSC 62196	Icepac Verification Matrix	Rev B
JSC 65015	General Laboratory Active Cryogenic ISS Experiment Refrigerator (GLACIER) To Payload Interface Definition Document	Baseline

c. **Required DRDs**

5.2.1 Glacier

DRD #	DRD Title	Quantity/Frequency
218 Added Rev 5	Engineering Analysis	1
235	Space Station Payload Safety Data Package	1

5.2.2 Icepac

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 5	Engineering Drawings and Model Files	2
102 Added Rev 5	Engineering Drawings and Model Files	2, FY08
230 Added Rev 5	Acceptance Data Package	50, FY08
230 Updated Rev 5	Acceptance Data Package	150
233 Updated Rev 5	Government Certification Approval Request (GCAR)	2
233 Added Rev 5	Government Certification Approval Request (GCAR)	1, FY08
237 Added Rev 5	Certification Data Package	1, FY08
237 Updated Rev 5	Certification Data Package	2

5.2.3 Experiment Support and Utilization Hardware

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 5	Engineering Drawings and Model Files	1
102 Added Rev 5	Engineering Drawings and Model Files	FY08, 1 per certification
233 Added Rev 5	Government Certification Approval Request (GCAR)	1 per certification
233	Government Certification Approval Request (GCAR)	3

5.2.4 MERLIN

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

5.2.5 Coldbag

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 5	Engineering Drawings and Model Files	2
107 Added Rev 5	Test Report	1

d. **Products**

5.2.1 Glacier

Product(s)	Quantity	Delivery Date
Data Requirements Document to TSC	1	9/30/2008
Ground Command Procedures	1	9/30/2008
Console Handbook Updated Rev 5	1	9/30/2007
Approved Phase II SDP Deleted Rev 5	1	9/30/2007
Submitted Phase III SDP Updated Rev 5	1	9/30/2007

5.2.2 Icepac

Product(s)	Quantity	Delivery Date
Icepac Hardware Product (Belt Assy)	150	9/30/2007
Acceptance Data Package	150	9/30/2007
Icepac Hardware Product (Belt Assy) (FY08)	50	9/30/08
Acceptance Data Package (FY08)	50	9/30/08

5.2.3 Experiment Support and Utilization Hardware

Product(s)	Quantity	Delivery Date
Material Certification	3	9/30/2007
Materials only GCAR	3	9/30/2007
Material Certification (FY08)	1 per certification	9/30/08
Materials only GCAR (FY08)	1 per certification	9/30/08

5.2.4 MERLIN

Product(s)	Quantity	Delivery Date
Integrated Safety Assessment	1	9/30/2007
Integrated Safety Assessment Added Rev 5	1 per launch	9/30/08

5.2.5 Coldbag

Product(s)	Quantity	Delivery Date
Summary Test Report Added Rev 5	1	9/30/07
Improved Double Coldbag Prototype Added Rev 5	1	9/30/07
Summary Test Report Added Rev 5	1	9/30/08
Improved Double Coldbag Prototype Added Rev 5	1	9/30/08

e. **Product Verification**

5.2.1 Glacier

i. Data Requirements Document to TSC
- Baseline of document

ii. Ground Command Procedures
- Baseline of document

iii. Console Handbook Updated Rev 5
- Baseline of document Updated Rev 5

iv. Approved Phase II SDP Deleted Rev 5
- PSRP Approval Deleted Rev 5

v. Submitted Phase III SDP Updated Rev 5
- Submittal memo Updated Rev 5

5.2.2 Icepac

i. Icepac Hardware Product (Belt Assy)

- Approved DD250

ii. Acceptance Data Package

- Approved DD250

iii. Icepac Hardware Product (Belt Assy) (FY08)

- Approved DD250

iv. Acceptance Data Package (FY08)

- Approved DD250

5.2.3 Experiment Support and Utilization Hardware

i. Material Certification

- Material Cert. # issue

ii. Materials only GCAR

- GCAR # assigned

iii. Material Certification (FY08)

- Material Cert. # issue

iv. Materials only GCAR (FY08)

- GCAR # assigned

5.2.4 MERLIN

i. Integrated Safety Assessment

- PSRP Approval

ii. Integrated Safety Assessment

- PSRP Approval Added Rev 5

5.2.5 Coldbag

i. Summary Test Report

- EC Branch Acceptance Review Added Rev 5

ii. Improved Double Coldbag Prototype

- EC Branch Acceptance Review Added Rev 5

iii. Summary Test Report

- EC Branch Acceptance Review Added Rev 5

iv. Improved Double Coldbag Prototype

- EC Branch Acceptance Review Added Rev 5

5.3 Cold Stowage Management and Experiment Integration

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide management for the planning and utilization of Cold Stowage Hardware.

5.3.1 Management Updated Rev 5
Project Code:

The contractor shall provide lab management of the Cold Stowage Systems Laboratory, B7 Room 2004. The CSSL is a Controlled Storage Area. Lab management activities include maintaining calibrated equipment, conducting Test Readiness Reviews and updating CSSL Standard Operating Procedures as required

The contractors shall participate in Cold Stowage Planning meetings, review and provide inputs to CEFs (Change Evaluation Forms) and Crew Procedures, and provide management for all Cold Stowage Projects. The Contractor shall provide configuration management of sample locations and configurations withhn Cold Stowage facilities on orbit.

5.3.2 Experiment Integration Updated Rev 5
Project Code:

Contractor shall conduct thermal performance tests to ensure and optimize launch, on orbit, and landing configurations for experiment hardware. Contractor shall develop flight procedures and exploded view diagrams for packing plans. The exploded view diagrams are graphical representations of Coldbag?s return configuration. The diagrams include the Coldbag, Icepac Belt Assemblies, and the experiment being transported during descent. The schematics are not intended to follow EDCC format or approval. Contractor shall conduct acceptance testing on payload developer's hardware per SSP 57070 as required. Contractor shall provide experiment integration expertise for HRP Nutrition, SPEGIS, Tropi, and Cell Wall Resist Wall experiments. For FY08, experiment integration expertise shall be provided for Tropi, Immuno, HRP Nutrition, HRP Bisphophonates, CWRW, Rad Gene & LOH, ROALD, PADIAC, SOLO, WAICO, and SAMPLE.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JSC 60347	Project Management Plan for the Cold Stowage Government Furnished Equipment Hardware Development and Operation	Basic
JSC 65305 Added Rev 5	Cold Stowage System Laboratory (CSSL) Standard Operating Procedure Manual	Basic
JSC 65381 Added Rev 5	CSSL Bloodborne Pathogens Exposure Control Plan	A, 11-05
SSP 57070 Added Rev 5	Cold Stowage Interface Requirements Document	A, 05-08
SSP 57070	Cold Stowage Interface Requirements Document	Baseline

c. **Required DRDs**

5.3.1 Management

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

5.3.2 Experiment Integration

DRD #	DRD Title	Quantity/Frequency
107	Test Report	4

d. **Products**

5.3.1 Management

Product(s)	Quantity	Delivery Date
Monthly Status Report Deleted Rev 5	12	9/30/2007
Laboratory Calendar	6	9/30/2007
Cold Stowage Action Item Log	12	9/30/2007
Monthly Status Report	12	9/30/08
MELFI/Cold Stowage Tracking Summary	6	9/30/07
MELFI/Cold Stowage Tracking Summary (FY08)	6	9/30/08

5.3.2 Experiment Integration

Product(s)	Quantity	Delivery Date
Summary Test Report	6	9/30/2007
Packing Diagrams Added Rev 5	2	9/30/07
Summary Test Report Added Rev 5	Up to 1 per landing	9/30/08
Packing Diagrams Added Rev 5	Up to 2 per landing	9/30/08

e. **Product Verification**

5.3.1 Management

i. Monthly Status Report Deleted Rev 5
- EC2 Branch Review of deliverable Deleted Rev 5
ii. Laboratory Calendar
- EC2 Branch Review of deliverable
iii. Cold Stowage Action Item Log
- EC2 Branch Review of deliverable
iv. Monthly Status Report
- EC2 Branch Review of deliverable
v. MELFI/Cold Stowage Tracking Summary
- EC2 Branch Review of deliverable
vi. MELFI/Cold Stowage Tracking Summary (FY08)
- EC2 Branch Review of deliverable

5.3.2 Experiment Integration

i. Summary Test Report
- EC2 Branch Review of deliverable
ii. Packing Diagrams
- EC2 Branch Review of deliverable Added Rev 5
iii. Summary Test Report
- EC2 Branch Review of deliverable Added Rev 5
iv. Packing Diagrams
- EC2 Branch Review of deliverable Added Rev 5

5.4 MELFI Sustaining Engineering

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide integration, operations, and maintenance for the Minus Eighty Laboratory Freezer for ISS (MELFI).

5.4.1 Flight Processing
Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall conduct characterization testing utilizing the LGM (Laboratory Ground Model) and/or the Engineering Unit, operate the MELFI systems to allow Science Verification Testing, and conduct fit checks as required.

5.4.2 Flight Verification
Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall provide verifications necessary for COFR, participate in COFR meetings, conduct crew training, participate as hardware developer and demonstrate hardware function at bench reviews and hardware verification reviews, and perform Integrated Safety Assessments and submit to PSRP (Payload Safety Review Panel) for approval as required.

5.4.3 Flight Operations
Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall perform stowage planning and analysis, conduct thermal analysis, develop and conduct console tools and training, participate in increment and flight simulations, and provide console staffing for real-time engineering assessments, operation, and problem resolution.

5.4.4 Maintenance
Project Code:

In accordance with the SOW paragraphs defined above, the contractor shall maintain Flight Unit Log Books, compile Sustaining Engineering Reports for ESA and EADS, provide hardware status reports, perform maintenance checks, and perform anomaly resolution and trouble shooting. The contractor shall conduct maintenance of all ground units, including the Engineering Unit and LGM.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NT-CWI-001	Task Performance Sheet (TPS)	Rev A 03-01
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	E
SSP 52000-PDS	Payload Data Sets Blank Book	Current
SSP 52054	ISS Payloads Certification of Flight Readiness Implementation Plan	Current
SSP 57000	Pressurized Payloads Accommodation Handbook	Current
SSP 57011	Payload Verification Program Plan	Current
SSP 57059	Standard Payload Integration Agreement for Pressurized Payloads	Current
SSP 57070	Cold Stowage Interface Document	Current

c. **Required DRDs**

5.4.1 Flight Processing

DRD #	DRD Title	Quantity/Frequency
107	Test Report	2
218	Engineering Analysis	1

5.4.2 Flight Verification

DRD #	DRD Title	Quantity/Frequency
235	Space Station Payload Safety Data Package	2

5.4.3 Flight Operations

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

5.4.4 Maintenance

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.4.1 Flight Processing

Product(s)	Quantity	Delivery Date
MELFI Analysis Report	1	9/30/2007

5.4.2 Flight Verification

Product(s)	Quantity	Delivery Date
Integrated Safety Assessment	2	9/30/2007
COFR Endorsements	3	9/30/2007

5.4.3 Flight Operations

Product(s)	Quantity	Delivery Date
Flight Operations	1	9/30/2007

5.4.4 Maintenance

Product(s)	Quantity	Delivery Date
Flight Unit 1 Log Book	3	9/30/2007
Flight Unit 2 Log Book	3	9/30/2007
Sustaining Engineering Reports	3	9/30/2007

e. **Product Verification**

5.4.1 Flight Processing

i. MELFI Analysis Report

- EC2 Branch Review of deliverable

5.4.2 Flight Verification

i. Integrated Safety Assessment

- PSRP Approval

ii. COFR Endorsements

- EC2 Branch Review of deliverable

5.4.3 Flight Operations

i. Flight Operations

- EC2 Branch Review of deliverable

5.4.4 Maintenance

i. Flight Unit 1 Log Book

- EC2 Branch Review of deliverable

ii. Flight Unit 2 Log Book

- EC2 Branch Review of deliverable

iii. Sustaining Engineering Reports

- EC2 Branch Review of deliverable

5.5 Flight Processing, Maintenance and Sustaining Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall configure flight items, conduct required pre-flight acceptance tests, and perform pre and post flight processing. Contractor shall participate as hardware developer and demonstrate hardware function at bench reviews and hardware verification reviews. Post flight processing includes de-integration of the Coldbags, Glaciers and other Cold Stowage hardware at KSC. Fed Ex White Glove or equivalent service will be used when shipping Glacier Systems. Contractors shall provide similar products in the event of alternate landing at Dryden and White Sands. NASA Quality or DCMA will be used at launch and landing locations if available. Contractor shall provide temperature controlled transportation of experiments from alternate (DFRC and WSSH) shuttle landing location to JSC. Contractor shall perform Integrated Safety Assessments and submit to Payload Safety Review Panel (PSRP) for approval as required. Contractor shall provide certification necessary for CoFR, participate in CoFR meetings, and prepare verification activities for flight including Certificate of Compliance, reflight verification, RCARs, and MRCARs. Contractor shall prepare and submit forms required for launch on Russian vehicles. Cold stowage shall pan to support a maximum of 3 Progress flights per FY post shuttle retirement. Contractor shall track limited life items and refurbish cold stowage hardware as necessary to maintain sufficient inventory. Contractor shall maintain MELFI hardware Log Books.

The Contractor shall provide sustaining activities, including support of late load temperature sensitive equipment for a maximum of 3 shuttle flights in FY 11. ESCG shall provide sustaining activities for a maximum of 3 Progress and 1 HTV flights per FY after Shuttle retirement. Post shuttle retirement the contractor shall provide launch and landing activities for temperature conditioned payloads on Space X vehicle. This will consist of 2 flights in FY 2012, and 2 flights in 2013. Support will include launch site preparations at KSC, and landing recovery in California. There will be limited facilities available for cold stowage at the landing location, so the samples shall be returned via a charter flight or equivalent. It is estimated that 1 Glacier and up to 5 Double Coldbags with Ice Bricks will be flown on ascent and descent of each Space X flight. It also includes launch activities for one orbital launch at Wallops Island.

DRD 230 (ADP) updates are no longer required for refurbishment/reprocessing of coldbags. Updated REV 8

5.5.1 Flight Processing, Maintenance and Sustaining Updated REV 8
Project Code: 00010

see description above 5.5 a.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NSTS 1700.7B Added Rev 5	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS	Safety Policy and Requirements for Payloads Using the International Space	Rev S 01-03

Addendum Added Rev 5	Station	
SSP 30524 Added Rev 5	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
CTSD-SS-3263 Added Rev 7	Applicable Requirements Matrix	B/L 4-09
CTSD-SS-3264 Added Rev 7	Verification Matrix	B/L 5-09
EA-WI-023 Added Rev 5	Project Management of GFE Flight Projects	Rev E, 02-06
JPR 8500 Added Rev 5	Engineering Drawing System Manual	K
JSC 28970 Added Rev 5	ARM for the Cellular Biotechnology Cryodewar	Rev C 11-03
JSC 47982 Added Rev 5	Statement of Work for CTSD Cold Stowage and GFE Hardware Development and Operations	Baseline 9-02
JSC 60361 Added Rev 5	Icepac Applicable Requirements Matrix (ARM)	Rev B 3-06
JSC 60361 Added Rev 6	Icepac Applicable Requirements Matrix (ARM), Updated	Rev E 09-08
JSC 62003 Added Rev 5	Icepac to Payload Experiment Interface Definition Document	Baseline 5-05
JSC 62040 Added Rev 5	ARM for the Cold Stowage Insulated Sample Bag	Rev B 3-06
JSC 62108 Added Rev 5	Coldbag to Payload Interface Definition Document	Baseline 6-05
JSC 62196 Added Rev 5	Verification Matrix for the Icepac Capsules	Rev E 9-08
JSC 62268 Added Rev 5	Verification Matrix for the Cold Stowage Insulated Sample Bag	Rev B 6-06
JSC 62395 Added Rev 5	Ground Processing and Handling Requirements and Constraints for the RCC Crack Repair Material (CRM)	Rev D 5-07
JSC 65119 Added Rev 5	Cold Stowage Sustaining Engineering Plan	Rev A 5-05
JSC 65404 Added Rev 5	Generic Ground Processing and Handling Requirements and Constraints for Cold Stowage	Rev B 10-07
NT-CWI-001 Added Rev 5	Task Performance Sheet (TPS)	C
SSP 52054 Added Rev 5	ISS Payloads Certification of Flight Readiness Implementation Plan, Generic	Rev E 8-05
SSP 57289 Added Rev 5	Interface Control Document for Coldbag Assembly	B/L 3/08
SSP 57935 Added Rev 5	Interface Control Document for Icepac Assembly	B/L 4-07

c. **Required DRDs**

5.5.1 Flight Processing, Maintenance and Sustaining

DRD #	DRD Title	Quantity/Frequency
230 Updated Rev 6	Acceptance Data Package	A/R

d. **Products**

5.5.1 Flight Processing, Maintenance and Sustaining

Product(s)	Quantity	Delivery Date
1027	Up to 2 per launch	A/R
PIA Task Performance Sheet (TPS) Updated REV 8	Up to 2 per launch	A/R
Flight Processing TPS Updated REV 8	Up to 6 per launch	A/R
Landing Processing TPS Updated REV 8	Up to 6 per launch	A/R
MELFI Flight Unit 1 Log Book	2	9/30/10
Engineering Unit Log Book	1	9/30/10
Generic Ground Processing and Handling Requirements and Constraints for Cold Stowage Updated REV 8	2 Rev	9/30/09
Updated ADP with shelf life Double Coldbag Deleted Rev 7	Up to 1per Coldbag limited life expiration	A/R
Ground Processing and Handling Requirements and Constraints for the RCC Crack Repair Material (CRM) Updated REV 8	2 Rev	9/30/09
Verification Certificate of Compliance Updated REV 8	Up to 2 per launch	A/R
CoFR Endorsements (MELFI, Coldbag, Icepacs)	Up to 3 per launch	A/R
Integrated Safety Assessments (Reflight Series Assessment) Updated REV 8	Up to 3 per launch	A/R
Integrated Safety Assessment	Up to 1 per increment	A/R
Technical Data Sheet for Cold Stowage Hardware on Russian Flights Updated REV 8	Up to 1 per launch	A/R
Passport for Progress Flights for Cold Stowage Hardware on Russian Flights Updated REV 8	Up to 1 per launch	A/R
Proforma for Progress Flights for Cold Stowage Hardware on Russian Flights	Up to 1 per launch	A/R
Updated ADP with shelf life Double Coldbag (no longer required as of 9/2009) Added	Up to 1per Coldbag limited	A/R

Rev 7	life expiration	
Flight Unit 2 Log Book Updated REV 8	2 per year	1/31/2013
Flight Unit 3 Log Book Updated REV 8	2 per year	1/31/2013
LROD for Cold Stowage Hardware Added REV 8	Up to 3 per launch	A/R

e. **Product Verification**

5.5.1 Flight Processing, Maintenance and Sustaining
i. 1027
- EC Branch review of deliverable
ii. PIA Task Performance Sheet (TPS)
- EC Branch review of deliverable
iii. Flight Processing TPS
- EC Branch review of deliverable
iv. Landing Processing TPS
- EC Branch review of deliverable
v. MELFI Flight Unit 1 Log Book
- EC Branch review of deliverable
vi. Engineering Unit Log Book
- EC Branch review of deliverable
vii. Generic Ground Processing and Handling Requirements and Constraints for Cold Stowage
- EC Branch review of deliverable
viii. Updated ADP with shelf life Double Coldbag Deleted Rev 7
- EC Branch review of deliverable Deleted Rev 7
ix. Ground Processing and Handling Requirements and Constraints for the RCC Crack Repair Material (CRM)
- EC Branch review of deliverable
x. Verification Certificate of Compliance
- EC Branch review of deliverable
xi. CoFR Endorsements (MELFI, Coldbag, Icepacs)
- EC Branch review of deliverable
xii. Integrated Safety Assessments (Reflight Series Assessment)
- EC Branch review of deliverable
xiii. Integrated Safety Assessment
- EC Branch review of deliverable
xiv. Technical Data Sheet for Cold Stowage Hardware on Russian Flights
- EC Branch review of deliverable
xv. Passport for Progress Flights for Cold Stowage Hardware on Russian Flights
- EC Branch review of deliverable
xvi. Proforma for Progress Flights for Cold Stowage Hardware on Russian Flights
- EC Branch review of deliverable
xvii. Updated ADP with shelf life Double Coldbag (no longer required as of 9/2009)
- EC Branch review of deliverable Added Rev 7
xviii. Flight Unit 2 Log Book
- EC Branch review of deliverable
xix. Flight Unit 3 Log Book
- EC Branch review of deliverable
xx. LROD for Cold Stowage Hardware
- EC Branch review of deliverable Added REV 8

5.6 Operations and Experiment Integration Updated Rev 7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform stowage planning and analysis, conduct thermal analysis, develop and conduct console tools and training, participate in increment and flight simulations, and provide console staffing for real-time engineering assessments, operation, and problem resolution. Contractor shall provide the capability to perform real-time operations off-site, participate in crew training. Contractor shall participate in Cold Stowage Planning meetings, review, and provide inputs to CEFs (Change Evaluation Forms), OCRs (Operational Change Requests), ECRs (Engineering Change Requests), and Crew Procedures and operations products as required. Contractor shall provide configuration management of sample locations and configurations within Cold Stowage facilities on orbit.

Contractor shall conduct thermal performance tests to ensure and optimize launch, on orbit, and landing configurations for experiment hardware. Contractor shall perform development of flight procedures and exploded view diagrams for packing plans. The exploded view diagrams are graphical representations of Coldbag?s return configuration. The diagrams include the Coldbag, Ice Brick Belt Assemblies or Glacier and the experiment being transported during descent. The schematics are not intended to follow EDCC format or approval. Contractor shall provide, if required, CCCD drawings for Glacier. Contractor shall conduct acceptance testing on payload developer's hardware per SSP 57070 as required. Contractor shall provide experiment integration expertise for ESA Payloads: Tropi, IMMUNO, CARD, SOLO, ROALD, WAICO, TRIPLELUX, SAMPLE, and GRAVI-2. NASA payloads: HRP-NUTRITION, HRP-Biophosphonates, HRP UMS, HRP Repository, IVGEN, NASA APEX-Cambium. JAXA payloads: JAXA Rad Gene & LOH, Rad Silk, CERISE, Space Seed, PCG, Hydro Tropi, Bio-Mente (Sanita-kan), EPO-Dewey?s Forest, Hair, Myolab, Nanoskeleton, Myco, Dome Gene, LADA VPU, CSA: Vascular, APEX-Cambium. The experiment make-up for 2011-2013 has not yet been defined; however, it will consists of HRP, JAXA, ESA, and CSA payloads. Updated Rev 7

5.6.1 Operations and Experiment Integration Updated REV 8
Project Code: 00010

see description in 5.6 a.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 5	No Requirement	
EA-WI-023 Added Rev 6	Project Management of GFE Flight Projects	Rev D 02-04
NT-CWI-001 Added Rev 6	Task Performance Sheet (TPS)	Rev A 03-01
EA-WI-023 Added Rev 6	Proejct Management of GFE Flight Projects	Rev. E, 02-06
NT-CWI-001 Added Rev 6	Task Performance Sheet (TPS)	Rev C, 07-08
SSP 52000-PDS Added Rev 5	Payload Data Sets Blank Book	G, 09-07
SSP 57070 Added Rev 5	Cold Stowage Interface Requirements Document	A, 07-08

c. **Required DRDs**

5.6.1 Operations and Experiment Integration

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

d. **Products**

5.6.1 Operations and Experiment Integration

Product(s)	Quantity	Delivery Date
Glacier Ground Command Procedures Added Rev 5	1	9/30/09
MELFI/Cold Stowage Configuration Plan Updated REV 8	1 per month	A/R
Engineering Evaluation of Thermal Performance of Experiment Hardware	Up to 2 per STS flight	A/R
Summary of Experiment Testing Added Rev 6	A/R	Quarterly
Engineering Evaluation of Thermal Performance of Experiment Hardware Added Rev 7	Up to 3 per Space X flight	L-2 months

e. **Product Verification**

5.6.1 Operations and Experiment Integration

i. Glacier Ground Command Procedures
- EC Branch Review of Deliverables Added Rev 5

ii. MELFI/Cold Stowage Configuration Plan
- EC Branch Review of Deliverables

iii. Engineering Evaluation of Thermal Performance of Experiment Hardware
- EC Branch Review of Deliverables

iv. Summary of Experiment Testing
- EC Branch Review of Deliverables Added Rev 6

v. Engineering Evaluation of Thermal Performance of Experiment Hardware

- EC Branch Review of Deliverables Added Rev 7

5.7 Laboratory Management Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide lab management of the Cold Stowage Systems Laboratory, B7 Room 2004. The CSSL is a Controlled Storage Area. Lab management activities include maintaining calibrated equipment, conducting Test Readiness Reviews and updating CSSL Standard Operating Procedures as required. Contractor shall provide management oversight and administrative tasks for all Cold Stowage projects.

Provide enhanced capability to support temperature conditioned science returned from ISS to the Cold Stowage Lab. This includes providing a +4 C refrigerator capability, as well as a back-up +4 C refrigerator. The refrigerators, as well as existing -80 C freezers shall have enhanced monitoring and paging systems to ensure team members are notified in the event the temperatures start to go out of range. Updated REV 8

5.7.1 Laboratory Management Updated REV 8
Project Code:

see description in 5.7.a.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 5	No Requirement	
JPG 1700.1 Added Rev 5	JSC Safety & Health Handbook	Rev I 07-02
JSC 60347 Added Rev 5	Project Management Plan for the Cold Stowage Government Furnished Equipment Hardware Development and Operation	Basic 5-03
JSC 65305 Added Rev 5	Cold Stowage System Laboratory (CSSL) Standard Operating Procedure Manual	Basic 7-05
JSC 65381 Added Rev 5	CSSL Bloodborne Pathogens Exposure Control Plan	Rev A , 11-05
SSP 57070 Added Rev 5	Cold Stowage Interface Requirements Document	Rev A, 05-08

c. **Required DRDs**

5.7.1 Laboratory Management

DRD #	DRD Title	Quantity/Frequency
Added Rev 5	No Requirement	

d. **Products**

5.7.1 Laboratory Management

Product(s)	Quantity	Delivery Date
Monthly Budget/Status Report Deleted REV 8	A/R	Monthly
DO 191 Schedule	A/R	Monthly
Cold Stowage Tracking Summary Added Rev 6	A/R	Monthly
Revised CCSL Standard Operating Procedure Added Rev 7	2	per PD

e. **Product Verification**

5.7.1 Laboratory Management

i. Monthly Budget/Status Report Deleted REV 8
- EC Branch Review of Deliverables Deleted REV 8

ii. DO 191 Schedule
- EC Branch Review of Deliverables

iii. Cold Stowage Tracking Summary
- EC Branch Review of Deliverables Added Rev 6

iv. Revised CCSL Standard Operating Procedure

- EC Branch Review of Deliverables Added Rev 7

5.8 Hardware Development and First Flight Integration Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide the following Cold Stowage hardware and products associated with flight deliveries. Quantities and product deliverable dates shall be defined via Project Directives, at a later date, based on acquiring requirements, vehicle schedule and environments. Updated REV 8

5.8.1 Ice Brick (Redesigned Icepacs) Updated REV 8
Project Code: 00010

Contractor shall assemble, test, and certify new Icepac Capsules which will be developed and flown as Ice Brick. Contractor shall present the new design to the Payload Safety Review Panel. Technical Interchange Meeting will be held in lieu of PDR/CDR due to the low complexity and similarity to existing Icepac design.

The contractor shall provide a delta certification for the Ice Bricks on Space X and at least one other future vehicle.

The contractor shall procure and deliver 700 additional Ice Brick Assemblies. Temperature and quantity of each type will be defined via a Project Directive.

5.8.2 Coldbag Updated REV 8
Project Code: 00010

Contractor shall fabricate 2 Coldbags of existing design due March 2009.

The contractor shall fabricate 4 flight Double Coldbags of existing design. The contractor shall provide a delta certification for the Double Coldbags on Space X and at least one other future vehicle.

The contractor shall design, fabricate, and deliver 8 Mini-Coldbags. The Mini-Coldbags shall be compatible with Soyuz requirements and capable of returning science on the Soyuz vehicle.

5.8.3 MELFI Hardware Updated REV 8
Project Code: 2C004

Contractor shall provide documentation review and developmental activities for the MELFI Lifetime Extension Certification Program (LECEP) hardware provided by ESA and EADS. Activities includes overseas travel to Europe for hardware reviews/pre-shipment reviews. Contractor shall maintain Flight Unit Log Books, compile Sustaining Engineering Reports for ESA and EADS, provide hardware status reports, perform maintenance checks, and perform anomaly resolution and trouble shooting. Contractor shall conduct maintenance of all ground units, including the Engineering Unit (EU) and Laboratory Ground Model (LGM). Maintenance testing is performed on a flight unit prior to launch while at KSC on 6-8 month intervals. Flight Unit (FU) #1 is operated near continuously on orbit. Console operations are covered under WBS 5.6. Regular maintenance checks/testing will be performed on FU #2 per ESA requirements and maintained in a flight ready status until launch. Contractor activities for FU #3 will be limited until the Second Acceptance Review is completed and the rack is shipped to KSC. Conduct routine maintenance check of FU #2 at KSC. CS team services for FU #3 will be limited until the unit is delivered to KSC.

Contractor shall conduct characterization testing utilizing the LGM and/or the EU and operate the MELFI systems to allow Science Verification Testing. The contractor shall perform engineering services for JAXA testing in the LGM. Testing shall not exceed 2 weeks per year.

5.8.4 Glacier Updated REV 8
Project Code:

Contractor shall provide certification processing activities and engineering services for Glacier. This task includes review of Glacier certification products, safety and design packages. Contractor shall attend, as required, checkout and integration tests at MSFC and KSC. The contractor shall perform engineering services in the possible recertification and/or redesign of Glacier if required due to Space X or future vehicle interface requirements.

The contractor shall perform engineering services if recertification and/or redesign of Glacier is required due to fabrication of 2 additional units.

5.8.5 Utilization Hardware Updated REV 8
Project Code:

Contractor shall design, test, and certify experiment ground processing and/or test support systems, and utilization hardware as required. Contractor shall certify and maintain Cryo Gloves, 3 x 5 Mesh Bags, generic desiccant bags, and Ziplock Bags. The contractor shall provide a delta certification of the hardware listed above as required to Space X.

The contractor shall procure, certify, and deliver temperature data loggers capable of being transported with science at -95 C. Certification shall include ISS, Space X, and Orbital.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 5	No Requirement	
EA-WI-023 Added Rev 6	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4 Added Rev 6	Engineering Drawing System Manual	Rev H 11-01
EA-WI-023 Added Rev 6	Project Managmeent of GFE Flight Projects	Rev. E, 02-06
JPR 8500.4 Added Rev 6	Engineering Drawing System Manual	Rev. K, 03-06
JSC 60334 Added Rev 5	Project Technical Requirements Specifications for the General Laboratory Active Cryogenic ISS Experiment Refrigerator (GLACIER)	Rev C, 02-08
JSC 60361 Added Rev 5	Icepac Applicable Requirements Matrix (ARM)	Rev E, 09-08
JSC 62040 Added Rev 5	ARM for the Cold Stowage Insulated Sample Bag	Rev B 3-06
JSC 62196 Added Rev 5	Icepac Verification Matrix	Rev E, 09-08
JSC 62268 Added Rev 5	Verification Matrix for the Cold Stowage Insulated Sample Bag	Rev B 6-06
JSC 65015 Added Rev 5	General Laboratory Active Cryogenic ISS Experiment Refrigerator (GLACIER) To Payload Interface Definition Document	Baseline, 06-06
NT-CWI-001 Added Rev 5	Task Performance Sheet (TPS)	Rev C, 07-08
SSP 57000 Added Rev 5	Pressurized Payloads Interface Control Document	Rev H 9-07
SSP 57112 Added Rev 5	Payload Interface Agreement for MELFI	4-00
SSP 57212 Added Rev 5	MELFI Hardware Interface Control Document	Rev C 2-03

c. **Required DRDs**

5.8.1 Ice Brick (Redesigned Icepacs)

DRD #	DRD Title	Quantity/Frequency
102 Updated Rev 6	Engineering Drawings and Model Files	A/R
233 Updated Rev 6	Government Certification Approval Request (GCAR)	A/R
237 Updated Rev 6	Certification Data Package	A/R

5.8.2 Coldbag

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 7	No Requirement	
233 Added Rev 7	Government Certification Approval Request (GCAR)	A/R

5.8.3 MELFI Hardware

DRD #	DRD Title	Quantity/Frequency
107 Updated Rev 6	Test Report	A/R

5.8.4 Glacier

DRD #	DRD Title	Quantity/Frequency
Added Rev 6	No Requirement	

5.8.5 Utilization Hardware

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 7	No Requirement	
233 Added Rev 7	Government Certification Approval Request (GCAR)	A/R

d. **Products**

5.8.1 Ice Brick (Redesigned Icepacs)

Product(s)	Quantity	Delivery Date
Ice Brick Hardware Product Delivery Added Rev 5	64	17A BR
Ice Brick Hardware Product Delivery Updated REV 8	336	9/30/09
Applicable Requirements Matrix for Ice Brick Added Rev 5	1	3/30/09
Verification Matrix for Ice Brick Added Rev 5	1	3/30/09
Flight Safety Data Package for Ice Bricks Added Rev 5	1	L-5 mo
Reflight Safety Data Package for Ice Bricks Added Rev 5	Up to 1 per flight	L-20 weeks
Ice Brick Assemblies for FU#3	75 +4 deg C, 60 -32 deg C, 20 class III	9/30/10
Delta Cert. for Ice Brick Added Rev 7	2	per PD
Delta Cert. for Icepac Added Rev 7	2	per PD
Ice Brick Assembly Added REV 8	700	9/30/12

5.8.2 Coldbag

Product(s)	Quantity	Delivery Date
Coldbag Hardware Delivery Updated REV 8	2	3/01/09
Prototype Mini Coldbag	1	9/30/10
Coldbag Flight Hardware Delivery	4	7/1/10
Delta Cert Added Rev 7	2	per PD
Mini-Coldbag Hardware Delivery Added REV 8	8	9/1/2011

5.8.3 MELFI Hardware

Product(s)	Quantity	Delivery Date
MELFI Test Report Added Rev 5	1	9/30/09
Flight Unit 2 Log Book Updated REV 8	2	9/30/10
Flight Unit 3 Log Book	1	9/30/10
Desiccant bags	20	12/31/09

5.8.4 Glacier

Product(s)	Quantity	Delivery Date

Engineering services to assure GLACIER hardware is successfully processed for flight use during the period of performance Updated REV 8	1 set	9/30/09
Engineering services to assure 2 new Glacier units are sucessfully delivered for flight Added REV 8	1 set	1/2013

5.8.5 Utilization Hardware

Product(s)	Quantity	Delivery Date
3x5 Mesh Bags Hardware Delivery Added Rev 5	50	11/4/08
3x5 Mesh Bags Hardware Delivery Added Rev 5	150	9/30/09
CDP for 3x5 Mesh Bag Updated REV 8	1	9/30/09
GCAR for 3x5 Mesh Bag Updated REV 8	1	9/30/09
Desiccant Bags	20	9/30/09
3x5 Mesh Bags (1st set) Added Rev 6	100	12/15/09
Desiccant Bags Added Rev 6	12	12/31/09
3 x 5 Mesh Bags (2nd set) Added Rev 6	150	2/28/10
Delta Cert for Ziplocs, mesh bags, gloves Added Rev 7	8	per PD
GCAR for common desiccants Added Rev 7	1	per PD
Temperature Data Logger Hardware Delivery Added Rev 7	per PD	per PD
3x5 Mesh Bags Added Rev 7	per PD	per PD

e. **Product Verification**

5.8.1 Ice Brick (Redesigned Icepacs)

i. Ice Brick Hardware Product Delivery
- EC Branch acceptance review of deliverables Added Rev 5

ii. Ice Brick Hardware Product Delivery
- EC Branch acceptance review of deliverables

iii. Applicable Requirements Matrix for Ice Brick
- EC Branch acceptance review of deliverables Added Rev 5

iv. Verification Matrix for Ice Brick
- EC Branch acceptance review of deliverables Added Rev 5

v. Flight Safety Data Package for Ice Bricks
- EC Branch acceptance review of deliverables Added Rev 5

vi. Reflight Safety Data Package for Ice Bricks
- EC Branch acceptance review of deliverables Added Rev 5

vii. Ice Brick Assemblies for FU#3
- EC Branch acceptance review of deliverables

viii. Delta Cert. for Ice Brick
- EC Branch acceptance review of deliverables Added Rev 7

ix. Delta Cert. for Icepac
- EC Branch acceptance review of deliverables Added Rev 7

x. Ice Brick Assembly
- EC Branch acceptance review of deliverables Added REV 8

5.8.2 Coldbag

i. Coldbag Hardware Delivery
- EC Branch acceptance review of deliverables

ii. Prototype Mini Coldbag
- EC Branch acceptance review of deliverables

iii. Coldbag Flight Hardware Delivery
- EC Branch acceptance review of deliverables

iv. Delta Cert
- EC Branch acceptance review of deliverables Added Rev 7

v. Mini-Coldbag Hardware Delivery
- EC Branch acceptance review of deliverables Added REV 8

5.8.3 MELFI Hardware

i. MELFI Test Report

- EC Branch acceptance review of deliverables Added Rev 5

ii. Flight Unit 2 Log Book

- EC Branch acceptance review of deliverables

iii. Flight Unit 3 Log Book

- EC Branch acceptance review of deliverables

iv. Desiccant bags

- EC Branch acceptance review of deliverables

5.8.4 Glacier

i. Engineering services to assure GLACIER hardware is successfully processed for flight use during the period of performance

- EC Branch acceptance review of deliverables Updated REV 8

ii. Engineering services to assure 2 new Glacier units are sucessfully delivered for flight

- EC Branch acceptance review of deliverables Added REV 8

5.8.5 Utilization Hardware

i. 3x5 Mesh Bags Hardware Delivery

- EC Branch acceptance review of deliverables Added Rev 5

ii. 3x5 Mesh Bags Hardware Delivery

- EC Branch acceptance review of deliverables Added Rev 5

iii. CDP for 3x5 Mesh Bag

- EC Branch acceptance review of deliverables

iv. GCAR for 3x5 Mesh Bag

- EC Branch acceptance review of deliverables

v. Desiccant Bags

- EC Branch acceptance review of deliverables

vi. 3x5 Mesh Bags (1st set)

- EC Branch acceptance review of deliverables Added Rev 6

vii. Desiccant Bags

- EC Branch acceptance review of deliverables Added Rev 6

viii. 3 x 5 Mesh Bags (2nd set)

- EC Branch acceptance review of deliverables Added Rev 6

ix. Delta Cert for Ziplocs, mesh bags, gloves

- EC Branch acceptance review of deliverables Added Rev 7

x. GCAR for common desiccants

- EC Branch acceptance review of deliverables Added Rev 7

xi. Temperature Data Logger Hardware Delivery

- EC Branch acceptance review of deliverables Added Rev 7

xii. 3x5 Mesh Bags

- EC Branch acceptance review of deliverables Added Rev 7

6.0 Cost Summary and Revision History

ROM C191%R8

SLC	Type	CY2	CY3	CY4	CY5	CY6	CY7	CY8	G Total
AS1	Sum of Hours								
	Sum of Dollars								
AS2	Sum of Hours								
	Sum of Dollars								
AS3	Sum of Hours								
	Sum of Dollars								
BS1	Sum of Hours								
	Sum of Dollars								
BS2	Sum of Hours								
	Sum of Dollars								
CM2	Sum of Hours								
	Sum of Dollars								
EN1	Sum of Hours								
	Sum of Dollars								
EN2	Sum of Hours								
	Sum of Dollars								
EN3	Sum of Hours								
	Sum of Dollars								
EN4	Sum of Hours								
	Sum of Dollars								
ESS	Sum of Hours								
	Sum of Dollars								
IT1	Sum of Hours								
	Sum of Dollars								
IT2	Sum of Hours								
	Sum of Dollars								
IT3	Sum of Hours								
	Sum of Dollars								
MGR	Sum of Hours								
	Sum of Dollars								
PC1	Sum of Hours								
	Sum of Dollars								
QA1	Sum of Hours								
	Sum of Dollars								

QA2	Sum of Hours
	Sum of Dollars
QE1	Sum of Hours
	Sum of Dollars
QE2	Sum of Hours
	Sum of Dollars
SE	Sum of Hours
	Sum of Dollars
SV	Sum of Hours
	Sum of Dollars
TN2	Sum of Hours
	Sum of Dollars
TN3	Sum of Hours
	Sum of Dollars
Total Direct Labor Hours	
Total Direct Labor Costs	
Travel Costs	
Subcontract	
NLR Misc	
Materials	
Burden on Non-Labor	
Total Non Labor	
Total Costs	
Fee	
Total	

b4

$11,705,221.95

DO 191 Revision History:	Total Cost	Reason for Revision
Original	1,539,121	
R1	1,664,379	5.1 Added charter flight for transportation of experiment samples. Added processing of hardware for additional launches. 5.2 Added new subtask to manufacture a prototype Improved Double Coldbag and trips to KSC and MSFC for MERLIN and GLACIER. 5.3 Added travel for new international experiment and on-orbit sample tracking was moved from 5.4 to 5.3. 5.4 Added travel to KSC for MELFI FU#2 maintenance. Added capability to conduct real-time on-orbit operations off-site.
R2	3,604,518	5.1 Add FY08 launch/landing activities. 5.2 Added MERLIN desiccant bags, improved vial bags, improved Icepacs. Added materials and labor to build redesigned Coldbag. Added HOBO data loggers. 5.3 Added FY08 experiment activities. 5.4 Added FY08 MELFI activities.
R3	3,090,106	All WBS affected – reduce scope of work for FY08.
R4	4,953,051	Increases the scope of work for FY09 and new WBS numbers 5.5 through 5.8 were added with this scope of work.
R5	5,022,439	Adds quality engineering and quality assurance activities

		required to meet the requirements in this delivery order. Moved resources for IT3 CS Configuration activities from WBS 5.7.1 to 5.6.1. Updated delivery dates for hardware items per current launch schedule and FY09 priorities.
R6	7,027,116	Modifies FY09 scope and adds FY10 scope for the following WBSs: 5.5.1: Reduces FY09 activities and adds FY10 flight processing. 5.6.1: Reduces FY09 activities and adds FY10 flight operations activities. 5.7.1: Reduces FY09 activities and adds FY10 management activities. 5.8.1: Adds FY09 and FY10 activities for Icepacs and Ice Bricks and new Ice Brick manufacturing. 5.8.2: Adds FY09 and FY10 Cold Bag activities and a Mini Coldbag prototype development. 5.8.3: Reduces FY09 activities and adds FY10 MELFI operations and delivery of desiccant bags. 5.8.4: Reduces FY09 activities. 5.8.5: Adds FY09 and FY10 hardware activities and delivery of Mesh Bags and Desiccant Bags.
R7	11,831,601	Adds scope for FY10 and for FY11-13. 5.5.1: Adds launch and landing activities for Progress, SpaceX, and Orbital. 5.6.1: Adds engineering evaluation of thermal performance of experiment hardware for STS and SpaceX. 5.7.1: Adds CCSL SOP and Cold Stowage Tracking Summary 5.8.1: Adds delta certification for Ice Brick for 2 vehicles 5.8.2: Adds delta certification for Coldbag for 2 vehicles 5.8.3: Adds MELFI FY10 activities 5.8.5: Adds delta certification for Ziplocs, mesh bags, and gloves, and desiccant GCAR. Also adds Temperature Data Logger and 3x5 mesh bag deliveries.
R8	11,705,222	Changes scope for FY11-13: 5.5.1: adds Space Shuttle flight activities and eliminates SpaceX flight activities in FY11. 5.6.1: adds the MELFI/Cold Stowage Configuration Plan 5.7.1: deletes the monthly budget/status report 5.8.1: adds fabrication and delivery of Ice Bricks in FY12 5.8.2: adds design, fabrication, and delivery of Mini-Coldbag in FY11 5.8.4: adds engineering services for new Glacier units 5.8.5: adds activities to be defined by PD

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ09HF38D DO 375 Rev 1

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 183-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 02/01/2010 – 01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: **10/02/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	JWST Chamber A Integration					
DO	**375 Rev 1**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$59,955,616.62

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ09HF38D-DO375 REV 1

Originator: Mary Cerimele (EC4) (281) 483-6621 **TMR:** Trent Martin (EC) (281) 483-3296

Revision Summary:
Incorporate recent revision of Project Plan in DO to align with updated phasing of project.

1. Title of Effort: JWST Chamber A Integration

2. Date of Request: 07/26/2011

3. Statement of Work Task Description

a. **2.1.3-Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 JWST Building 32 Chamber A Modifications Updated REV 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide hardware and software products and services to modify JSC Building 32 Chamber A for the James Webb Space Telescope Thermal Vacuum Test.

Note:

For DO, please remove DRD 310 and 335 since they are Constellation DRDs. Also in the products section, any document that starts with CTSD should be an Updated document since all of these will be delivered on the previous DO Updated REV 1

5.1.1 JWST Building 32 Chamber A Modifications and Testing Updated REV 1

Project Code:

Specifically, the contractor shall develop and deliver products and services identified by items listed in Table 5.1d to the requirements defined in JSC-47164.

b. **Applicable Documents**

Document Number	Document Name	Rev.
29 CFR 1910	Occupational Safety and Health	Current
CTSD-JWT-016	JWST Configuration Management Plan	Current
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Current
ISO 9001	International Standards Organization, Guidelines for Configuration Management	Current
JPR 1710.13	Design, Inspection and Certification of Pressure Vessels and Pressurized Systems	Current
JSC-47164	Project Plan for the JWST Thermal Vacuum Chamber Modification and Testing	Current
JWST ICD Drawings Added REV 1	GSFC Provided JWST ICD Drawing Set	Current
JWST-IRCD-03577 Added REV 1	JWST Project Observatory to NASA JSC Test Facility Interface Requirements and Control Document	Current
JWST-MOU-008809	Memorandum of Understanding Between the JSC Engineering Directorate and JWST Project	B
NASA-STD-8719.9	NASA Standard for Lifting Devices and Equipment	Current
NFPA 70	National Electrical Code	Current
NPR 7120.5C	NASA Program and Project Management Processes and Requirements	Current
STB-E-084	CTSD STB Drawing System and Configuration Control Procedure	C
STB-E-554	Systems Test Branch Operating Guidelines	Current
STB-E-557	Systems Test Branch Facilitiy and Major Test Buildup Procedure	Current
STB-F-361	Electrical Guidelines for Facility Modifications and Test Buildups	Current
STB-F-366	Mechanical Guidelines for Test Facilities and Buildups	Current

c. **Required DRDs**

5.1.1 JWST Building 32 Chamber A Modifications and Testing

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	I.A.W. JWST Project Pan
102	Engineering Drawings and Model Files	I.A.W. JWST Project Plan
105	Regular Status Report/Summary Review	I.A.W. JWST Project Plan
201	Project Technical Requirements Specification (PTRS)	I.A.W. JWST Project Plan
204	Preliminary Design Review (PDR) Data Package	I.A.W. JWST Project Plan
213	Flight Product Critical Design Review (CDR) Data Package	I.A.W. JWST Project Plan
218	Engineering Analysis	I.A.W. JWST Project Plan

d. **Products**

5.1.1 JWST Building 32 Chamber A Modifications and Testing		
Product(s)	**Quantity**	**Delivery Date**
CTSD-JWT-033B/JSC-47162 JSC JWST Detailed Schedule, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-009/JSC-65631 Technical Specification Document, JWST Test at JSC, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-034/JSC-64542 PTRS for Chamber A Gaseous Helium Shroud System, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-023/JSC-64555 PTRS for the Chamber A High Vacuum System, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-027/JSC-64559 PTRS for the Chamber A Facility Controls, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-025/JSC-64557 PTRS for the Chamber A Vessel Modifications, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-026/JSC-46558 PTRS for the Chamber A Emergency Power System, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-024/JSC-64556 PTRS for the Chamber A Air Flow and Contamination System, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-022/JSC-64554 PTRS for the Chamber A Liquid Nitrogen Distribution System, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-021/JSC-64553 PTRS for the Chamber A Liquid Nitrogen Shroud System, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-020/JSC-64552 PTRS for the Chamber A Helium System, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-038/JSC-47174 PTRS for Facility Preparation, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-037/JSC-47173 JSC Chamber A ICD, update Updated REV 1	1	Per JSC-47164
CTSD-JWT-039/JSC-47175 Verification Plan for the JSC JWST Chamber A Modifications, update Updated REV 1	1	Per JSC-47164
Facility Preparation Tasks	1	Per JSC-47164
Vessel Modifications Tasks	1	Per JSC-47164
LN2 Cryogenic Shrouds	1	Per JSC-47164
Gaseous Helium Cryogenic Shrouds	1	Per JSC-47164
LN2 Distribution System	1	Per JSC-47164
Helium Refrigeration System	1	Per JSC-47164
Airflow Management System	1	Per JSC-47164
High Vacuum System	1	Per JSC-47164
Controls and Data System	1	Per JSC-47164
Emergency Power Distribution System	1	Per JSC-47164
Complete Laboratory Preparation Tasks	1	Per JSC-47164

e. **Product Verification**

5.1.1 JWST Building 32 Chamber A Modifications and Testing

i. CTSD-JWT-033B/JSC-47162 JSC JWST Detailed Schedule, update

- JSC JWST CCB approval of Project Plan

ii. CTSD-JWT-009/JSC-65631 Technical Specification Document, JWST Test at JSC, update

- Systems Test Branch Chief (or designee) approval of modified facility drawings.

iii. CTSD-JWT-034/JSC-64542 PTRS for Chamber A Gaseous Helium Shroud System, update

- Document delivered to JSC JWST CCB for review and approval.

iv. CTSD-JWT-023/JSC-64555 PTRS for the Chamber A High Vacuum System, update

- Document delivered to JSC JWST CCB for review and approval.

v. CTSD-JWT-027/JSC-64559 PTRS for the Chamber A Facility Controls, update

- Document delivered to JSC JWST CCB for review and approval.

vi. CTSD-JWT-025/JSC-64557 PTRS for the Chamber A Vessel Modifications, update

- Document delivered to JSC JWST CCB for review and approval.

vii. CTSD-JWT-026/JSC-46558 PTRS for the Chamber A Emergency Power System, update

- Document delivered to JSC JWST CCB for review and approval.

viii. CTSD-JWT-024/JSC-64556 PTRS for the Chamber A Air Flow and Contamination System, update

- Document delivered to JSC JWST CCB for review and approval.

ix. CTSD-JWT-022/JSC-64554 PTRS for the Chamber A Liquid Nitrogen Distribution System, update

- Document delivered to JSC JWST CCB for review and approval.

x. CTSD-JWT-021/JSC-64553 PTRS for the Chamber A Liquid Nitrogen Shroud System, update

- Document delivered to JSC JWST CCB for review and approval.

xi. CTSD-JWT-020/JSC-64552 PTRS for the Chamber A Helium System, update

- Document delivered to JSC JWST CCB for review and approval.

xii. CTSD-JWT-038/JSC-47174 PTRS for Facility Preparation, update

- Document delivered to JSC JWST CCB for review and approval.

xiii. CTSD-JWT-037/JSC-47173 JSC Chamber A ICD, update

- Document delivered to JSC JWST CCB for review and approval.

xiv. CTSD-JWT-039/JSC-47175 Verification Plan for the JSC JWST Chamber A Modifications, update

- Document delivered to JSC JWST CCB for review and approval.

xv. Facility Preparation Tasks

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xvi. Vessel Modifications Tasks

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xvii. LN2 Cryogenic Shrouds

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xviii. Gaseous Helium Cryogenic Shrouds

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xix. LN2 Distribution System

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xx. Helium Refrigeration System

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xxi. Airflow Management System

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xxii. High Vacuum System

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xxiii. Controls and Data System

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xxiv. Emergency Power Distribution System

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

xxv. Complete Laboratory Preparation Tasks

- 1) Products meet specification 2) Hardware and documentation products (including released drawings and models) accepted by NASA JSC JWST CCB Chaiman on DD-250.

6.0 Cost Summary and Revision History

SLC	Type	CY1	CY6	CY7	CY8	G Total
AS2	Sum of Hours					
	Sum of Dollars					
AS3	Sum of Hours					
	Sum of Dollars					
BS1	Sum of Hours					
	Sum of Dollars					
BS3	Sum of Hours					
	Sum of Dollars					
CM1	Sum of Hours					
	Sum of Dollars					
EN1	Sum of Hours					
	Sum of Dollars					
EN2	Sum of Hours					
	Sum of Dollars					
EN3	Sum of Hours					
	Sum of Dollars					
EN4	Sum of Hours					
	Sum of Dollars					
ESS	Sum of Hours					
	Sum of Dollars					
ET3	Sum of Hours					
	Sum of Dollars					
ETS	Sum of Hours					
	Sum of Dollars					
IT1	Sum of Hours					
	Sum of Dollars					
IT2	Sum of Hours					
	Sum of Dollars					
IT3	Sum of Hours					
	Sum of Dollars					
PC2	Sum of Hours					
	Sum of Dollars					
PS3	Sum of Hours					
	Sum of Dollars					
QA2	Sum of Hours					
	Sum of Dollars					
SC4	Sum of Hours					
	Sum of Dollars					
SV	Sum of Hours					
	Sum of Dollars					
TN1	Sum of Hours					
	Sum of Dollars					
TN2	Sum of Hours					
	Sum of Dollars					
TN3	Sum of Hours					
	Sum of Dollars					
Total Direct Labor Hours						
Total Direct Labor Costs						
Travel Costs						
Subcontract						
NLR Misc						
Materials						
Burden on Non-Labor						
Total Non Labor						
Total Costs						
Fee						
Total						$59,955,616.62

DO 375 Revision History	Total Cost	Reason for Revision
Original	$38,737,577	Original
Revision 1	$59,955,617	Incorporates scope and milestone changes as documented in JSC 47164

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ06HI39D DO 200 R19

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2006 –09/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: 09/09/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Robotics Technology**					
DO	**200 R19**					
	Est. Labor Costs	64				
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				64	
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the orders requirements take precedence over the contractors proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$31,652,063.37

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ06HI39D-DO200 REV 19

Originator: Jared Woodfill (ER) (281) 483-6331 **TMR:** Jared Woodfill () (281) 483-6331

Revision Summary:

Perform robotic project builds, including additional materials for components and outsourced parts. Specifically, Revision 19 adds additional material for multiple R2 parts submitted to the B10 shop for fabrications. These services are now needed this fiscal year. Due to the shop load, these fabrication services need to be outsourced. Scope increases for several key electrical components on the R2 backpack and leg development, and need to be provided before the end of the fiscal year.

1. Title of Effort: Robotics Technology

2. Date of Request: 08/19/2011

3. Statement of Work Task Description

a. **2.1-Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 19

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2006 and ends 09/30/2011.

5. Product Requirements

5.1 Advanced Robotics Lab Development and Testing Updated Rev 12

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Provide technical services as described in ER4-TM200 and under the technical authority of the Robotic Systems Technology Branch of the Automation, Robotics, and Simulation Division (AR&SD). All technology development will be done as described in ER4-TM200. Updated Rev 12

5.1.1 Advanced Robotics Lab Development and Testing Updated Rev 16

Project Code: 3R704

The contractor shall provide technical services for the following laboratories, test-beds, and facilities in the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

- Dexterous Robotics Laboratory
- Robotic Mechanisms Laboratory
- Robot Integration Laboratory
- Robotic Electronics Laboratory

Services shall include testing activities, hardware configuration, software analysis, and other configuration work in advanced development.

5.1.2 Manufacturing Services Updated Rev 16

Project Code: 3R704

The contractor shall provide manufacturing services for the fabrication of hardware and electronics components in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements. Manufacturing services are inclusive of

- Robotic Hardware and component elements
  - Chariot/LER/SPR/SEV
  - Centaur II
  - Robonaut 2 testbeds hardware and component elements
  - FIRST robotics events and competitions

R2 mockups

b. **Applicable Documents**

Document Number	Document Name	Rev.
IPC 2221 Added Rev 9	No Requirement	
IPC-6011 Added Rev 9	Generic Standard on Printed Board Design	
JPD 2800.4 Added Rev 9	Generic Performance Specification for Printed Boards	Rev A 05-03
JPG 2800.3 Added Rev 9	JSC Information Technology (IT) Program Management	07-96
JSC 26648 Added Rev 9	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	03-01
MIL-STD-882 Added Rev 9	JSC Automated Information System User?s Security Guide	
NASA-STD-8739.1 Added Rev 9	Standard Practice for System Safety	7-94
NASA-STD-8739.2 Added Rev 9	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	Rev D 02-02
NASA-STD-8739.3 Added Rev 9	Surface Mount Technology	8-99
NASA-STD-9739.4 Added Rev 9	Soldered Electrical Connection	8-99
NPD 9501.1 Added Rev 9	Crimping, Interconnecting Cables, Harnesses, and Wiring	12-97
NPD 9501.3 Added Rev 9	NASA Contractor Financial Management Reporting System	2-98
	Earned Value Management	Rev G 05-00 Rev A 08-02

NSTS 22206 Added Rev 9	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	Rev D 12-93
ER4-TM200 Added Rev 12	Robotics Labs Technology Requirements	Rev. 11
ER4-TM200 Added Rev 12	Robotics Labs Technology Requirements	Rev. 12
ER4-TM200 Added Rev 10	Robotics Labs Technology Requirements	Rev 10, 7/22/2009
ER4-TM200 Added Rev 13	Robotics Labs Technology Requirements	Rev. 13
ER4-TM200 Added Rev 16	Robotics Labs Technology Requirements	Rev. 16
ER4-TM200 Rev 15 Added Rev 15	Robotics Labs Technology Requirements	Rev. 14 Sept. 2010
JPR 1700.1 Added Rev 9	JSC Safety & Health Handbook	J, 04-2008
NPR 8621.1 Added Rev 9	Security of Information Technology	A, 05-2006
NT-CWI-001 Added Rev 9	Task Performance Sheet (TPS)	C, 07-2008
NT-CWI-003 Added Rev 9	Quality Assurance Record Center Discrepancy Reporting and Tracking	C, 11-20061

c. **Required DRDs**

5.1.1 Advanced Robotics Lab Development and Testing

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Monthly
107 Added Rev 12	Test Report	Per ER4-TM200
218 Updated Rev 12	Engineering Analysis	Per ER4-TM200

5.1.2 Manufacturing Services

DRD #	DRD Title	Quantity/Frequency
Added Rev 15	No Requirement	

d. **Products**

5.1.1 Advanced Robotics Lab Development and Testing

Product(s)	Quantity	Delivery Date
Implementation of ER4-TM200, Section I within Advanced Robotics Lab Development and Testing Services Deleted Rev 15	12	09/30/2007
Implementation of ER4-TM200, Section I Deleted Rev 15	1 set	09/30/2008
Implementation of ER4-TM200 Deleted Rev 15	1 set	09/30/2009
Monthly Status Report	4	No later than the 15th of the month following the period of performance covered by the report
Advanced Robotics Lab Development and Testing Products Deleted Rev 15	Per ER4-TM200	Per ER4-TM200
Advanced Robotics Lab Development and Testing Products and Services (Oct. 01, 2006 through FY09)	Per ER4-TM200	9/30/2009

5.1.2 Manufacturing Services

Product(s)	Quantity	Delivery Date
Fabricated Hardware Products Added Rev 15	Per ER4-TM200	1/31/2011

e. **Product Verification**

5.1.1 Advanced Robotics Lab Development and Testing

i. Implementation of ER4-TM200, Section I within Advanced Robotics Lab Development and Testing Services Deleted Rev 15
- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data. Deleted Rev 15

ii. Implementation of ER4-TM200, Section I Deleted Rev 15
- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data. Deleted Rev 15

iii. Implementation of ER4-TM200 Deleted Rev 15
- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data. Deleted Rev 15

iv. Monthly Status Report

- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data.

v. Advanced Robotics Lab Development and Testing Products Deleted Rev 15

- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data. Deleted Rev 15

vi. Advanced Robotics Lab Development and Testing Products and Services (Oct. 01, 2006 through FY09)

- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data.

5.1.2 Manufacturing Services

i. Fabricated Hardware Products

- SR&SD Robotics Systems Technology Branch Review, witness and acceptance of fabricated hardware Added Rev 15

5.2 Reserved for Future Use Added Rev 10

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall None - This WBS is reserved for future use Added Rev 10

5.2.1 None Added Rev 10
Project Code: Not Applicable

None - This WBS is reserved for future use

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 10	No Requirement	

c. **Required DRDs**

5.2.1 None

DRD #	DRD Title	Quantity/Frequency
Added Rev 10	No Requirement	

d. **Products**

5.2.1 None

Product(s)	Quantity	Delivery Date
None Added Rev 10	0	1/31/2010

e. **Product Verification**

5.2.1 None

i. None

- No product verification requied Added Rev 10

5.3 Advanced Robotics Lab Development and Testing (GFY 2010) Updated Rev 12

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide technical services as described in ER4-TM200 and under the technical authority of the Robotic Systems Technology Branch of the Automation, Robotics, and Simulation Division (AR&SD). All technology development will be done as described in ER4-TM200.

The contractor shall provide engineering and technical services for the coordination and performance of media events for LER and Non-LER robotics elements in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

The contractor shall provide Engineering and technical services for the assembly and integration of LER and Non-LER robotics elements in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

The contractor shall provide cost account reporting at the third tier WBS level. Cost reporting shall be provided to the Robotic Systems

Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements. Updated Rev 12

5.3.1 Engineering Core Services Updated Rev 17
Project Code: 3R704

The contractor shall provide Core technical services for the following laboratories, test-beds, and facilities in the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

- Dexterous Robotics Laboratory
- Robotic Mechanisms Laboratory
- Robot Integration Laboratory
- Robotic Electronics Laboratory
- Educational Outreach
- LER Robotics Mobility Development
- Non-LER Robotics Mobility Development

5.3.2 Manufacturing Services Updated Rev 17
Project Code:

The contractor shall provide manufacturing for the fabrication of hardware and electronics components in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements. Manufacturing services are inclusive of

- LER Hardware and component elements
- Non LER Hardware and component elements which follow:
- Robonaut 2 testbeds hardware and component elements
- FIRST robotics events and competitions
- R2 Testbeds
- R2 mockups
- Modified Truncated Cones

b. **Applicable Documents**

Document Number	Document Name	Rev.
IPC 2221 Added Rev 10	Generic Standard on Printed Board Design	Rev A 05-03
IPC-6011 Added Rev 10	Generic Performance Specification for Printed Boards	07-96
JPD 2800.4 Added Rev 10	JSC Information Technology (IT) Program Management	03-01
JPG 1700.1 Added Rev 10	JSC Safety & Health Handbook	Rev I 07-02
JPG 2800.3 Added Rev 10	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JSC 26648 Added Rev 10	JSC Automated Information System User?s Security Guide	7-94
MIL-STD-882 Added Rev 10	Standard Practice for System Safety	Rev D 02-02
NASA-STD-8739.1 Added Rev 10	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	8-99
NASA-STD-8739.2 Added Rev 10	Surface Mount Technology	8-99
NASA-STD-8739.3 Added Rev 10	Soldered Electrical Connection	12-97
NASA-STD-9739.4 Added Rev 10	Crimping, Interconnecting Cables, Harnesses, and Wiring	2-98
NPD 9501.1 Added Rev 10	NASA Contractor Financial Management Reporting System	Rev G 05-00
NPD 9501.3 Added Rev 10	Earned Value Management	Rev A 08-02
NPR 8621.1 Added Rev 10	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NSTS 22206 Added Rev 10	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	Rev D 12-93
NT-CWI-001 Added Rev 10	Task Performance Sheet (TPS)	Rev A 03-01
NT-CWI-003 Added Rev 10	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01

ER4-TM200 Added Rev 10	Robotics Labs Technology Requirements	
ER4-TM200 Added Rev 12	Robotics Labs Technology Requirements	Rev 10, 7-22-2009
ER4-TM200 Added Rev 12	Robotics Labs Technology Requirements	Rev. 11
ER4-TM200 Added Rev 13	Robotics Labs Technology Requirements	Rev. 12
ER4-TM200 Rev. 15 Added Rev 15	Robotics Labs Technology Requirements	Rev. 13
ER4-TM200 Rev. 17 Added Rev 17	Robotics Labs Technology Requirements	Rev. 15
		Rev. 17

c. **Required DRDs**

5.3.1 Engineering Core Services

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 10	Regular Status Report/Summary Review	1/Monthly
107 Added Rev 12	Test Report	Per ER4-TM200
218 Added Rev 12	Engineering Analysis	Per ER4-TM200

5.3.2 Manufacturing Services

DRD #	DRD Title	Quantity/Frequency
Added Rev 10	No Requirement	

d. **Products**

5.3.1 Engineering Core Services

Product(s)	Quantity	Delivery Date
Monthly Report	4	15th of each month
Advanced Robotics Lab Development and Testing Products and Services (GFY2010) Added Rev 15	Per ER4-TM200	9/30/2010

5.3.2 Manufacturing Services

Product(s)	Quantity	Delivery Date
Fabricated hardware products Deleted Rev 15	Per ER4-TM-200	Per ER4-TM200
Fabricated hardware products Added Rev 15	Per ER4-TM200	6/30/2010

e. **Product Verification**

5.3.1 Engineering Core Services

i. Monthly Report

- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data

ii. Advanced Robotics Lab Development and Testing Products and Services (GFY2010)

- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data Added Rev 15

5.3.2 Manufacturing Services

i. Fabricated hardware products Deleted Rev 15

- AR&SD Robotics Systems Technology Branch review, witness and acceptance of fabricated hardware Deleted Rev 15

ii. Fabricated hardware products

- AR&SD Robotics Systems Technology Branch review, witness and acceptance of engineering data Added Rev 15

5.4 Robonaut to ISS Added Rev 13

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall In compliance with the above identified SOW(s) the contractor shall provide technical services as described in ER4-TM200 and under the technical authority of the Robotic Systems Technology Branch of the Automation, Robotics, and Simulation Division (AR&SD). All technology development will be done as described in ER4-TM200.

The contractor shall provide Engineering and technical services for the assembly and integration of Robonaut elements in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

The contractor shall provide cost account reporting for this specific WBS. Cost reporting shall be provided to the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements as well as the Robonaut to ISS Integration manager. Added Rev 13

5.4.1 Engineering Core Services Updated Rev 18
Project Code: 3R704

The contractor shall provide Core technical services for the following laboratories, test-beds, and facilities in the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

Non-LER Robotics Mobility Development

5.4.2 Manufacturing Services Updated Rev 18
Project Code: 3R704

The contractor shall provide manufacturing services for the fabrication of hardware and electronics components in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements. Manufacturing services are inclusive of

- Non LER Hardware and component elements
  - Robonaut 2 testbeds hardware and component elements

b. **Applicable Documents**

Document Number	Document Name	Rev.
IPC 2221 Added Rev 13	Generic Standard on Printed Board Design	Rev A 05-03
IPC 2221 Added Rev 13	Generic Standard on Printed Board Design	Rev A 05-03
IPC-6011 Added Rev 13	Generic Performance Specification for Printed Boards	07-96
JPD 2800.4 Added Rev 13	JSC Information Technology (IT) Program Management	03-01
JPG 1700.1 Added Rev 13	JSC Safety & Health Handbook	Rev I 07-02
JPG 2800.3 Added Rev 13	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JSC 26648 Added Rev 13	JSC Automated Information System User?s Security Guide	7-94
MIL-STD-882 Added Rev 13	Standard Practice for System Safety	Rev D 02-02
NASA-STD-8739.1 Added Rev 13	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	8-99
NASA-STD-8739.2 Added Rev 13	Surface Mount Technology	8-99
NASA-STD-8739.3 Added Rev 13	Soldered Electrical Connection	12-97
NASA-STD-9739.4 Added Rev 13	Crimping, Interconnecting Cables, Harnesses, and Wiring	2-98
NPD 9501.1 Added Rev 13	NASA Contractor Financial Management Reporting System	Rev G 05-00
NPD 9501.3 Added Rev 13	Earned Value Management	Rev A 08-02

NPR 8621.1 Added Rev 13	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NSTS 22206 Added Rev 13	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	Rev D 12-93
NT-CWI-001 Added Rev 13	Task Performance Sheet (TPS)	Rev A 03-01
NT-CWI-003 Added Rev 13	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01
ER-TM200 Rev 19 Added REV 19	Robotics Labs Technology Requirements	Rev. 19
ER4-200 Updated Rev 15 Added Rev 15	Robotics Labs Technology Requirements	Rev 15, Sept. 2010
ER4-TM200 Updated REV 14 Added Rev 14	Robotics Labs Technology Requirements	Rev 14, 2-5-2010
ER4-TM200 Updated REV 18 Added Rev 18	Robotics Labs Technology REquirements	Rev. 18, 7-1-2011

c. **Required DRDs**

5.4.1 Engineering Core Services

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 13	Regular Status Report/Summary Review	1/Monthy

5.4.2 Manufacturing Services

DRD #	DRD Title	Quantity/Frequency
Added Rev 13	No Requirement	

d. **Products**

5.4.1 Engineering Core Services

Product(s)	Quantity	Delivery Date
Monthly Report Updated REV 19	4	15th of each month
Robonaut to ISS Updated REV 19	Per ER4-TM200	ER4-TM200

5.4.2 Manufacturing Services

Product(s)	Quantity	Delivery Date
Fabricated Hardware Products Added Rev 13	Per ER4-TM-200	7/31/2010

e. **Product Verification**

5.4.1 Engineering Core Services

i. Monthly Report

- SR&SD Robotics Systems Technology Branch Review, witness and acceptance of engineering data

ii. Robonaut to ISS

- SR&SD Robotics Systems Technology Branch Review, witness and acceptance of engineering data

5.4.2 Manufacturing Services

i. Fabricated Hardware Products

- SR&SD Robotics Sysems Technology Branch review, witness and acceptance of fabricated hardware Added Rev 13

5.5 Advanced Robotics Lab Development and Testing Services (GFY 2011) Added REV 15 Updated Rev 17

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall In compliance with the above identified SOW(s) the contractor shall provide technical services as described in ER4-TM200 and under the technical authority of the Robotic Systems Technology Branch of the Software, Robotics, and Simulation Division (SR&SD). All technology development will be done as described in ER4-TM200.

The contractor shall provide engineering and technical services for the coordination and performance of media events for all robotics elements in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

The contractor shall provide Engineering and technical services for the assembly and integration of all robotics elements in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

The contractor shall provide cost account for this WBS. Cost reporting shall be provided to the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements. Updated Rev 17

5.5.1 Engineering Core Services Updated Rev 17
Project Code: 3R704

The contractor shall provide Core technical services for the following laboratories, test-beds, and facilities in the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements.

- Dexterous Robotics Laboratory
- Robotic Mechanisms Laboratory
- Robot Integration Laboratory
- Robotic Electronics Laboratory
- Educational Outreach
- Robotics Mobility Development

5.5.2 Manufacturing Services: Updated Rev 16
Project Code:

The contractor shall provide manufacturing services for the fabrication of hardware and electronics components in support of the Robotic Systems Technology Branch in accordance with ER4-TM200 Robotics Labs Technology Requirements. Manufacturing services are inclusive of:

* Robotic Hardware and component elements

*Chariot/LER/SPR/SEV

*Centaur II

*Robonaut 2 testbeds hardware and component elecments

* FIRST robotics events and competitions

*R2 mockups

b. **Applicable Documents**

Document Number	Document Name	Rev.
IPC 2221 Added Rev 15	Generic Standard on Printed Board Design	Rev A 05-03
IPC-6011 Added Rev 15	Generic Performance Specification for Printed Boards	07-96
JPG 1700.1 Added Rev 15	JSC Safety & Health Handbook	Rev I 07-02
JPG 2800.3 Added Rev 15	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JSC 26648 Added Rev 15	JSC Automated Information System User?s Security Guide	7-94
MIL-STD-882 Added Rev 15	Standard Practice for System Safety	Rev D 02-02
NASA-STD-8739.1 Added Rev 15	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	8-99
NASA-STD-8739.2 Added Rev 15	Surface Mount Technology	8-99
NASA-STD-8739.3 Added	Soldered Electrical Connection	12-97

Rev 15		
NASA-STD-9739.4 Added Rev 15	Crimping, Interconnecting Cables, Harnesses, and Wiring	
NPD 9501.1 Added Rev 15	NASA Contractor Financial Management Reporting System	2-98
NPD 9501.3 Added Rev 15	Earned Value Management	Rev G 05-00
NPR 8621.1 Added Rev 15	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 08-02
NSTS 22206 Added Rev 15	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	Rev A 02-04
NT-CWI-001 Added Rev 15	Task Performance Sheet (TPS)	Rev D 12-93
NT-CWI-003 Added Rev 15	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev A 03-01
ER-TM200 Added REV 19	Robotics Labs Technology Requirements	Rev B 03-01
ER-TM200 Rev. 18 Added Rev 18	Robotics Labs Technology Requirements	19
ER4-TM200 Added Rev 16	Robotics Labs Technology Requirements	18
ER4-TM200 Rev. 15 Added Rev 15	Robotics Labs Technology Requirements	16
ER4-TM200 Rev. 17 Added Rev 17	Robotics Labs Technology Requirements	15
JPD 2800.4 Added Rev 15	JSC Information Technology (IT) Program Management	17
		03-01

c. **Required DRDs**

5.5.1 Engineering Core Services

DRD #	DRD Title	Quantity/Frequency
105 Added Rev 15	Regular Status Report/Summary Review	1 monthly

5.5.2 Manufacturing Services:

DRD #	DRD Title	Quantity/Frequency
Added Rev 15	No Requirement	

d. **Products**

5.5.1 Engineering Core Services

Product(s)	Quantity	Delivery Date
Monthly Report Updated REV 19	4	15th of each month
Advanced Robotics Lab Development and Testing (GFY2011) Updated REV 19	Per ER4-TM200	Per ER4-TM200

5.5.2 Manufacturing Services:

Product(s)	Quantity	Delivery Date
Fabricated hardware products	Per ER4-TM200	9/30/2011

e. **Product Verification**

5.5.1 Engineering Core Services

i. Monthly Report

- - SR&SD Robotics Systems Technology Branch review, witness and acceptance of fabricated hardware

ii. Advanced Robotics Lab Development and Testing (GFY2011)

- SR&SD Robotics Systems Technology Branch review, witness and acceptance of fabricated hardware

5.5.2 Manufacturing Services:

i. Fabricated hardware products

- SR&SD Robotics Systems Technology Branch review, witness and acceptance of fabricated hardware

6.0 Cost Summary and Revision History

DO 200 R19 Summary								
SLC		CY2	CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS3									
	Sum of Hrs								
	Sum of Dollars								
EN1									
	Sum of Hrs								
	Sum of Dollars								
EN2									
	Sum of Hrs								
	Sum of Dollars								
EN3									
	Sum of Hrs								
	Sum of Dollars								
EN4									
	Sum of Hrs								
	Sum of Dollars								
ESS									
	Sum of Hrs								
	Sum of Dollars								
IT2									
	Sum of Hrs								
	Sum of Dollars								
QA1									
	Sum of Hrs								
	Sum of Dollars								
SC4									
	Sum of Hrs								
	Sum of Dollars								
SV									
	Sum of Hrs								
	Sum of Dollars								
TN3									
	Sum of Hrs								
	Sum of Dollars								
PC2									
	Sum of Hrs								
	Sum of Dollars								
SC2									
	Sum of Hrs								
	Sum of Dollars								
AS2									
	Sum of Hrs								
	Sum of Dollars								
IT3									
	Sum of Hrs								
	Sum of Dollars								
QA2									
	Sum of Hrs								
	Sum of Dollars								
QE2									
	Sum of Hrs								
	Sum of Dollars								
ET2									
	Sum of Hrs								
	Sum of Dollars								
MGR									
	Sum of Hrs								
	Sum of Dollars								
PC1									
	Sum of Hrs								

Sum of Dollars	
CM2	
Sum of Hrs	
Sum of Dollars	
QE3	
Sum of Hrs	
Sum of Dollar	
Total Direct Labor Hrs	
Total Direct Labor Cos	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**$31,652,063.37**

b4

DO 200 revision history	Total cost	Reason for revision
Original	1,421,308	Original FY'07 Robotic Systems Technology Branch Services
Revision 1	2,722,235	Added services for FIRST student competition support and trailer transportation
Revision 2	2,912,234	Added services for attaching strain gauges to load cell spring elements for Robonaut 2 finger assemblies building additional finger assemblies, building sensors and controls for fingers and additional material dollars for Rover assembly and finger outsourced manufacturing.
Revision 3	7,830,517	Added services and material for FY08. Added services to support SCOUT vehicle power system at JSC as well as on travel. Added funding to support critical procurements.
Revision 4	8,780,401	Added scope for additional technician support for Robonaut 2. Added scope for additional manufacturing support for Chariot, Robonaut 2 and the Small Pressurized Rover. Per ER4-TM200 (R4 2008, 12 March, 2008)
Revision 5	9,610,534	Implementation of ER4-TM200 Robotics Labs Technology Requirements (R5 2008, 23 May 2008) whi includes addition of a moon dust study. Additional resources are provided for the maintenance of the current level of manufacturing and engineering services which are required satisfy the on-going requirements which were reduced in response to priority changes associated with new procurements implemented in the execution of Revision 4. This revision also mitigates the cost risk associated with unfilled orders for long-lead items which were placed in anticipation of this revision.
Revision 6	10,810,525	Implementation of ER4-TM200 Robotics Labs Technology Requirements (R6 2008, 13 August 2008) which includes a continuation of a moon dust study. Additional resources are provided for the maintenance of the current level of manufacturing and engineering services which are required to satisfy the on-going requirements which were reduced in response to priority changes associated with new procurements implemented in the execution of Revision 5. This revision also mitigates the cost risk associated with unfilled orders for long-lead items which were placed in anticipation of this revision. This revision also extends the contract through accounting month January 2009.
Revision 7	11,810,816	Implementation of ER4-TM200 Robotics Labs Technology Requirements (R7 2008, 15 December 2008 Additional resources are provided for the maintenance of the current level of manufacturing and

		engineering services which are required to satisfy the on-going requirements. This revision also adds travel to Washington for Chariot team for the inaugural parade. This revision also extends the contract through 5/30/2009. Revision 7 increases the cost for DO200 by $1,000,290 over Revision 6.
Revision 8	13,309,690	Implementation of ER4-TM200 Robotics Labs Technology Requirements (R8 2009, 26 January 2009). Additional resources are provided for the maintenance of the current level of manufacturing and engineering services which are required to satisfy the on-going requirements. This revision also adds travel to Washington for FIRST machine shop support. This revision also extends the contract through 9/30/2009. Revision 8 increases the cost for DO200 by $1,498,873 over Revision 7.
Revision 9	14,795,076	Implementation of ER4-TM200 Robotics Labs Technology Requirements (R9, 2009). Additional resources are added and are provided to extend the current level of manufacturing and engineering services satisfy the on-going requirements. This action accommodates a reprioritized increase in long le item procurement which occurred during the execution of Revision 8. Further this revision adds travel t Arizona for desert trials of the Lunar Electric Rover. Revision 9 increases the cost for DO200 by $1,485,387 over Revision 8.
Revision 10	15,356,207	Implementation of ER4-TM200 Robotics Labs Technology Requirements (R12, 11 December 2009). Additional resources are added and are provided to extend the current level of manufacturing and engineering services to satisfy the on-going requirements. Revision 9 increases the cost for DO200 by $1,203,075 over Revision 9.
Revision 11	16,015,653	Revision 11 exercises the Option in Revision 10 for the November 1, 2009 thru January 31, 2010 portio of the Contractor's proposal dated August 21, 2009, an increase of $659,446.00.
Revision 12	22,015,653	Revision 12 incorporates the changes associated with Implementation of ER4-TM200 Robotics Labs Technology Requirements (R11 2009, 11/30/ 2009). The revision extends the period of performance through May 31, 2010 and increases the scope of manufacturing services. The revision also adds engineering services for the Centaur II robot mobility project and funding for Robonaut 2 Testbeds manufacturing and procurement. Total revision increase is $6,000,000.00.
Revision 13	$23,015,638	Revision 13 incorporates the changes associated with Implementation of ER4-TM200 Robotics Labs Technology Requirements (R13 2010, 2/5/ 2010). The revision extends the period of performance through July 31, 2010. The revision also adds engineering services for the Roboraut to ISS task and procurement. Total revision increase is $999,985.
Revision 14	$24,789,318	Revision 14 incorporates the changes associated with Implementation of ER4-TM200 Robotics Labs Technology Requirements (R14 2010, 5/14/ 2010). The revision extends the period of performance through June 30, 2011. The revision also adds travel monies for Desert Rats and money for Modified Truncated Cone targets manufacturing . Total revision increase is $1,773,680
Revision 15	$25,389,318	Revision 15 incorporates the changes associated with Implementation of ER4-TM200 Robotics Labs Technology Requirements (R15, 9/2010). This revision adds monies for Micro Conical Fitting on WBS03. WBS05 picks up the engineering, manufacturing, development and testing of the Chariot/SPR, Centaur II, and Education Outreach activities for FY2011. WBS-04 R2 to ISS technical services and money for materials are also extended for the build up of ground support robots and test articles. Subcontract money levels are maintained. Total revision increase is $600,000.

Revision 16	$26,055,984	Revision 16 incorporates the changes associated with Implementation of ER4-TM200 Robotics Labs Technology Requirements (R16, 11/2010). This revision adds scope and funding for additional Micro Conical Fitting on WBS03. Period of performance is extended for WBS05 (engineering, manufacturing, development, and testing of the Chariot/SPR, Centaur II, and Education Outreach activities for FY2011 as well as WBS-04 (R2 to ISS technical services through January 31, 2011. Total Revision is $666,666
Revision 17	$28,801,286	Revision 17 incorporates the changes associated with implementation of ER4-TM200 Robotics Labs Technology Requirements (R17, 1/2011). Period of performance is extended through September 30, 2011 (N.B. funding planned for this revision is only thru April). WBS04 scope now includes technical services for continued R2 support when R2 arrives on station, as well as buildup of additional R2 units. WBS05 now includes scope to provide technical services for an additional electric vehicle.
Revision 18	$30,552,063	Revision 18 incorporates the changes associated with Implementation of ER4-TM200 Robotics Labs Technology Requirements (R18, 7/2011). WBS04 scope now includes technical services to provide continued R2 support in the buildup of six R2 units, R2 legs and other R2 related testbeds. WBS05 extends provision of 1)engineering and other technical services for the Centaur, Space Exploration Vehicle (SEV), and GM electric vehicle and testbeds 2)technical services for IT/Media support and the Electrical Design Laboratory (EDL) and 3) education outreach. Travel has been added for support of Desert RATs at the end of FY11.
Revision 19	$31,652,063	Revision 19 adds an additional $1,100,000 (including burden and fee) in material funding to WBS04. Multiple R2 parts submitted to the B10 shop for fabrications are now needed this fiscal year and due to the shop load, we need to outsource the work (~$100K). Also, several key electrical components for the R2 backpack and leg development need to be procured and received before the end of the fiscal year (~200K). The remainder of the additional purchases will be made before FY end but not received till FY12.Revision 19 incorporates the changes associated with Implementation of ER4-TM200 Robotics Labs Technology Requirements (R19, 8/2011).

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ07HC95D DO 213 R7

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 03/09/2007 – 09/30/2011

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Chuck Murgia

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: **04/05/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Shuttle Tile Panel and Holder Assembly for Arc Jet Testing**					
DO	**213 R7**					
	Est. Labor Costs	b4			b4	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. The orders requirements however take precedence over the contractors proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$ 121,217

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ07HC95D-DO213 R7

Originator: Malise Fletcher (MV6) (281) 483-1952 **TMR:** Malise Fletcher (MV) (281) 483-1952

Revision Summary:
Update period of performance.

1. Title of Effort: Shuttle Tile Panel and Holder Assembly for Arc Jet Testing

2. Date of Request: 03/15/2011

3. Statement of Work Task Description

a. **2.1.1-Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated R7

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/12/2007 and ends 09/30/2011.

5. Product Requirements

5.1 Shuttle Tile Panel and Holder Assembly for Arc Jet Testing Updated R7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall install and remove Class III GFE Shuttle Tile panels in holders pre and post Arc Jet testing respectively, modify Class III GFE tile panel for variable configuration, and repair tile panels.

Project Directives (PD) will used provide more detailed description and approve the Ground Test Services by the MV6 CCB, with ESCG engagement. Updated R7

5.1.1 Shuttle Tile Panel and Holder Assembly for Arc Jet Testing Updated R7

Project Code: none

The contractor shall install and remove Class III GFE Shuttle Tile panels in holders in accordance with the requirements per Boeing Company NASA Systems drawing numbers VT70-191001 and VT70-191352 pre and post Arc Jet testing respectively. The contractor shall modify one Class III VT70-191094-001 GFE tile panel in accordance with the VT70-191120-001 Boeing Catia Variable Configuration Tile Array Model. The contractor shall provide Shuttle tile panel ground test services associated with Shuttle mission operations, to include installation/removal from test frames, repair, and machining to simulate damage. All items will be provided as GFE except for miscellaneous items such as Kapton tape, silicone caulking and closeout thermal insulation.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPR 8500.4	Engineering Drawing System Manual	K
VT70-191001	Assembly of Arc Jet Test Panel and Holder	Original
VT70-191120-001 Added Rev 2	Boeing Catia Variable Configuration Tile Array Model	Original
VT70-191352	(CATIA) TEST ARTICLE; MLGD THERMAL INHIBITOR	

c. **Required DRDs**

5.1.1 Shuttle Tile Panel and Holder Assembly for Arc Jet Testing

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	1 set
105 Added Rev 1	Regular Status Report/Summary Review	monthly

d. **Products**

5.1.1 Shuttle Tile Panel and Holder Assembly for Arc Jet Testing

Product(s)	Quantity	Delivery Date
Install arc jet Tile Array test articles into test frames (Class III) pre arc jet test Updated R7	15	12/31/2009
Remove arc jet Tile Array test articles from test frames (Class III) post arc jet test Updated R7	6	12/31/2009
Install arc jet Main Landing Gear Door test articles into test frames (Class III) pre arc jet test Updated R7	2	09/30/2008
Remove arc jet Main Landing Gear Door test articles from test frames (Class III) post arc jet test Updated R7	2	09/30/2008
Fabricate and deliver tile test assembly panels (Class III) Updated R7	12	09/30/2008
Master Plan and Schedule Updated R7	1	11/01/2009
Status Reports Updated R7	1/month	15th of the month
Modify GFE tile panel for variable configuration Updated R7	1	09/30/2008
Repair GFE tile panel Updated R7	1	12/31/2009
Ground Test Services per Project Directive (PD) Updated R7	Per PD	9/30/2011

e. **Product Verification**

5.1.1 Shuttle Tile Panel and Holder Assembly for Arc Jet Testing
i. Install arc jet Tile Array test articles into test frames (Class III) pre arc jet test
- Completed upon verification and acceptance by the MV6 TMR or designee as indicated by closure of all work authorizing documentation.
ii. Remove arc jet Tile Array test articles from test frames (Class III) post arc jet test
- Completed upon verification and acceptance by the MV6 TMR or designee as indicated by closure of all work authorizing documentation.
iii. Install arc jet Main Landing Gear Door test articles into test frames (Class III) pre arc jet test
- Completed upon verification and acceptance by the MV6 TMR or designee as indicated by closure of all work authorizing documentation.
iv. Remove arc jet Main Landing Gear Door test articles from test frames (Class III) post arc jet test
- Completed upon verification and acceptance by the MV6 TMR or designee as indicated by closure of all work authorizing documentation.
v. Fabricate and deliver tile test assembly panels (Class III)
- Completed upon verification and acceptance by the MV6 TMR or designee as indicated by closure of all work authorizing documentation.
vi. Master Plan and Schedule
- Completed upon acceptance and signature by the MV6 TMR or designee.
vii. Status Reports
- Completed upon acceptance and signature by the MV6 TMR or designee.
viii. Modify GFE tile panel for variable configuration
- Completed upon verification and acceptance by the MV6 TMR or designee as indicated by closure of all work authorizing documentation.
ix. Repair GFE tile panel
- Completed upon verification and acceptance by the MV6 TMR or designee as indicated by closure of all work authorizing documentation.
x. Ground Test Services per Project Directive (PD)
- Completed upon verification and acceptance by the MV6 TMR or designee.

6. Cost Summary and Revision History

DO 213 R7 Summary		ContractYear					
SLC		CY3	CY4	CY5	CY6	CY7	**Total**
AS3							
	Sum of Hrs						
	Sum of Dollars						
BS2							
	Sum of Hrs						
	Sum of Dollars						
EN2							
	Sum of Hrs						
	Sum of Dollars						
EN3							
	Sum of Hrs						
	Sum of Dollars						
EN4							
	Sum of Hrs						
	Sum of Dollars						
ESS							
	Sum of Hrs						
	Sum of Dollars						
PC2							
	Sum of Hrs						
	Sum of Dollars						

PS3	
	Sum of Hrs
	Sum of Dollars
QA2	
	Sum of Hrs
	Sum of Dollars
QE2	
	Sum of Hrs
	Sum of Dollars
SV	
	Sum of Hrs
	Sum of Dollars
TN3	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**$121,217.16**

DO 213 revision history	Total cost	Reason for revision
Original	140,595	
Revision 1	117,513	5.1 Original scope of contract plus 1 integration/de-integration of a MLGD test article and misc. test fixture manufacturing
Revision 2	124,815	5.1 Original scope of contract to include R1 plus tile array, VT70-191094-001, modification and integration/de-integration
Revision 3	120,614	5.1 Original scope of contract to include R2 plus extend period of performance and reduction in quantity of Install/Remove arc jet Tile Array
Revision 4	102,179	5.1 Original scope of contract to include R3 plus reduce quantity of Install/Remove arc jet Tile Array, reduce the quantity of MER-ESC-006 DO213 Master Plan and Schedule products, change the Status Report deliver from fixed quantity to monthly delivery, add a requirement to repair tile panels and associated product, and extend period of performance through December 31, 2009
Revision 5	119,244	5.1 Original scope of contract to include R4 plus reduce quantity of Install/Remove arc jet Tile Array and add Shuttle tile panel ground test services associated with Shuttle mission operations.
Revision 6	121,217	Original technical scope of contract to include R5 plus extend period of performance to March 30, 2011, which requires additional monthly reporting.
Revision 7	121,217	Original technical scope of contract to include R6 plus extend period of performance to September 30, 2011. This is a zero cost change.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ07HE18D DO 239 Rev 4	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 07/13/2007 - 01/31/2013

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: **Ray DeVall**

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: **09/08/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**ARES Scientific Infrastructure Enhancements for Exploration Research**					
DO	**239 R4**		bf		bf	
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. **Total**

$2,572,837.02

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ07HE18D-DO239 REV 4

Originator: Susan Runco (KA) (281) 244-8848 **TMR:** Susan Runco (KA) (281) 244-8848

Revision Summary:
To extend period of performance to January 31, 2013 and to replan laboratory enhancements which have been deferred.

1. Title of Effort: ARES Scientific Infrastructure Enhancements for Exploration Research

2. Date of Request: 08/23/2011

3. Statement of Work Task Description

a. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

b. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

c. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 4

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 07/01/2007 and ends 01/31/2013.

5. Product Requirements

5.1 ARES Infrastructure Upgrades for Exploration Research

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide enhanced scientific capabilities by conducting facilities systems modernization and upgrade to meet ARES objectives described in the applicable documents and which are outlined in accordance with KA-WI-001, ARES Master Work Instruction. No flight products will be required.

5.1.1 ARES Infrastructure Upgrades Updated REV 4

Project Code:

The contractor will provide increased scientific capabilities required to implement ARES exploration objectives as defined by the applicable documents and which are outlined in accordance with KA-WI-001, ARES Master Work Instruction.

b. **Applicable Documents**

Document Number	Document Name	Rev.
HITF-KX-003 Added Rev 3	ARES BUMPER Micro-Meteoroid and Orbital Debris (MMOD) Risk Assessment Process Hypervelocity Impact Technology Facility (HITF)	Current
JSC 03225	JSC Plan for Safeguarding Lunar Samples	
JSC 26014	JSC Operational Plan for Curator's Display in Space Center Houston	Current
JSC-62688	JSC Image Science & Analysis Group Operations Plan for Mission Support	Current
KA-WI-001	ARES Master Work Instruction	Current
KA-WI-002	ARES Configuration Management	Current
KA-WI-003	ARES Management of Research Proposals	Current
KR-001	Office of Astromaterials research Configuration Management Process	Current
KR-ESC-02	ARES Astromaterials Research Action Plan	Current
KX-002	ARES Earth Observations Operations Plan	Current
KX-HITF-001	ARES Hypervelocity Impact Technology Facility (HITF) Internal Task Plan and Schedule	Current
KX-IA-001	JSC Image Science and Analysis Facilities CoFR Plan	Current
KX-OD-001	ARES Orbital Debris Deliverable Control Board Internal Task Plan and Schedule	Current
KX-OD-002	ARES Orbital Debris Project Surveillance Plan	Current
LOP 54	Approved Materials and Items: PSLV, RSLV, and RPL	Current
LOP 58	Approved Materials and Items: MPL	Current
LOP 60	Approved Materials and Items: Genesis Laboratory	Current
LOP 73 Added Rev 2	SEH Lab Entry, Exit, Housekeeping, Maintenance and Acceptable Materials	Current
MP 11	Facility Description:PSLV	Current
MP 13	Facility Description: Sample Control and Sample Information Center	Current
MP 14	Facility Description: TSL	Current
MP 16	Facility Description Genesis Laboratory	Current
MP 2	Hurricane Plan for the Planetary Materials Facility	Current
MP 5	Emergency Action Plan for Response to Oxygen Alarm in the Curatorial Laboratories	Current
MP 6	General Operating Procedure for the Genesis Laboratory	Current
MP 90A	Index of Curatorial Procedures	Current
SCDP 11	RSF Records Procedure for Maintenance/Removing Sample from Inventory	Current
SPKA0004	Meteoroid/Orbital Debris Research Facilities	Current
SPKA0005	Image Science and Analysis Laboratory (ISAL)	Current
SPKA0006 Added Rev 2	Astromaterials Research and Curation (AR&C) Facility	Current
TSP 64 Added Rev 2	Genesis Lab: Protocols and Schedules for Housekeeping and Contamination Control Monitoring	Current
TSP 82 Added Rev 2	Remote Storage Facility: Routine Maintenance Operations	Current

c. **Required DRDs**

5.1.1 ARES Infrastructure Upgrades

DRD #	DRD Title	Quantity/Frequency
Updated Rev 2	No Requirement	Per DRD 25 report requirements

d. **Products**

5.1.1 ARES Infrastructure Upgrades		
Product(s)	**Quantity**	**Delivery Date**
Scientific infrastructure enhancements Updated REV 4	1 set	Per KA-WI-001
Delivery/Acceptance Report (per DRD 25) Updated REV 4	1/quarter	quarterly
Instrument installation/verification report	1/instrument	Quarterly; Included in Delivery/Acceptance Report

e. **Product Verification**

5.1.1 ARES Infrastructure Upgrades
i. Scientific infrastructure enhancements
- NASA DO Technical Monitor will review/accept scientific enhancements. Acceptance by TM will be documented with final acceptance by TMR/Alternate. Updated REV 4
ii. Delivery/Acceptance Report (per DRD 25)
- NASA TM approval of Delivery/Acceptance Report with final acceptance by the TMR/Alternate
iii. Instrument installation/verification report
- The NASA DO Technical Monitor will review/accept the installation and system check out upon completion with respect to quality and schedule. Deliverables will be accepted by TM with final acceptance by the TMR/Alternate.

6.0 Cost Summary and Revision History

SLC		CY3	CY4	CY5	CY6	CY7	CY8	Grand Total
BS2								
	Sum of Hrs							
	Sum of Dollars							
SC3								
	Sum of Hrs							
	Sum of Dollars							
Total Direct Labor Hrs								
Total Direct Labor Cos								
Subcontract								
Material								
Travel								
NLR Misc								
Burden on Non-Labor								
Total Non-Labor								
Total Costs								
Fee (100% of Pool)								
Total								**$2,572,837.02**

64

DO239 revision history	Total cost	Reason for revision
Original	$762,084	
Revision 1	$2,217,183	Increase material cost by 64
Revision 2	$2,847,491	To extend period of performance to December 31, 2010 and to increase materials.
Revision 3	$2,718,865	To extend period of performance to December 31, 2011, to descope materials that will not be procured, and to replan material procurements that have been deferred.
Revision 4	$2,572,837	To extend period of performance to January 31, 2013 and to descope and replan material procurements that have been canceled or deferred.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ07HI55D DO 245 R8

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson1 Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2007 – 01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: 7/18/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Exercise Countermeasures System**					
DO	**245 R8**					
	Est. Labor Costs		b4			
	Materials/Subcontracts					
	Travel				b4	
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the orders requirements take precedence over the contractors proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$25,431,831.10

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ07HI55D-DO245 REV 8

Originator: PATRICK BEVILL (ER3) (281) .24-7348 **TMR:** Jared Woodfill (ER) (281) 483-6331

Revision Summary:

DO 245 revision to add additional scope (TVIS Life Extension tasks, ARED platform analysis, HRM2 receiver board redesign, new L&M deliverables) for FY11. This revision will incorporate changes to JSC-63223, ?Engineering Product Plan for International Space Station and Space Shuttle Programs for the Exercise Countermeasures System? and JSC-62970 ?CHeCS Countermeasures (CMS) Logistics & Resupply Products".

1. Title of Effort: Exercise Countermeasures System

2. Date of Request: 06/01/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

e. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

f. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

g. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

h. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

i. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

j. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

k. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

l. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 6

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 09/29/2007 and ends 01/31/2013.

5. Product Requirements

5.1 ISS Countermeasures System Engineering Updated Rev 7

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Sustain the International Space Station (ISS) Crew HealthCare System (CHeCS) Countermeasures System (CMS) to support on-orbit operations and ground operations as defined in the subsequent paragraphs. Updated Rev 7

5.1.1 ISS CMS Engineering Products Updated Rev 7

Project Code: TVIS; 00100, CEVIS;00099, IRED;00101, BP/ECG;00102, MEC;00103; ARED;2B201, HRM2;00066

Deliver flight performance engineering analysis, assessments, and products for flight hardware failure resolution, engineering products for flight hardware and ground support hardware design changes, and engineering products to support ISS Program Office engineering, planning, and operational decisions for the following ISS CHeCS CMS subsystems and tasks:

1. Treadmill with Vibration Isolation & Stabilization (TVIS) System
2. Cycle Ergometer with Vibration Isolation & Stabilization (CEVIS) System
3. Interim Resistive Exercise Device (IRED)
4. Advanced Resistive Exercise Device (ARED)
5. Second Generation Heart Rate Monitor (HRM2)
6. Blood Pressure/Electrocardiogram Device (BP/ECG)
7. Medical Equipment Computer (MEC) software and Countermeasures System Software (CMSS)

8. CMS Knowledge Capture

Detail information necessary for planning these tasks is defined in JSC 63223, "Engineering Products for International Space Station and Space Shuttle Programs for the Exercise Countermeasures System".

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 4	JSC Lessons Learned Process	10-02
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
IEEE/ASTM SI 10-2002 Added Rev 4	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
JSC 17773	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27260	Decal Design and Production Facility- Decal Process Document and Catalog	Rev D 05-02
JSC 27472	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 28035	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
JSC 49879 Draft	Johnson Space Center (JSC) Wire and Cable Integrity Compliance Program	Draft
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
MIL-STD-882 Added Rev 4	Standard Practice for System Safety	Rev D 02-02
NASA-STD-5003	Fracture Control Requirements for Payloads Using the Space Shuttle	10-96
NASA-STD-8739.1	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	8-99
NASA-STD-8739.3	Soldered Electrical Connection	12-97
NASA-STD-9739.4	Crimping, Interconnecting Cables, Harnesses, and Wiring	2-98
NPD 9501.1 Added Rev 4	NASA Contractor Financial Management Reporting System	Rev G 05-00
NPD 9501.3 Added Rev 4	Earned Value Management	Rev A 08-02
NPR 2810.1 Added Rev 4	Security of Information Technology	08-99
NPR 8621.1 Added Rev	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04

4		
NPR 8715.3 Added Rev 4	NASA Safety Manual	Change 1 06-02
NPR 9501.2 Added Rev 4	NASA Contractor Financial Management Reporting	Rev D 05-01
OB-MER-006	MER Handbook	Draft 07-00
SN-C-0005	Contamination Control Requirements	Rev D 07-98
SSP 30234	Failure Modes and Effects Analysis and Critical Items Requirements List for Space Station	Rev F 10-02
SSP 30240	Space Station Grounding Requirements	Rev D 12-02
SSP 30243	Space Station Requirements for Electromagnetic Compatibility	Rev G 12-02
SSP 30309	Safety Analysis and Risk Assessment Requirements	Rev E 01-95
SSP 30312	Electrical, Electronic and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program	Rev F 11-95
SSP 30423	Space Stations Approved Electrical, Electronic, and Electromechanical Parts List	Rev F 11-95
SSP 30524	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
SSP 30558	Fracture Control Requirements for Space Station	Rev C 11-01
SSP 30559	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01
SSP 30599	ISS Safety Review Process	Rev A 06-95
SSP 30695	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287	Hardware/Software Acceptance Process	Rev A 05-01
	Documents specific to each CMS subsystem are located within their respective JSC Engineering Directorate Project Flight GFE websites	
	ISS Multilateral Operations Integration Control Board (MOICB) Directives	
EA-WI-016	Off-the-Shelf Hardware Utilization in Flight Hardware Development	Basic
EA-WI-018	Use of Off-the-Shelf Software in Flight Projects	Basic
EA-WI-023 Added Rev 5	Project Management of GFE Projects	Rev. E, 02-2006
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Basic
EA-WI-027	Configuration Management Requirements	A
EA3-WI-013 Added Rev 5	Receiving, Control and Shipment of NASA Property	E
EA3-WI-022 Added Rev 5	Test Facilities Operations	E
EA3-WI-043 Added Rev 5	Control of Hazardous Energy (Lockout/Tagout and Energy Source Isolation) Process	C
EA3-WI-044 Added Rev 5	Bond Room Operations/Building 36	C
JPR 1700.1 Added Rev 4	JSC Safety and Health Handbook	Rev. J, 04-08
JPR 8080.5	JSC Design and Procedural Standards Manual	A
JPR 8500.4	Engineering Drawing System Manual	K
JSC 27827 Added Rev 4	Government Furnished Equipment Configuration Management Plan	E
JSC 49774	Standard Manned Spacecraft Requirements for Materials and Processes	A
JSC 63223 Added REV 8	Engineering Products for International Space Station and Space Shuttle Programs for the Exercise Countermeasures System	K
JSC EV-009 Added Rev 4	Government Furnished Equipment Project Management Instructions	F
JSC-62970 Added REV 8	CHeCS Countermeasure System (CMS) Logistics & Resupply Products	R
NASA-STD-4003	ELECTRICAL BONDING FOR NASA LAUNCH VEHICLES, SPACECRAFT, PAYLOADS, AND FLIGHT EQUIPMENT	Basic
NT-CWI-001 Added Rev 3	Task Performance Sheet (TPS)	Rev C 07-08
NT-CWI-003 Added Rev 3	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev C 11-06
NT-CWI-004	Flight Equipment Pre-Shipment Readiness Review (JSC Form 1027)	C
NT-GFE-007	Certification Approval for JSC Government Furnished Equipment (GFE)	C
NT-GFE-008	Government Furnished Equipment (GFE)/ Extravehicular Activity (EVA) Failure Modes and Effects Analysis (FMEA)/Critical Items List (CIL) Preparation and Processing	D

NT-GFE-009	Government Furnished Equipment (GFE) Safety and Mission Assurance Review Team (SMART) Logistics Process	E
NT-GFE-014	Safety Analysis and Risk Assessment Executive Summary Reports (RAESR) for Government Furnished Equipment	Basic
NT-GFE-015	Flight Safety Review Process for Government Furnished Equipment	Basic
SRSD-09-011 Added Rev 5	Configuration Management Change Processing	Basic
SRSD-09-012 Added Rev 5	Change Procedures for CHeCS Vendor Drawings	Basic
SRSD-09-013 Added Rev 5	Work Instruction for Control of Redlined Production Drawings	Basic
SRSD-09-014 Added Rev 5	Work Instruction for the Release and Control of Project Documentation	Basic
SSCD 10110	CHeCS (Crew Health Care System) CEVIS (Cycle Ergometer with Vibration Isolation & Stabilization) Spare Control Panels	Basic
SSCD 10440	Oxygen Uptake Measurement for use during crew Periodic Fitness Evaluations (OUM-PFE)	Basic
SSCD 8053	Provide CMS Hardware for Expedition 10	R2
SSP 30233	Space Station Requirements for Materials and Processes	G
SSP 30240 Added Rev 4	Space Station Grounding Requirements	Rev G, 06-2006
SSP 30243 Added Rev 4	Space Station Requirements for Electromagnetic Compatibility	Rev L, 02-2007
SSP 30309 Added Rev 4	Safety Analysis and Risk Assessment Requirements	Rev E, 01-2007
SSP 30312 Added Rev 4	Electrical, Electronic and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program	Rev H, 01-2007
SSP 30423 Added Rev 4	Space Stations Approved Electrical, Electronic, and Electromechanical Parts List	Rev FJ, 01-2007
SSP 30524 Added Rev 4	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E, 01-2007
SSP 30559 Added Rev 4	Structural Design and Verification Requirements	Rev D, 02-2008
SSP 30599 Added Rev 4	ISS Safety Review Process	Rev D, 10-2007
SSP 41172	Qualification and Acceptance Environmental Test Requirements	Y
SSP 50287 Added Rev 4	Hardware/Software Acceptance Process	Rev A, 01-2007
SSP 50470 Added Rev 3	Crew Health Care System (CHeCS) GFE Specification	C
SSP 50492 Added Rev 4	General International Space Station On-Orbit Requirements for Nonpressurized Support Equipment	Baseline, 01-2007
UWI-AI-001 Added Rev 4	Office of the CIO Process for Document and Data Control	Rev B, 3-01

c. **Required DRDs**

5.1.1 ISS CMS Engineering Products		
DRD #	**DRD Title**	**Quantity/Frequency**
101	Project Schedule	Qty as defined in JSC 63223
102	Engineering Drawings and Model Files	Qty as defined in JSC 63223
103	Electrical, Electronic, and Electromechanical (EEE) Parts List and Analysis Report	Qty as defined in JSC 63223
104	Engineering Design Change Proposal	Qty as defined in JSC 63223
106	Reliability and Maintainability (R&M) Plan	Qty as defined in JSC 63223
107	Test Report	Qty as defined in JSC 63223
202	Flight Products Systems Requirements Review (SRR) Data Package	Qty as defined in JSC 63223
203	Flight Products Project Requirements and Verification Documentation (PRVD)	Qty as defined in JSC

		63223
204	Preliminary Design Review (PDR) Data Package	Qty as defined in JSC 63223
205	Flight Products Workmanship Specification List	Qty as defined in JSC 63223
206	Flight Products Interface Control Document (ICD)	Qty as defined in JSC 63223
207	Flight Products Specification	Qty as defined in JSC 63223
208	Flight Products Failure Analysis Report	Qty as defined in JSC 63223
209	Flight Products Verification and Validation Plan	Qty as defined in JSC 63223
210	Flight Products Software Requirements Specification	Qty as defined in JSC 63223
211	Flight Products Software Development Plan	Qty as defined in JSC 63223
212	Flight Products Software Design Document	Qty as defined in JSC 63223
213	Flight Product Critical Design Review (CDR) Data Package	Qty as defined in JSC 63223
214	Flight Products Qualification Test Procedures	Qty as defined in JSC 63223
215	Software Code	Qty as defined in JSC 63223
216	Flight Products Qualification Plan	Qty as defined in JSC 63223
217	Flight Product Qualification Report	Qty as defined in JSC 63223
218	Engineering Analysis	Qty as defined in JSC 63223
219	Flight Product User's Guide	Qty as defined in JSC 63223
220	Flight Projects Authorization to Proceed Record	Qty as defined in JSC 63223
221	Flight Products Acceptance Test Procedures	Qty as defined in JSC 63223
222	Flight Product Verification and Validation Report	Qty as defined in JSC 63223
230	Acceptance Data Package	Qty as defined in JSC 63223
231	Limited Life Items List	Qty as defined in JSC 63223
233	Government Certification Approval Request (GCAR)	Qty as defined in JSC 63223
237	Certification Data Package	Qty as defined in JSC 63223
238	Space Station Reliability and Maintainability Predictions Report	Qty as defined in JSC 63223
239	Space Station Hardware Failure Modes Effects and Analysis (FMEA) and Critical Items List	Qty as defined in JSC 63223
240	Space Station Hazard Reports (HR's)	Qty as defined in JSC 63223
241	Risk Assessment Executive Summary Report (RAESR)	Qty as defined in JSC 63223

d. **Products**

5.1.1 ISS CMS Engineering Products

Product(s)	Quantity	Delivery Date
Engineering products and services as detailed in JSC 63223 Updated REV 8	As defined in JSC 63223	As defined in JSC 63223
TCSR as detailed in JSC 63223 Updated REV 8	1/month	As required to suport program review
~~Financial Supplemental Report Deleted Rev 7~~	~~1/Month~~	~~within 2 days of the 533 financial~~

	report submittal

e. **Product Verification**

5.1.1 ISS CMS Engineering Products
i. Engineering products and services as detailed in JSC 63223
- Product and service verifications as detailed in JSC 63223
ii. TCSR as detailed in JSC 63223
- Submittal into DDMS and posted to CMS shared TCSR folder.
iii. Financial Supplemental Report Deleted Rev 7
- Receipt by E-mail by the LE Financial Analyst and CMS Engineering Lead Deleted Rev 7

5.2 SSP Biomedical Equipment Engineering Updated Rev 4

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall sustain the Space Shuttle Program (SSP) Biomedical Equipment to support on-orbit operations and ground operations, as defined in the subsequent paragraphs. Updated Rev 4

5.2.1 SSP Biomedical Equipment Engineering Products Updated Rev 7
Project Code: 00099

Deliver flight performance engineering analysis and assessments, products for flight hardware failure resolution, engineering products for flight hardware and ground support hardware design changes, and engineering products to support SSP Office engineering, planning, and operational decisions for the following Space Shuttle Program Biomedical Equipment:
1. Shuttle Cycle Ergometer

Detail information necessary for planning these tasks is defined in Section 5 of JSC 63223, "Engineering Products for International Space Station and Space Shuttle Programs for the Exercise Countermeasures System.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 4	JSC Lessons Learned Process	10-02
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
IEEE/ASTM SI 10-2002 Added Rev 4	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
IEEE/ASTM SI 10-2002 Added Rev 4	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
JSC 17481 Added Rev 4	Safety Requirements Document for JSC Space Shuttle Flight Equipment	Rev B 09-02
JSC 17773	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27260	Decal Design and Production Facility- Decal Process Document and Catalog	Rev D 05-02
JSC 27472	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 28035	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
JSC 49879 Draft	Johnson Space Center (JSC) Wire and Cable Integrity Compliance Program	Draft
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
MIL-STD-882 Added Rev 4	Standard Practice for System Safety	Rev D 02-02
NASA-STD-5003	Fracture Control Requirements for Payloads Using the Space Shuttle	10-96
NASA-STD-8739.1	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	8-99
NASA-STD-8739.3	Soldered Electrical Connection	12-97
NASA-STD-9739.4	Crimping, Interconnecting Cables, Harnesses, and Wiring	2-98
NPD 9501.1 Added Rev	NASA Contractor Financial Management Reporting System	Rev G 05-00

4		
NPD 9501.3 Added Rev 4	Earned Value Management	Rev A 08-02
NPR 2810.1 Added Rev 4	Security of Information Technology	08-99
NPR 8621.1 Added Rev 4	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 9501.2 Added Rev 4	NASA Contractor Financial Management Reporting	Rev D 05-01
NSTS 13830	Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station	Rev C change 4 01-02
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 21288	Required Data/Guidelines for Payload/Shuttle Electromagnetic Compatibility (EMC) Analysis	Basic 01-94
NSTS 22206	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	Rev D 12-93
NSTS 22254	Methodology for Conduct of Space Shuttle Program Hazard Analysis	Rev B 12-93
NSTS 37329	Structural Integration Analysis Responsibility Definition for Space Shuttle Vehicle and Cargo Element Developers	Rev B Change 2 12-01
NSTS 5300.4 (1D-2)	Safety, Reliability, Maintainability and Quality Provisions for the Space Shuttle Program	9-97
OB-MER-006 Added Rev 4	MER Handbook	Draft 07-00
SN-C-0005	Contamination Control Requirements	Rev D 07-98
SSP 30234 Added Rev 4	Failure Modes and Effects Analysis and Critical Items Requirements List for Space Station	Rev F 10-02
	Documents specific to Shuttle Cycle Ergometer located within JSC Engineering Directorate Project Flight GFE website	
EA-WI-016	Off-the-Shelf Hardware Utilization in Flight Hardware Development	Basic
EA-WI-023 Added Rev 4	Project Management of GFE Flight Projects	Rev E, 02-2006
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Basic
EA-WI-027	Configuration Management Requirements	A
EA3-WI-013 Added Rev 5	Receiving, Control and Shipment of NASA Property	E
EA3-WI-022 Added Rev 5	Test Facilities Operations	E
EA3-WI-023 Added Rev 3	Control/Handling of Class I Hardware in Support of Remote Site Activities	B
EA3-WI-043 Added Rev 5	Control of Hazardous Energy (Lockout/Tagout and Energy Source Isolation) Process	C
EA3-WI-044 Added Rev 5	Bond Room Operations/Building 36	C
JPR 1700.1 Added Rev 4	JSC Safety and Health Handbook	Rev. J, 04-08
JPR 8080.5	JSC Design and Procedural Standards Manual	A
JPR 8500.4	Engineering Drawing System Manual	K
JSC 27827 Added Rev 4	Government Furnished Equipment Configuration Management Plan	E
JSC 49774	Standard Manned Spacecraft Requirements for Materials and Processes	A
JSC 62970 Added REV 8	CHeCS Countermeasures System (CMS) Logistics & Resupply Products	R
JSC 63223 Added REV 8	Engineering Product Plan for International Space Station and Space Shuttle Programs for the Exercise Countermeasures System	K
JSC EV-009 Added Rev 4	Government Furnished Equipment Project Management Instructions	F
NASA-STD-4003	ELECTRICAL BONDING FOR NASA LAUNCH VEHICLES, SPACECRAFT, PAYLOADS, AND FLIGHT EQUIPMENT	Basic
NT-CWI-001 Added Rev 3	Task Performance Sheet (TPS)	Rev C 07-08
NT-CWI-003 Added Rev 3	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev C 04-06
NT-GFE-007	Certification Approval for JSC Government Furnished Equipment (GFE)	C

NT-GFE-008	Government Furnished Equipment (GFE)/ Extravehicular Activity (EVA) Failure Modes and Effects Analysis (FMEA)/Critical Items List (CIL) Preparation and Processing	D
NT-GFE-009	Government Furnished Equipment (GFE) Safety and Mission Assurance Review Team (SMART) Logistics Process	E
NT-GFE-014	Safety Analysis and Risk Assessment Executive Summary Reports (RAESR) for Government Furnished Equipment	Basic
NT-GFE-015	Flight Safety Review Process for Government Furnished Equipment	Basic
SRSD-09-011 Added Rev 5	Configuration Management Change Processing	Basic
SRSD-09-014 Added Rev 5	Work Instruction for the Release and Control of Project Documentation	Basic
SSP 30240 Added Rev 4	Space Station Grounding Requirements	Rev G, 06-2006
SSP 30243 Added Rev 4	Space Station Requirements for Electromagnetic Compatibility	Rev L, 02-2007
SSP 30309 Added Rev 4	Safety Analysis and Risk Assessment Requirements	Rev E, 01-2007
SSP 30312 Added Rev 4	Electrical, Electronic and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program	Rev H, 01-2007
SSP 30423 Added Rev 4	Space Stations Approved Electrical, Electronic, and Electromechanical Parts List	Rev FJ, 01-2007
SSP 30524 Added Rev 4	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E, 01-2007
SSP 30558 Added Rev 4	Fracture Control Requirements for Space Station	Rev C, 11-01
SSP 30559 Added Rev 4	Structural Design and Verification Requirements	Rev D, 02-2008
SSP 30599 Added Rev 4	ISS Safety Review Process	Rev D, 10-2007
SSP 30695 Added Rev 4	Acceptance Data Package Requirements Specification	Rev A, 01-1995
SSP 41172 Added Rev 4	Qualification and Acceptance Environmental Test Requirements	V
SSP 50287 Added Rev 4	Hardware/Software Acceptance Process	Rev A, 01-2007
SSP 50470 Added Rev 4	Crew Health Care Systems (CHeCS) GFE Specification	A
SSP 50492 Added Rev 4	General International Space Station On-Orbit Requirements for Nonpressurized Support Equipment	Baseline, 01-2007
UWI-AI-001 Added Rev 4	Office of the CIO Process for Document and Data Control	Rev B, 3-01

c. **Required DRDs**

5.2.1 SSP Biomedical Equipment Engineering Products

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Qty as defined in JSC 63223
102	Engineering Drawings and Model Files	Qty as defined in JSC 63223
103	Electrical, Electronic, and Electromechanical (EEE) Parts List and Analysis Report	Qty as defined in JSC 63223
104	Engineering Design Change Proposal	Qty as defined in JSC 63223
107	Test Report	Qty as defined in JSC 63223
203	Flight Products Project Requirements and Verification Documentation (PRVD)	Qty as defined in JSC 63223
206	Flight Products Interface Control Document (ICD)	Qty as defined in JSC 63223
208	Flight Products Failure Analysis Report	Qty as defined in JSC 63223
209	Flight Products Verification and Validation Plan	Qty as defined in JSC 63223
214	Flight Products Qualification Test Procedures	Qty as defined in JSC

		63223
218	Engineering Analysis	Qty as defined in JSC 63223
220	Flight Projects Authorization to Proceed Record	Qty as defined in JSC 63223
221	Flight Products Acceptance Test Procedures	Qty as defined in JSC 63223
222	Flight Product Verification and Validation Report	Qty as defined in JSC 63223
231	Limited Life Items List	Qty as defined in JSC 63223
233	Government Certification Approval Request (GCAR)	Qty as defined in JSC 63223
234	Space Shuttle Flight Products Safety Analysis Report (SAR) and Hazard Report (HR)	Qty as defined in JSC 63223
236	Certification and Acceptance Requirements Document (CARD)	Qty as defined in JSC 63223
237	Certification Data Package	Qty as defined in JSC 63223
241	Risk Assessment Executive Summary Report (RAESR)	Qty as defined in JSC 63223
242	Space Shuttle Hardware Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	Qty as defined in JSC 63223

d. **Products**

5.2.1 SSP Biomedical Equipment Engineering Products		
Product(s)	**Quantity**	**Delivery Date**
Engineering products and services as detailed in JSC 63223 Updated REV 8	1 (as defined in JSC 63223)	As defined in JSC 63223
TCSR as detailed in JSC 63223	1/month	on schedule to support monthly TCSR

e. **Product Verification**

5.2.1 SSP Biomedical Equipment Engineering Products
i. Engineering products and services as detailed in JSC 63223
- Product and service verifications as detailed in JSC 63223
ii. TCSR as detailed in JSC 63223
- Delivered to DDMS and posted to CMS shared TCSR folder.

5.3 ISS Countermeasures System Logistics and Resupply Updated REV 8

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, and pre and post flight processing in order to maintain the function of the program's system products on the International Space Station or to deliver flight products that restore flight product operation of program products that are so costly that there are a limited number. Specifically, this Delivery Order applies to the products identified in "CHeCS Countermeasures System (CMS) Logistics & Resupply Products", JSC-62970. This document provides data necessary to plan, schedule, and coordinate the activities necessary to complete this delivery order. Some of the flight products require pre-flight inspection after delivery to KSC. These are also identified in JSC-62970. The processes, plans and procedures used shall comply with the EA and ER Work instructions identified as Applicable Documents and with applicable documents included in the contract.

NASA retains some in-line responsibilities in support of this DO. These responsibilities are identified in JSC-62970. The NASA responsibilities may be performed by other contractors or by Civil Servants. The contractor shall identify all activities that are to be performed, performing the integrated planning, and coordinating the overall activity.

The contractor shall plan and implement the replacement of flight products on orbit. The contractor shall develop a project schedule (DRD 101) that provides the insight into events that combine for a successful maintenance of systems functions on the mission as well as the replacements of parts or systems. The contractor shall provide Countermeasures Systems logistics and maintenance data and schedules for the planning of manifests by the ISS program. The contractor shall provide replacement hardware and software; plan, schedule and perform associated testing; develop procedures; and develop and deliver technical data. The contractor shall establish and maintain a flight product inventory and replace that inventory due to product life depletion or due to unplanned loss.

A TCSR shall be submitted monthly at a time that allows the cost data to be consistent with the Financial Report, DRD 004.

The space vehicles available to deliver flight products to ISS are the Shuttle and the International Partner Vehicles (IP). The contractor

shall coordinate the delivery of flight products with the ISS program. The contractor shall plan and coordinate the use of the launch delivery method that provides the best opportunity to maintain the systems functionality onboard ISS. Unless otherwise specified in JSC-62970 the contractor shall deliver flight products from Building 36 facilities to the JSC Center Operation Directorate Logistics Division for delivery for launch.

The amount of hardware and the resupply time will change as a function of crew size assigned to an ISS increment. The ISS crew size is 3 and will remain until May of 2009 when it increases to 6.

One domestic trip per year maybe required to assure proper handling or to resolve minor issues or problems integrating the products for this system. Domestic travel for the inspection of the hardware defined in JSC-62970 shall be assessed as part of JSC-62970. One domestic trip per MPLM launch for hardware delivery maybe required in order to assure proper handling, product integration, issues resolution, and to provide engineering system expertise during flight product inspection, and Crew Bench Reviews and other readiness activities. Updated REV 8

5.3.1 Cycle Ergometer with Vibration Isolation & Stabilization and Associated Kits Updated Rev 7
Project Code: 00099 CEVIS

Provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, pre and post flight processing necessary to maintain the function of cardiovascular exercise by cycling on the Cycle Ergometer. The contractor shall develop and maintain the Flight Data that captures the hardware and mission data specific to the Flight Products that is necessary to perform the logistics, maintenance, repair, hardware and software integration, inter/intra center integration, and pre and post processing. The contractor shall provide guidelines and process documents that define how the Systems specific data is entered, modified and accessed. Records for official source of the Flight Data entered into a database such as the Certification of Compliance, Task Performance Sheets, Verification Reports, etc. shall be referenced or electronically linked if available.

5.3.2 Interim Resistive Exercise Device, Contingency Resistive Exercise Device & Associated Kits Updated Rev 7
Project Code: 00101 IRED CRES

Provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, pre and post flight processing necessary to maintain the function of providing crew exercise using the Interim Resistive Exercise Device and the Contingency Resistive Exercise Device onboard the ISS.

The contractor shall develop and maintain the Flight Data that captures the hardware and mission data specific to the Flight Products that is necessary to perform the logistics, maintenance, repair, hardware and software integration, inter/intra center integration, and pre and post processing. The contractor shall provide guidelines and process documents that define how the Systems specific data is entered, modified and accessed. Records for official source of the Flight Data entered into a database such as the Certification of Compliance, Task Performance Sheets, Verification Reports, etc. shall be referenced or electronically linked if available.

5.3.3 Treadmill with Vibration Isolation & Stabilization System and Associated Kits and ORU's Updated Rev 7
Project Code: 00100 TVIS

Provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, pre and post flight processing necessary to maintain the function of providing cardiovascular exercise by running on a treadmill while limiting the vibration transferred to the ISS.

The contractor shall develop and maintain the Flight Data that captures the hardware and mission data specific to the Flight Products that is necessary to perform the logistics, maintenance, repair, hardware and software integration, inter/intra center integration, and pre and post processing.

The contractor shall provide guidelines and process documents that define how the Systems specific data is entered, modified and accessed. Records for official source of the Flight Data entered into a database such as the Certification of Compliance, Task Performance Sheets, Verification Reports, etc. shall be referenced or electronically linked if available.

5.3.4 CMS Trainer Maintenance Updated Rev 7
Project Code: N/A CMS Trainer Maintenance

Provide the trainer maintenance necessary to repair, refurbish and/or replace CMS training hardware.

5.3.5 Second Generation Heart Rate Monitor Updated Rev 7
Project Code: 00066 ISS Heart Rate Monitor (HRM2)

Provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, pre and post flight processing necessary to maintain the functions of measuring crewmembers heart rate during exercise and collecting exercise data from the CMS equipment and data on the crew in order for the SA directorate to analyze the exercise protocols.

The contractor shall develop and maintain the flight data that captures the hardware and mission data specific to the Flight Products that is necessary to perform the logistics, maintenance, repair, hardware and software integration, inter/intra center integration, and pre and post processing.
The contractor shall provide guidelines and process documents that define how the Systems specific data is entered, modified and accessed.

Records for official source of the Flight Data entered into a database such as the Certification of Compliance, Task Performance Sheets, Verification Reports, etc. shall be referenced or electronically linked if available.

5.3.6 Blood Pressure Electrocardiogram Updated Rev 7
Project Code: 00102; BP/ECG

Provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, pre and post flight processing necessary to maintain the common functions of measuring monitoring blood pressure and heart condition during exercise and collecting exercise data from the CMS equipment and data on the crew in order to analyze the exercise protocols. The Blood Pressure/Electrocardiogram and associated kits are included.

The contractor shall develop and maintain the flight data that captures the hardware and mission data specific to the Flight Products that is necessary to perform the logistics, maintenance, repair, hardware and software integration, inter/intra center integration, and pre and post processing.
The contractor shall provide guidelines and process documents that define how the Systems specific data is entered, modified and accessed.
Records for official source of the Flight Data entered into a database such as the Certification of Compliance, Task Performance Sheets, Verification Reports, etc. shall be referenced or electronically linked if available.

5.3.7 Second Generation Heart rate Monitor for use during Shuttle Visits Updated Rev 7
Project Code: 00066

Provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center integration, pre and post flight processing necessary to maintain the common functions of measuring the heart rate of the Shuttle crew during exercise on ISS and collecting exercise data from the CMS equipment and data on the crew in order to analyze the exercise protocols.

The contractor shall develop and maintain the Flight Data that captures the hardware and mission data specific to the Flight Products that is necessary to perform the logistics, maintenance, repair, hardware and software integration, inter/intra center integration, and pre and post processing.
The contractor shall provide guidelines and process documents that define how the Systems specific data is entered, modified and accessed.
Records for official source of the Flight Data entered into a database such as the Certification of Compliance, Task Performance Sheets, Verification Reports, etc. shall be referenced or electronically linked if available.

5.3.8 Advanced Resistive Exercise Device Updated REV 8
Project Code: 2B201

Provide the logistics, maintenance, repair, hardware and software integration; inter/intra-center

integration, pre and post flight processing necessary to maintain the function of providing crew exercise using the Advance Resistive Exercise Device onboard the ISS.

The contractor shall develop and maintain the Flight Data that captures the hardware and mission data specific to the Flight Products that is necessary to perform the logistics, maintenance, repair, hardware and software integration, inter/intra center integration, and pre and post processing.
The contractor shall provide guidelines and process documents that define how the Systems specific data is entered, modified and accessed.
Records for official source of the Flight Data entered into a database such as the Certification of Compliance, Task Performance Sheets, Verification Reports, etc. shall be referenced or electronically linked if available.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 4	JSC Lessons Learned Process	10-02
EA-WI-025 Added Rev 4	GFE Flight Project Software and Firmware Development	Rev A 11-01
IEEE/ASTM SI 10-2002 Added Rev 1	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
JHB 1710.13 Added Rev 1	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JSC 17481 Added Rev 1	Safety Requirements Document for JSC Space Shuttle Flight Equipment	Rev B 09-02
JSC 17773 Added Rev 1	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 23642 Added Rev 4	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549 Added Rev 1	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27260 Added Rev 4	Decal Design and Production Facility- Decal Process Document and Catalog	Rev D 05-02
JSC 27472 Added Rev 4	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 28035 Added Rev 1	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 61360 Added Rev 1	Engineering Directorate Certified Parts Approval Process	Revi A
NSTS 22254 Added Rev 1	Methodology for Conduct of Space Shuttle Program Hazard Analysis	Rev B 12-93
OB-MER-006 Added Rev 4	MER Handbook	Draft 07-00
SN-C-0005 Added Rev 1	Contamination Control Requirements	Rev D 07-98
SSP 30234 Added Rev 4	Failure Modes and Effects Analysis and Critical Items Requirements List for Space Station	Rev F 10-02
SSP 30695 Added Rev 1	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287 Added Rev 1	Hardware/Software Acceptance Process	Rev A 05-01
EA-083 Added Rev 1	Material Usage Control Procedure	
EA-CWI-033 Added Rev 1	Battery Processing	
EA-WI-017 Added Rev 1	Control of Hazardous Energy Process	
EA-WI-023 Added Rev 4	Project Management of GFE Flight Projects	Rev E, 02-2006
EA-WI-024 Added Rev 1	General Operating Procedures Manual for EA Testing Facilities	
EA-WI-027 Added Rev 1	Confifuration Management Requirements	A
EA3-WI-0013 Added Rev 5	Recieving, Control, Shipment of NASA Property	E
EA3-WI-0022 Added Rev 5	Test Facilities Coordination	E
EA3-WI-0035 Added Rev 5	Thermal Chambers Operations and Configuration Control	C
JPR 1700.1 Added Rev 4	JSC Safety & Health Handbook	Rev J, 04-2008
JPR-8500.4J Added Rev 1	Engineering Drawing System Manual	J

JSC 20793 Added Rev 1	Crewed Space Vehicle Battery Safety Requirements	A
JSC 62970 Added REV 8	CHeCS Countermeasures System (CMS) Logistics & Resupply Products	R
JSC 63223 Added REV 8	Engineering Products for International Space Station and Space Shuttle Programs for the Exercise Countermeasures System	K
NT-CWI-001 Added Rev 3	Task Performance Sheet (TPS)	Rev C 7-08
NT-CWI-003 Added Rev 3	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev C 11-06
NT-CWI-004 Added Rev 1	Flight Equipment Pre-Shipment Readiness Review	A
SRSD-09-012 Added Rev 5	Change Procedures for CHeCS Vendor Drawings	Basic
SRSD-09-016 Added Rev 5	Lithium Battery Handling	Basic
SSP 30240 Added Rev 4	Space Station Grounding Requirements	Rev G, 06-2006
SSP 30243 Added Rev 4	Space Station Requirements for Electromagnetic Compatibility	Rev L, 02-2007
SSP 30309 Added Rev 4	Safety Analysis and Risk Assessment Requirements	Rev E, 01-2007
SSP 30312 Added Rev 4	Electrical, Electronic and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program	Rev H, 01-2007
SSP 30423 Added Rev 4	Space Stations Approved Electrical, Electronic, and Electromechanical Parts List	Rev FJ, 01-2007
SSP 30524 Added Rev 4	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E, 01-2007
SSP 30558 Added Rev 4	Fracture Control Requirements for Space Station	Rev C, 11-01
SSP 30559 Added Rev 4	Structural Design and Verification Requirements	Rev D, 02-2008
SSP 30599 Added Rev 4	ISS Safety Review Process	Rev D, 10-2007
SSP 30695 Added Rev 4	Acceptance Data Package Requirements Specification	Rev A, 01-1995
SSP 41172 Added Rev 4	Qualification and Acceptance Environmental Test Requirements	Y
SSP 50287 Added Rev 4	Hardware/Software Acceptance Process	Rev A, 01-2007
SSP 50470 Added Rev 4	Crew Health Care Systems (CHeCS) GFE Specification	C
SSP 50492 Added Rev 4	General International Space Station On-Orbit Requirements for Nonpressurized Support Equipment	Baseline, 01-2007
UWI-AI-001 Added Rev 4	Office of the CIO Process for Document and Data Control	Rev B, 3-01

c. **Required DRDs**

5.3.1 Cycle Ergometer with Vibration Isolation & Stabilization and Associated Kits

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	1 and updated frequently
230 Added Rev 1	Acceptance Data Package	Update Made per item per flight preperation

5.3.2 Interim Resistive Exercise Device, Contingency Resistive Exercise Device & Associated Kits

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	1 and updated frequently
230 Added Rev 1	Acceptance Data Package	Update Made per item per flight preperation

5.3.3 Treadmill with Vibration Isolation & Stabilization System and Associated Kits and ORU's

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	1 and updated frequently

230 Added Rev 1	Acceptance Data Package	Update Made per item per flight preperation

5.3.4 CMS Trainer Maintenance

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	1 and updated frequently

5.3.5 Second Generation Heart Rate Monitor

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	1 and updated frequently
230 Added Rev 1	Acceptance Data Package	Update Made per item per flight preperation

5.3.6 Blood Pressure Electrocardiogram

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	1 and updated frequently
230 Added Rev 1	Acceptance Data Package	Update Made per item per flight preperation

5.3.7 Second Generation Heart rate Monitor for use during Shuttle Visits

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	1 and updated frequently
230 Added Rev 1	Acceptance Data Package	Update made per item delivery

5.3.8 Advanced Resistive Exercise Device

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	1 and updated frequently
230 Added Rev 3	Acceptance Data Package	Update Made per item per flight preparation

d. **Products**

5.3.1 Cycle Ergometer with Vibration Isolation & Stabilization and Associated Kits

Product(s)	Quantity	Delivery Date
CEVIS or associated parts processed for Flight Updated REV 8	As required to maintain the functionality on orbit and implemented in the ISS MIOCB manifest.	As required to maintain the functionality on orbit and implemented in the ISS MIOCB manifest.
Test Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As required per Flight Delivery
S&MA Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight Delivery
Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012 Updated REV 8	1 set	As required to deliver flight hardware per the ISS MIOCB manifest.
TCSR Updated REV 8	1/month	As defined in JSC 62970. Reporting Requirements Section.

5.3.2 Interim Resistive Exercise Device, Contingency Resistive Exercise Device & Associated Kits

Product(s)	Quantity	Delivery Date
IRED, CRES, or associated parts processed for Flight Updated REV 8	As required to maintain the functionality on orbit and implemented in the ISS MIOCB manifest.	As required to maintain the functionality on orbit and implemented in the ISS MIOCB manifest.

Test Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
S&MA Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012 Updated REV 8	1 set	As required to deliver flight hardware per the ISS MIOCB manifest.
TCSR Updated REV 8	1/month	As defined in JSC 62970. Reporting Requirements Section.

5.3.3 Treadmill with Vibration Isolation & Stabilization System and Associated Kits and ORU's

Product(s)	Quantity	Delivery Date
TVIS or associated parts processed for Flight Updated REV 8	As required to maintain the functionality on orbit and implemented in the ISS MIOCB manifest.	As required to maintain the functionality on orbit and implemented in the ISS MIOCB manifest.
Test Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
S&MA Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012 Updated REV 8	1 set	As required to deliver flight hardware per the ISS MIOCB manifest.
TCSR	1/month	As defined in JSC 62970. Reporting Requirements Section.

5.3.4 CMS Trainer Maintenance

Product(s)	Quantity	Delivery Date
CMS Trainer Maintenance hardware and on call maintenance for ISS crew training sessions Updated REV 8	As required to support crew training based on hardware manifested per the ISS MIOCB manifest	As required for crew training based on hardware manifested per the ISS MIOCB manifest
TCSR	1/month	As defined in JSC 62970. Reporting Requirements Section.

5.3.5 Second Generation Heart Rate Monitor

Product(s)	Quantity	Delivery Date
HRM or associated parts processed for flight Updated REV 8	As required	As required per ISS Manifest
Test Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
S&MA Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
TCSR	1/month	As defined in JSC 62970. Reporting Requirements Section.
Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012 Updated REV 8	1 set	As required to deliver flight hardware per the ISS MIOCB manifest.

5.3.6 Blood Pressure Electrocardiogram

Product(s)	Quantity	Delivery Date
BP/ECG/MEC or associated parts processed for flight Updated REV 8	As required per ISS Manifest	As required per ISS Manifest
Test Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
S&MA Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
TCSR	1/month	As defined in JSC 62970. Reporting Requirements Section.
Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012 Updated REV 8	1 set	As required to deliver flight hardware per the ISS MIOCB manifest.

5.3.7 Second Generation Heart rate Monitor for use during Shuttle Visits

Product(s)	Quantity	Delivery Date

HRM or associated parts processed for flight Updated REV 8	As required per Shuttle Manifest	As required per Shuttle Manifest
Test Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
S&MA Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
TCSR	1/month	As defined in JSC 62970. Reporting Requirements Section.

5.3.8 Advanced Resistive Exercise Device

Product(s)	Quantity	Delivery Date
ARED or associated parts processed for Flight Updated REV 8	As Required	As required to maintain the functionality on orbit and implemented in the ISS MIOCB manifest.
Test Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
S&MA Documentation per EA-WI-024 Updated REV 8	1 set/item/flight	As Required per Flight
Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and EA3-WI-0004 Updated REV 8	1 set	As required to deliver flight hardware per the ISS MIOCB manifest.
TCSR	1/month	As defined in JSC 62970. Reporting Requirements Section.

e. **Product Verification**

5.3.1 Cycle Ergometer with Vibration Isolation & Stabilization and Associated Kits

i. CEVIS or associated parts processed for Flight

- Maintained continuous functional operation on orbit for each month. Updated REV 8

ii. Test Documentation per EA-WI-024

- Test documentation completed and closed prior to shipment for each flight. Updated REV 8

iii. S&MA Documentation per EA-WI-024

- S&MA documentation complete and closed prior to stowage for launch for each flight.

iv. Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012

- Release of all Drawing Change Notices into the EDCC prior to delivery for each flight. Updated REV 8

v. TCSR

- Entered into DDMS and posted to CMS Shared TCSR folder

5.3.2 Interim Resistive Exercise Device, Contingency Resistive Exercise Device & Associated Kits

i. IRED, CRES, or associated parts processed for Flight

- Maintained continuous functional operation on orbit for each month.

ii. Test Documentation per EA-WI-024

- Test documentation completed and closed prior to delivery for each flight needed. Updated REV 8

iii. S&MA Documentation per EA-WI-024

- S&MA documentation complete and closed prior to stowage for launch for each flight needed. Updated REV 8

iv. Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012

- Release of all Drawing Change Notices into the EDCC prior to delivery for each flight. Updated REV 8

v. TCSR

- Entered into DDMS and posted toCMS Shared TCSR folder.

5.3.3 Treadmill with Vibration Isolation & Stabilization System and Associated Kits and ORU's

i. TVIS or associated parts processed for Flight

- Maintained continuous functional operation on orbit for each month. Updated REV 8

ii. Test Documentation per EA-WI-024

- Test Documentation completed and closed prior to delivery for each flight needed. Updated REV 8

iii. S&MA Documentation per EA-WI-024

- S&MA Documentation complete and closed prior to stowage for launch for each flight needed.

iv. Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012

- Release of all Drawing Change Notices into the EDCC prior to delivery for each flight.

v. TCSR

- Entered into DDMS and posted to CMS Shared TCSR folder.

5.3.4 CMS Trainer Maintenance

i. CMS Trainer Maintenance hardware and on call maintenance for ISS crew training sessions

- Delivery of CMS Trainer Maintenance support for crew training sessions based on ISS crew training support as required by the ISS MIOCB manifest. Updated REV 8

ii. TCSR

- Entered into DDMS and posted to CMS Shared TCSR folder.

5.3.5 Second Generation Heart Rate Monitor

i. HRM or associated parts processed for flight

- Maintained continuous functional operation on orbit for each month. Updated REV 8

ii. Test Documentation per EA-WI-024

- Test Documentation completed and closed prior to delivery for each flight needed. Updated REV 8

iii. S&MA Documentation per EA-WI-024

- S&MA Documentation complete and closed prior to stowage for launch for each flight needed. Updated REV 8

iv. TCSR

- Entered into DDMS and posted to CMS Shared TCSR folder.

v. Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012

- Release of all Drawing Change Notices into the EDCC prior to delivery for each flight. Updated REV 8

5.3.6 Blood Pressure Electrocardiogram

i. BP/ECG/MEC or associated parts processed for flight

- Maintained continuous functional operation on orbit for each month.

ii. Test Documentation per EA-WI-024

- Test Documentation completed and closed prior to delivery for each flight needed.

iii. S&MA Documentation per EA-WI-024

- S&MA Documentation complete and closed prior to stowage for launch for each flight needed. Updated REV 8

iv. TCSR

- Entered into DDMS and posted to CMS Shared TCSR folder.

v. Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and SRSD-09-012

- Release of all Drawing Change Notices into the EDCC prior to delivery for each flight. Updated REV 8

5.3.7 Second Generation Heart rate Monitor for use during Shuttle Visits

i. HRM or associated parts processed for flight

- Maintained continuous functional operation during the Shuttle mission.

ii. Test Documentation per EA-WI-024

- Test Documentation completed and closed prior to delivery for each flight needed.

iii. S&MA Documentation per EA-WI-024

- S&MA Documentation complete and closed prior to stowage for launch for each flight needed.

iv. TCSR

- Entered into DDMS and posted to CMS Shared TCSR folder.

5.3.8 Advanced Resistive Exercise Device

i. ARED or associated parts processed for Flight

- Maintained continuous functional operation on orbit for each month.

ii. Test Documentation per EA-WI-024

- Test Documentation completed and closed prior to delivery for each flight needed.

iii. S&MA Documentation per EA-WI-024

- S&MA documentation complete and closed prior to stowage for launch for each flight needed.

iv. Drawing Changes (Resupply Based Non-Configuration Change) per JPR 8500 and EA3-WI-0004

- Release of all Drawing Change Notices into the EDCC prior to delivery for each flight.

v. TCSR

- Entered into DDMS and posted to CMS Shared TCSR folder.

5.4 Robotic Exercise Device Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall review existing research in the area of on-orbit and terrestrial exercise to determine a viable approach for robotic exercise for future space missions which are characterized by extended crew stays in reduced gravity environments. This review will determine a set of primary exercises and loading requirements that can provide benefits to crew health. Muscle loads and exercise motion trajectories shall be defined to identify robotic workspace requirements and support sizing of the manipulator/robot components.

The requirements from the definition activity will lead to a conceptual design capable of meeting the required machine capabilities. The conceptual design will include the hardware/manipulator/robot components as well as the elements of the software required to control the machine. Key areas of emphasis in this phase will be component sizing, loads, dynamic isolation strategy, software component definition, achievable exercise list and expected physiological benefit. This activity should consider the potential for use of variants of existing robot designs including cable driven systems such as the Charlotte robot.

Key questions to be addressed shall include, but are not limited to the following:
a. Can beneficial exercise be achieved with robots?
b. What exercises can be performed using a robotic system?
c. What is the exercise workspace required for the robot system?
d. What is the size of the robot that is required to provide beneficial exercise?
e. What software components are required to achieve safe exercise?
f. What is the best robot system configuration to achieve the exercise goals?

Completed effective this revision 5. Updated Rev 5

5.4.1 Product Requirements
Project Code: None

1. White Paper: Will summarize the analyses performed and discuss the following:
   a. Can beneficial exercise be achieved with robots?
   b. What exercises can be performed using a robotic system?
   c. What is the exercise workspace required for the robot system?
   d. What is the size of the robot that is required to provide beneficial exercise?
   e. What software components are required to achieve safe exercise?
   f. What is the best robot system configuration to achieve the exercise goals?

   In addition the White paper shall include the following:
   a. Identify design concepts developed/evaluated, analysis or rating criteria and recommended concept(s) for further development.
   b. Provide results and methodology used for Kinematics analyses
   c. Preliminary software functional specifications.
   d. Identify a recommended forward plan and schedule for follow-on phases (detailed design phase, fabrication phase and analysis and test phase).

2. Presentation
   Will summarize results of the study and address the following:
   a. Can beneficial exercise be achieved with robots?
   b. What exercises can be performed using a robotic system?
   c. What is the exercise workspace required for the robot system?
   d. What is the size of the robot that is required to provide beneficial exercise?
   e. What software components are required to achieve safe exercise?
   f. What is the best robot system configuration to achieve the exercise goals?

   In addition the Presentation shall include the following:
   a. Identify design concepts developed/evaluated, analysis or rating criteria and recommended concept(s) for further development.
   b. Provide results and methodology used for Kinematics analyses
   c. Preliminary software functional specifications.
   d. Identify a recommended forward plan and schedule for follow-on phases (detailed design phase, fabrication phase and analysis and test phase).

3. Mid-term progress report
   Shall summarize progress of the study

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	
	No Title Entered	

c. **Required DRDs**

5.4.1 Product Requirements

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
218	Engineering Analysis	1 set

d. **Products**

5.4.1 Product Requirements

Product(s)	Quantity	Delivery Date
White Paper	1	ATP+2.5 Months
Presentation	1	ATP+2.5 Months
Mid Term Progress Report	1	ATP+45 Days
TCSR	1/month	As defined in JSC 63223, Reporting Requirement Section

e. **Product Verification**

5.4.1 Product Requirements

i. White Paper

- Receipt of report by Branch Management

ii. Presentation

- Meeting held with Branch Management and presentation delivered to Branch Management

iii. Mid Term Progress Report

- Receipt of report by Branch Management

iv. TCSR

- Entered into DDMS and posted to CMS shared folder

6.0 Cost Summary and Revision History

DO 245 R8 Summary								
SLC		CY3	CY4	CY5	CY6	CY7	CY8	Total
AS1								
	Sum of Hrs							
	Sum of Dollars							
AS2								
	Sum of Hrs							
	Sum of Dollars							
BS2								
	Sum of Hrs							
	Sum of Dollars							
EN1								
	Sum of Hrs							
	Sum of Dollars							
EN2								
	Sum of Hrs							
	Sum of Dollars							
EN3								
	Sum of Hrs							
	Sum of Dollars							
EN4								
	Sum of Hrs							
	Sum of Dollars							
ESS								
	Sum of Hrs							
	Sum of Dollars							
IT3								
	Sum of Hrs							
	Sum of Dollars							
IT4								
	Sum of Hrs							
	Sum of Dollars							
MGR								
	Sum of Hrs							
	Sum of Dollars							
TN2								
	Sum of Hrs							
	Sum of Dollars							
TN3								
	Sum of Hrs							
	Sum of Dollars							
ET3								
	Sum of Hrs							
	Sum of Dollars							
ETS								
	Sum of Hrs							
	Sum of Dollars							
IT2								
	Sum of Hrs							
	Sum of Dollars							
QA2								
	Sum of Hrs							
	Sum of Dollars							
QE1								
	Sum of Hrs							
	Sum of Dollars							
QE2								

64

	Sum of Hrs
	Sum of Dollars
CM2	
	Sum of Hrs
	Sum of Dollars
PC2	
	Sum of Hrs
	Sum of Dollars
SC1	
	Sum of Hrs
	Sum of Dollars
SV	
	Sum of Hrs
	Sum of Dollars
ET2	
	Sum of Hrs
	Sum of Dollars
TN1	
	Sum of Hrs
	Sum of Dollars
PAM	
	Sum of Hrs
	Sum of Dollars
PC1	
	Sum of Hrs
	Sum of Dollars
PS3	
	Sum of Hrs
	Sum of Dollars
IT1	
	Sum of Hrs
	Sum of Dollars
SE	
	Sum of Hrs
	Sum of Dollars
AS3	
	Sum of Hrs
	Sum of Dollars
BS1	
	Sum of Hrs
	Sum of Dollars
QA1	
	Sum of Hrs
	Sum of Dollars
CM1	
	Sum of Hrs
	Sum of Dollars
SC2	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	

b4

Fee (100% of Pool)	
Total	$25,431,831.10

64

DO 245 Revision History	Total cost	Reason for revision
Original	$4,164,423	Original
Revision 1	$9,706,809	Transferred CMS related CRLs from DO027 for Resupply and Logistics activities. Increased scope of work associated with new revision of JSC 63223.
Revision 2	$9,736,029	Increased scope of work associated with new CRL 60 "Robot Resistive Exercise Device"
Revision 3	$ 10,446,779	Increased scope (including improved TVIS rollers, FY09 and 10 tasks) and rephasing of work associated with new revisions of JSC 63223 and JSC 62970.
Revision 4	$ 10,745,554	Increased scope (including ARED Hard Stop, HRM2 Transmitter Testing, ARED Exercise and Cable Arm Ropes, Travel to KSC for SCE support, CEVIS Braking Band effort and materials, FY09, and 10 tasks) and rephasing of work associated with new revisions of JSC 63223 and JSC 62970.
Revision 5	$24,407,080	Increased scope to extend the DO until the end of the ESCG contract. Also, HRM2 Transmitter remaining fabrication, HRM2 remaining Testing of associated parts, and FY10 tasks and rephasing of work associated with new revisions of JSC 63223 and JSC 62970.
Revision 6	$25,895,469	Increased scope from ARED CR (procurement of ARED Exercise and Cable Arm Ropes, X-rotation Dashpot Assemblies, Male and Female Restraint Bench, Left and Right Cable Actuator Assy, Miscellaneous spare fasteners for ARED VIS, Rod End Coupling, Springs, Shock Absorbers, Fasteners, X-Rotation Components, Pacebooks, and Stainless Steel Cylinder-Flywheels), FY10 procurement and delivery of spare ARED left and right Upper Stop Cables, FY10 inspection of the DAMEC facility for CEVIS Ergometer, FY10-11 HRM testing and certification of USB to IR converter, FY10 TVIS PCM/CIA Cards for flight 40P, full Delivery Integration support was reinstated for FY 13, and rephasing of work associated with new revisions of JSC 63223 and JSC 62970.
Revision 7	$26,835,529	Increased scope from CEVIS CR (procurement of Isolator Kit, Ergometers, Braking Band, and Manual Knob), Certification and delivery of new ARED Exercise Rope (SJG52102655-301), IRED Retirement Activities, the addition of a new WBS "CMS Knowledge Capture", and rephasing of work associated with new revisions of JSC 63223 and JSC 62970.
Revision 8	$25,431,831	Increased scope to cover FY11 deliveries and associated work and documented decreased scope for FY12 due to Program funding (see section 3.0 from above).

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ07HI61D DO 252 R5	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 09/28/2007 – 09/30/2011

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: **03/24/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**CEV Avionics**					
DO	**252 R5**		64			
	Est. Labor Costs					
	Materials/Subcontracts				64	
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the orders requirements take precedence over the contractor's order.					

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$ 3,810,947

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ07HI61D-DO252 REV.5

Originator: Kaylene Kindt (EV311) (281) 483-2153 **TMR:** Cordelia Foster (EV) (281) 483-5265

Revision Summary:
Revision to add content to C&DH section for Field Programmable Gate Array engineering services.

1. Title of Effort: CEV Avionics

2. Date of Request: 01/31/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 2

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2007 and ends 09/30/2011.

5. Product Requirements

5.1 Systems Engineering and Integration Products and Services - All work in this section is complete as October 1, 2010 Updated Rev 4

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide systems engineering and integration (SE&I) services associated with the Crew Exploration Vehicle (CEV) avionics for SE&I System Management (SM). The SM function, as specified in CxP-72088, CEV Systems Engineering Management Plan (SEMP), is the single point of contact for oversight and management of the development of the avionics and software system. Included subsystems are defined in the CEV Statement of Work, Attachment J-1. This function covers the entire life cycle including feasibility assessments, project definition, requirements, design, production, certification and operations. The SE&I SM also participates in the development of the CEV System Requirements Document, CEV to other element Interface Requirements Documents (IRDs) and Interface Control Documents (ICDs), the CEV avionic architecture definition, and related trade studies. In addition, this function monitors development, schedules and risk, and participates in programmatic support activities such as Requirements Assessment Cycle (RAC), Design Analysis Cycle (DAC), mode teams and other system integration activities and forums. This function leads an integrated government team of stakeholder disciplines throughout the system development lifecycle involved in the oversight of the contractors' activities. The stakeholder disciplines include flight operations, ground operations, flight crew office, Safety and Mission Assurance (S&MA), and Independent Verification and Validation (IV&V). Updated Rev 4

5.1.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the Orion, subsystem and components PDR and CDR. Updated Rev 4

Project Code:

Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs for CEV, subsystems and component PDR and CDR, Contractor shall also represent SM in activities related to the Orion flight test program.

All work in this section is stopped as of October 1, 2010. No other engineering analysis is required.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NPR 7150.2	NASA Software Engineering Requirements	Basic 09-04
CEV RFP	Statement of Work, Attachment J-1	current
CxP-72000 Added Rev 2	CEV System Requirements Document	current
CxP-72088	CREW EXPLORATION VEHICLE (CEV) SYSTEMS ENGINEERING MANAGEMENT PLAN (SEMP)	current
DRD CEV-B-003	CEV Integrated Master Schedule (IMS), included in CEV Cost Performance Report	current

c. **Required DRDs**

5.1.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the Orion, subsystem and components PDR and CDR.

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	one per month
218	Engineering Analysis	one per analysis

d. **Products**

5.1.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the Orion, subsystem and components PDR and CDR.

Product(s)	Quantity	Delivery Date
Engineering assessment/ RID package, with technical review 1 week prior to life cycle reviews	1 set per lifecycle review	CEV Integrated Master Schedule, DRD CEV-B-003
Activity report	weekly	one per week
Action item tracking list Deleted Rev 2	1	updated weekly
Change Request (CR) evaluation form Added Rev 2	1	per CR delivery date

e. **Product Verification**

5.1.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the Orion, subsystem and components PDR and CDR.
i. Engineering assessment/ RID package, with technical review 1 week prior to life cycle reviews
- EV9 review and acceptance
ii. Activity report
- EV9 review and acceptance
iii. Action item tracking list Deleted Rev 2
- EV9 review and acceptance Deleted Rev 2
iv. Change Request (CR) evaluation form
- EV9 review and acceptance Added Rev 2

5.2 C3I Gateway Engineering Services and Products - All work in section complete with this revision Updated Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services to the CEV Command, Control, Communication and Information (C3I) Gateway subsystem management (SSM). The SSM function, as specified in CxP-72088, CEV Systems Engineering Management Plan (SEMP), is the single point of contact for oversight and management of the development of an specific system. Included subsystems are defined in the CEV Statement of Work, Attachment J-1. This function covers the entire life cycle including feasibility assessments, project definition, requirements, design, production, certification and operations. The SSM also participates in the development of the CEV System Requirements Document, CEV to other element Interface Requirements Documents (IRDs) and Interface Control Documents (ICDs), the CEV avionic architecture definition, and related trade studies. In addition, this function monitors development, schedules and risk, and participates in programmatic support activities such as Requirements Assessment Cycle (RAC), Design Analysis Cycle (DAC), mode teams and other system integration activities and forums. This function leads an integrated government team of stakeholder disciplines throughout the system development lifecycle involved in the oversight of the contractors' activities. The stakeholder disciplines include flight operations, ground operations, flight crew office, and Safety and Mission Assurance (S&MA).

All work in this section is stopped as of this revision. No other engineering analysis is required as of this revision.
Updated Rev 3

5.2.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem PDR, Orion PDR and CDR.
Project Code:

1. Develop security requirements for the C3I Interoperability Standard and C3I Security Plan. Provide an analysis of implementation options for Constellation and CEV

2. Provide analysis of network and link layer standards, requirements and Request For Comments (RFCs) as applicable to CEV in the C3I Interoperability Standards. Provide an analysis of the implementation options of the requirements in the C3I Interoperability Standards for the network and link layer.

3. Provide an analysis of the CEV architecture as applicable to items 1 and 2

b. **Applicable Documents**

Document Number	Document Name	Rev.
CEV RFP	Statement of Work, Attachment J-1	current
CxP-70022 Vol 1	Constellation C3I Interoperability Standards Vol 1	current
CxP-70022 Vol 6	Constellation C3I Interoperability Standards Vol 6	current
CxP-70022 Vol 7	Constellation C3I Interoperability Standards Vol 7	current
CxP-70070-ANX05	Constellation Book 1 Cx Functional Security Requirements	current
CxP-70070-ANX05	Constellation Book 2 C3I Security Plan	current
CxP-70070-ANX05	Constellation Security Management Plan	current
CxP-72022 Vol 8	Constellation C3I Interoperability Standards Vol 8	current
CxP-72088	CREW EXPLORATION VEHICLE (CEV) SYSTEMS ENGINEERING MANAGEMENT PLAN (SEMP)	current
DRD CEV-B-003	CEV Integrated Master Schedule (IMS), included in CEV Cost Performance Report	current

c. **Required DRDs**

5.2.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem PDR, Orion PDR and CDR.

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	one per month
218	Engineering Analysis	one per analysis

d. **Products**

5.2.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem PDR, Orion PDR and CDR.

Product(s)	Quantity	Delivery Date
Engineering assessment/ RID package, with technical review 1 week prior to life cycle reviews	1 set per lifecycle review	CEV Integrated Master Schedule, DRD CEV-B-003
Activity report	weekly	one per week
Action item tracking list	1	updated weekly
Change Request (CR) evaluation form	1	per CR delivery date

e. **Product Verification**

5.2.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem PDR, Orion PDR and CDR.

i. Engineering assessment/ RID package, with technical review 1 week prior to life cycle reviews

- EV9 review and acceptance

ii. Activity report

- EV9 review and acceptance

iii. Action item tracking list

- EV9 review and acceptance

iv. Change Request (CR) evaluation form

- EV9 review and acceptance

5.3 Command and Data Handling Products and Services Updated REV.5

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering services for CEV Command and Data Handling (C&DH) System Management (SM). The SM function, as specified in CxP-72088, CEV Systems Engineering Management Plan (SEMP), is the single point of contact for oversight and management of the development of an specific system. Included subsystems are defined in the CEV Statement of Work, Attachment J-1. This function covers the entire life cycle including feasibility assessments, project definition, requirements, design, production, certification and operations. The SM also participates in the development of the CEV System Requirements Document, CEV to other element Interface Requirements Documents (IRDs) and Interface Control Documents (ICDs), the CEV avionic architecture definition, and related trade studies. In addition, this function monitors development, schedules and risk, and participates in programmatic support activities such as Requirements Assessment Cycle (RAC), Design Analysis Cycle (DAC), mode teams and other system integration activities and forums. This function leads an integrated government team of stakeholder disciplines throughout the system development lifecycle involved in the oversight of the contractors' activities. The stakeholder disciplines include flight operations, ground operations, flight crew office, and Safety and Mission Assurance (S&MA). Updated REV.5

5.3.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem PDR, subsystem CDR, Orion PDR and CDR. Updated REV.5

Project Code:

Provide engineering services for the CEV C&DH SM, CEV flight computer subsystem management, CEV instrumentation subsystem management, and provide DFI instrumentation engineering.

1. Provide analysis of CEV SRD requirements as pertaining to these areas above

2. Provide analysis to assist in the requirements maturation process

3. Review CEV documents with consideration to these areas - generate and work RIDs if required

4. Perform trade studies

5. Participate in team technical interface meetings (TIM)

6. Represent SMs at meetings - prepare and present briefings

5.3.2 Contractor shall provide engineering analysis of Field Programmable Gate Arrays (FPGA) test and verification. Added REV.5

Project Code:

Provide the following engineering services for the CEV Avionics, Power and Software (APS) FPGA system.

1. Design and development of FPGA test benches.

2. Design and development of test scripts to be used in the verification of the FPGAs.

3. Development of FPGA verification test plans.

4. Execution of FPGA verification.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CEV RFP	Statement of Work, Attachment J-1	current
CxP-72000 Added Rev 2	CEV Systems Requirements Document	current
CxP-72088	CREW EXPLORATION VEHICLE (CEV) SYSTEMS ENGINEERING MANAGEMENT PLAN (SEMP)	current
DRD CEV-B-003	CEV Integrated Master Schedule (IMS), included in CEV Cost Performance Report	current

c. **Required DRDs**

5.3.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem PDR, subsystem CDR, Orion PDR and CDR.

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	one per month
218	Engineering Analysis	one per analysis

5.3.2 Contractor shall provide engineering analysis of Field Programmable Gate Arrays (FPGA) test and verification.

DRD #	DRD Title	Quantity/Frequency
105 Added REV.5	Regular Status Report/Summary Review	one per month

d. **Products**

5.3.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem PDR, subsystem CDR, Orion PDR and CDR.

Product(s)	Quantity	Delivery Date
Engineering assessment/ RID package, with technical review 1 week prior to life cycle reviews Updated REV.5	1 set per lifecycle review	CEV Integrated Master Schedule, DRD CEV-B-003
Activity report	weekly	one per week
Action item tracking list Deleted Rev 2	1	updated weekly
Change Request (CR) evaluation form Added Rev 2	1	per CR delivery date

5.3.2 Contractor shall provide engineering analysis of Field Programmable Gate Arrays (FPGA) test and verification.

Product(s)	Quantity	Delivery Date
Activity report Added REV.5	weekly	one per week

Engineering Analysis Added REV.5	1	9/30/2011

e. **Product Verification**

5.3.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem PDR, subsystem CDR, Orion PDR and CDR.
i. Engineering assessment/ RID package, with technical review 1 week prior to life cycle reviews
- EV2 review and acceptance Updated REV.5
ii. Activity report
- EV2 review and acceptance
iii. Action item tracking list Deleted Rev 2
- EV9 review and acceptance Deleted Rev 2
iv. Change Request (CR) evaluation form
- EV2 review and acceptance Added Rev 2

5.3.2 Contractor shall provide engineering analysis of Field Programmable Gate Arrays (FPGA) test and verification.
i. Activity report
- EV2 review and acceptance Added REV.5
ii. Engineering Analysis
- EV2 review and acceptance Added REV.5

5.4 Displays and Controls Products and Services Updated Rev 4

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services for C&DH System Management (SM) for Displays and Control. The SM function, as specified in CxP-72088, CEV Systems Engineering Management Plan (SEMP), is the single point of contact for oversight and management of the development of an specific system. Included subsystems are defined in the CEV Statement of Work, Attachment J-1. This function covers the entire life cycle including feasibility assessments, hardware and software prototyping, project definition, requirements, design, production, certification and operations. The SM also participates in the development of the CEV System Requirements Document, CEV to other element Interface Requirements Documents (IRDs) and Interface Control Documents (ICDs), the CEV avionic architecture definition, and related trade studies. In addition, this function monitors development, schedules and risk, and participates in programmatic support activities such as Requirements Assessment Cycle (RAC), Design Analysis Cycle (DAC), mode teams and other system integration activities and forums. This function leads an integrated government team of stakeholder disciplines throughout the system development lifecycle involved in the oversight of the contractors' activities. The stakeholder disciplines include flight operations, ground operations, flight crew office, human engineering, and Safety and Mission Assurance (S&MA). Updated Rev 4

5.4.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the Orion, subsystem and components CDRs, and component PDRs. Updated Rev 4

Project Code:

Provide engineering services for C&DH System displays and control, in the areas of displays units, panels, switches, panel devices, caution and warning, hand controllers and input devices. As of October 1, 2010, all work in this section is stopped due to the Orion project deferred all display and control work for FY11.

1. Provide analysis of CEV SRD requirements as pertaining to these areas above. Task no longer required as of October 1, 2009.

2. Provide analysis for requirements maturation process. Task no longer required as of October 1, 2009.

3. Review CEV documents with consideration to these areas - generate and work RIDs if required

4. Perform trade studies

5. Participate in team technical interface meetings (TIM)

6. Represent SM at meetings - prepare and present briefings

7. Perform development, design, procurement, buildup, operation, test support, and configuration management of an Orion avionics displays and controls laboratory. This laboratory will be used to validate Orion requirements and to explore potential lunar block advanced user interface technologies.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CEV RFP	Statement of Work, Attachment J-1	current
CxP-72000 Added Rev 2	CEV Systems Requirements Document	current
CxP-72088	CREW EXPLORATION VEHICLE (CEV) SYSTEMS ENGINEERING MANAGEMENT PLAN (SEMP)	current
DRD CEV-B-003	CEV Integrated Master Schedule (IMS), included in CEV Cost Performance Report	current

c. **Required DRDs**

5.4.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the Orion, subsystem and components CDRs, and component PDRs.

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	one per month
218	Engineering Analysis	one per analysis

d. **Products**

5.4.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the Orion, subsystem and components CDRs, and component PDRs.

Product(s)	Quantity	Delivery Date
Engineering assessment/ RID package, with technical review 1 week prior to life cycle reviews	1 set per lifecycle review	CEV Integrated Master Schedule, DRD CEV-B-003
Activity report	weekly	one per week
Action item tracking list Deleted Rev 2	1	updated weekly
Change Request (CR) evaluation form Added Rev 2	1	per CR delivery date

e. **Product Verification**

5.4.1 Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the Orion, subsystem and components CDRs, and component PDRs.

i. Engineering assessment/ RID package, with technical review 1 week prior to life cycle reviews

- EV9 review and acceptance

ii. Activity report

- EV9 review and acceptance

iii. Action item tracking list Deleted Rev 2

- EV9 review and acceptance Deleted Rev 2

iv. Change Request (CR) evaluation form

- EV9 review and acceptance Added Rev 2

6.0 Cost Summary & Revision History

DO 252 R5 Summary							
SLC		CY3	CY4	CY5	CY6	CY7	**Grand Total**
AS2							
	Sum of Hrs						
	Sum of Dollars						
EN3							
	Sum of Hrs						
	Sum of Dollars						
EN4							
	Sum of Hrs						
	Sum of Dollars						
ESS							
	Sum of Hrs						
	Sum of Dollars						
MGR							
	Sum of Hrs						
	Sum of Dollars						
PC1							
	Sum of Hrs						
	Sum of Dollars						
PS1							
	Sum of Hrs						
	Sum of Dollars						
ZP0							
	Sum of Hrs						
	Sum of Dollars						
ZP1							
	Sum of Hrs						
	Sum of Dollars						
IT2							
	Sum of Hrs						
	Sum of Dollars						
QA2							
	Sum of Hrs						
	Sum of Dollars						

BS1	
	Sum of Hrs
	Sum of Dollars
TN1	
	Sum of Hrs
	Sum of Dollars
EN2	
	Sum of Hrs
	Sum of Dollars
TN2	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**3,810,947**

b4

Revision History:

DO 252 revision history	Total cost	Reason for revision
Original	$2,646,227	Original Proposal
Revision 1	$2,465,799	Readjust FY09 and FY10 costs.
Revision 2	$4,346,764	Readjust costs to extend period of performance through end of FY11 and include D&C Lab activities.
Revision 3	$4,109,020	Readjust costs to stop work on the C3I activities beginning 15 March 2010 through end of DO.
Revision 4	$3,712,237	This revision changes the name of the ESCG project manager, closes WBS 5.1 and WBS 5.4 to indicate all work is now complete after de-scoping these WBS tasks to reflect Orion project deferrals and increases the scope of work in section 5.3 for CEV C&DH engineering services i.e. services for the CEV C&DH SM, CEV flight computer subsystem manager, the CEV instrumentation subsystem manager, and serve as the DFI instrumentation engineer.
Revision 5	3,810,947	This revision adds content to C&DH section 5.3 for Field Programmable Gate Array engineering services as documented in section 5.3.2, and changes branches from EV9 to EV2.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ07HI67D – DO270 Rev. 1	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Miyoshi J. Thompson
Tel. No.: (281) 244-1683 FAX: (281) 483-7890
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 01/07/2008 - 01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **Jessica Corely**

Signtature: **Jessica Corley** Date: **12/18/2009**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Engineering Directorate Facility Planning**					
DO	**270 Rev.1**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

bf bf

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$1,838,478

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ07HI67D-DO270 Rev. 1

Originator: Barry Plante (EA2) (281) 483-9206 **TMR:** Stephen Lamkin (EA) (281) 483-8264

Revision Summary:
Extends period of performance through Jan. 31,2013. Also updates Facility Planning Requirements and Deliverables to reflect current expectations.

Original DO was approved 1/07/2008, so 10/01/2009 starting date is incorrect.

Corrections were made to products in 5.1.3 d).

1. Title of Effort: Engineering Directorate Facility Planning

2. Date of Request: 10/19/2009

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

c. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 1

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 01/07/2008 and ends 01/31/2013.

5. Product Requirements

5.1 Engineering Directorate Facility Utilization Plan Updated Rev 1

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall help perform strategic and tactical planning of the Engineering Directorate's technical and office space. Updated Rev 1

5.1.1 Graphical depiction of all Engineering Directorate Physical Assets Updated Rev 1
Project Code:

The contractor shall develop a graphical depiction of each building that the Engineering Directorate occupies and/or uses. This will consist of a drawing/sketch of each building floor space showing the square footage of office anjd technical space. In some cases, drawings should include locations and general size of large techinical assets. Each area shall identifiy the present use and actual square footage.

5.1.2 Utilization Database of Engineering Directorate's Physical Assets
Project Code:

The contractor shall develop a database identifying the unique capabilities for each of the Engineering Directorate's building, fabracation, lab, training, and mock ups areas. This database shall for each area include by percent of time the present (actual) and forecast utilization by Program and/or Organization of each unique capability. Utilization metrics in the database shall include Equivalent Utilization Days (EUD).

5.1.3 Strategic and Tactical Plans for EA Assets Utilization Updated Rev 1
Project Code:

The contractor, with consulting from the Engineering Directorate Divisions and Offices, shall prepare strategic and tactical plans for future usage of the Directorate facility assets and floor space. Status of these plans during development shall be reported in bi-monthly reports identifying future changes to technical and office space utllization,

5.1.4 Facility-related Information Requests Updated Rev 1
Project Code:

On a case-by-case request, the contract shalll provide facility-related information in support of periodic data calls such as Space Utilization Reports, Major Facility Reports, etc.

The estimated number of requests for periodic data calls is 2-12/year.

5.1.5 Preparation of Work Requests for Facilities/Assets Changes/Additions and for Space Utilization. Updated Rev 1
Project Code:

The contractor shall prepare or help Division personnel prepare Work Requests (WADs) and coordinate with "JA" for all modifications as needed to any of the Directorate's facilities/assets. This includes serving as a coordinator and technical interface between the work requestor and JA to the extent that it provides the necessary communication and interfacing to ensure the work is completed as requested. Also included is job walks and resolution of technical, schedule, and cost issues associated with approved WADs as the need arises.

The approximate # of WAD-related actions is100-200/year.

The contractor shall prepare recommendations for floor space allocation to accommondate personnel changes and work with Division requestors to determine optimum floor space utilization. The contractor shall coordinate all activities associated with the changes including the preparation of appropriate forms (e.g., space requests, moving forms, equipment transfer/move forms, etc.).

The approximate # of move-related requests is 150-250/year.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	Preparation of input/recommendations for a budget call shall be consistent with the received directions provide in the budget call	Latest Budget Call Directions
JSC form 174	Intracenter Move Request	IATEST VERSION AS FOUND JA's LOGISTIC WEB-SITE

c. **Required DRDs**

5.1.1 Graphical depiction of all Engineering Directorate Physical Assets

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
102 Added Rev 1	Engineering Drawings and Model Files	As changes are Made

5.1.2 Utilization Database of Engineering Directorate's Physical Assets

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

5.1.3 Strategic and Tactical Plans for EA Assets Utilization

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
218 Added Rev 1	Engineering Analysis	bi-monthly

5.1.4 Facility-related Information Requests

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
218 Added Rev 1	Engineering Analysis	As Needed

5.1.5 Preparation of Work Requests for Facilities/Assets Changes/Additions and for Space Utilization.

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.1.1 Graphical depiction of all Engineering Directorate Physical Assets

Product(s)	Quantity	Delivery Date
Pilot set of graphical depiction of buildings (including all of Bldg. 16) Updated Rev 1	1	2/1/2008
Floor space utilization drawings Updated Rev 1	40-50 Buildings	As changes are made
Up dated and further inclusive set of graphical depiction of additional buildings Updated Rev 1	1	7/1/2008
A Final Complete set of graphical depiction of all EA buildings/assets	1	9/30/2008

5.1.2 Utilization Database of Engineering Directorate's Physical Assets

Product(s)	Quantity	Delivery Date
Initial draft of database format with information available for several buildings/assets	1	1/15/2008
100% complete database for all EA buildings/assets	1	3/15/2008
Bi-monthly update of the database (completed with Rev.1) Updated Rev 1	6/year	Starting 5/15/2008

5.1.3 Strategic and Tactical Plans for EA Assets Utilization

Product(s)	Quantity	Delivery Date
Electronic report showing all completed and active move requests (Terminated Rev. 1) Deleted Rev 1	4 year	starting 10/01/2009
Electronic report showing all completed and active WADs (Terminated Rev. 1) Deleted Rev 1	4 year	starting 10/01/2009
Long-term Assets Ultilization Plan Updated Rev 1	1	12/30/2008
Status report of major strategic planning activities Added Rev 1	bi-monthly	Per Master Product List/Schedule (DDMS# 0001002686)
Bi-monthly report containing recommended strategic and tactical plans for EA buildings/assets Added Rev 1	10	Starting 2/1/2008 through 12/31/2009
Short-Term Assets Utilization Plan comprising Facility Planning Office Process Documents Added Rev 1	1 set, Per Master Product List/Schedule (DDMS# 0001002686)	Per Master Product List/Schedule (DDMS# 0001002686)

5.1.4 Facility-related Information Requests

Product(s)	Quantity	Delivery Date
Report consisting of recommended responses to various budget calls [CoF, SII, SCAP, Space Utilization](Terminated Rev 1) Updated Rev 1	12	1/31/2010
Facility Related reports on EA Technical Facilities, including Office Space Added Rev 1	as needed	Starting 1/31/10

5.1.5 Preparation of Work Requests for Facilities/Assets Changes/Additions and for Space Utilization.

Product(s)	Quantity	Delivery Date
Electronic report showing all completed and active WADs Updated Rev 1	4/year	Per Master Product List/Schedule (DDMS# 0001002686)
Electronic report showing all completed and active move requests Added Rev 1	4/year	Per Master Product List/Schedule (DDMS# 0001002686)
Work Requests and/or personnel move request (Terminated Rev. 1) Added Rev 1	100	Per Master Product List/Schedule (DDMS# 0001002686)

e. **Product Verification**

5.1.1 Graphical depiction of all Engineering Directorate Physical Assets

i. Pilot set of graphical depiction of buildings (including all of Bldg. 16)

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM

ii. Floor space utilization drawings

- Random audit by the Engineering Directorate Assets/Facilities FAM Updated Rev 1

iii. Up dated and further inclusive set of graphical depiction of additional buildings

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM

iv. A Final Complete set of graphical depiction of all EA buildings/assets

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM

5.1.2 Utilization Database of Engineering Directorate's Physical Assets

i. Initial draft of database format with information available for several buildings/assets

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM

ii. 100% complete database for all EA buildings/assets

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM

iii. Bi-monthly update of the database (completed with Rev.1)

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM

5.1.3 Strategic and Tactical Plans for EA Assets Utilization

i. Electronic report showing all completed and active move requests (Terminated Rev. 1) Deleted Rev 1

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM Deleted Rev 1

ii. Electronic report showing all completed and active WADs (Terminated Rev. 1) Deleted Rev 1

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM Deleted Rev 1

iii. Long-term Assets Ultilization Plan

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM

iv. Status report of major strategic planning activities

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM and NASA TMR Added Rev 1

v. Bi-monthly report containing recommended strategic and tactical plans for EA buildings/assets

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM Added Rev 1

vi. Short-Term Assets Utilization Plan comprising Facility Planning Office Process Documents

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM Added Rev 1

5.1.4 Facility-related Information Requests

i. Report consisting of recommended responses to various budget calls [CoF, SII, SCAP, Space Utilization](Terminated Rev 1)

- Reviewed and accepted by the Engineering Directorate Assets/Facilities FAM

ii. Facility Related reports on EA Technical Facilities, including Office Space

- Requested reports will be made by Facilities FAM and products will be reviewed at that time. Added Rev 1

5.1.5 Preparation of Work Requests for Facilities/Assets Changes/Additions and for Space Utilization.

i. Electronic report showing all completed and active WADs

- The quarterly reports will be reviewed and accepted by the Engineering Directorate Assets/Facilities FAM Updated Rev 1

ii. Electronic report showing all completed and active move requests

- The quarterly reports will be reviewed and accepted by the Engineering Directorate Assets/Facilities FAM Added Rev 1

iii. Work Requests and/or personnel move request (Terminated Rev. 1)

- Change to Electronic report showing all completed and active Work or Move Requests Added Rev 1

6.0 Cost Summary and Revision History:

DO 270 R1 Summary		Contract Year						
SLC		CY3	CY4	CY5	CY6	CY7	CY8	**Grand Total**
EN1								
	Sum of Hrs							
	Sum of Dollars							
EN2								
	Sum of Hrs							
	Sum of Dollars							
IT3								
	Sum of Hrs							
	Sum of Dollars							
MGR								
	Sum of Hrs							
	Sum of Dollars							
PC3								
	Sum of Hrs							
	Sum of Dollars							
SV								
	Sum of Hrs							
	Sum of Dollars							
Total Direct Labor Hrs								
Total Direct Labor Cost								
Subcontract								
Material								
Travel								
NLR								
Misc								
Burden on Non-Labor								
Total Non-Labor								
Total Costs								
Fee (100% of Pool)								
Total								**1,838,478**

b4

Revision History:

Rev No.	Date	Summary
Rev. 1	12/18/2009	Extends period of performance through Jan. 31,2013. Also updates Facility Planning Requirements and Deliverables to reflect current expectations. Original DO was approved 1/07/2008, so 10/01/2009 starting date is incorrect. Corrections were made to products in 5.1.3 d).
Original		

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ08HC71D DO 286 R5

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 09/08/2008–01/31/2013

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall
Signature: _____ Date: _____

10. Name: **Ronald Johnson**
Signtature: Ronald Johnson Date: 03/07/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**CPAS – CEV Parachute Assembly System**					
DO	**286 R5**		64			
	Est. Labor Costs					
	Materials/Subcontracts				64	
	Travel & NLR Misc					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However, the orders requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$89,011,022.74

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ08HC71D-DO286 REV 5

Originator: Justin Kerr (MV6) (281) 244-5071 **TMR:** Jan Yokley (EA) (281) 483-7581

Revision Summary:

Deleted sections 5.4.2 through 5.4.4 since the AA-2 test flight has been cancelled.

Restructure section 5.5 adding section 5.5.8 EDU Testing beginning in FY11

Restructure section 5.6 from PA2 to Flight for Program testing

Restructure section 5.7 adding section 5.7.4 Analytical Tech Services

1. Title of Effort: CPAS- CEV Parachute Assembly System

2. Date of Request: 01/14/2011

3. Statement of Work Task Description

a. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

d. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

e. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 3

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2008 and ends 01/31/2013.

5. Product Requirements

5.1 CPAS Project Management and Control (WBS 1.0) Updated REV 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall the contractor shall provide the oversight and control to manage the design, development, and test activities. The contractor shall provide general administrative and logistical functions, budget and cost tracking and reporting, schedule maintenance and updates. The contractor shall provide management and control functions for Safety and Mission Assurance, Quality, and Configuration Management for the CPAS project. Updated REV 5

5.1.1 CPAS Project Management (WBS1.1) Updated REV 5

Project Code:

The contractor shall provide the oversight and control to manage the design, development, and test activities. The contractor shall implement processes and procedures for effective communication of objectives, changes, and resolution of issues. The contractor shall implement a risk management process to track identified risks and mitigations. The contractor shall maintain the master schedule and provide cost, risk, schedule, and performance tracking and reporting. The contractor shall provide monthly project management reports to include cost, schedule, risk, and project performance and issues. The contractor shall also provide project actual costs to the WBS level specified in Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221 and JSC63495 CPAS PMP. The contractor shall provide monthly TCSR reviews and weekly integrate product teams (IPT) status.

Effective with Revision 5, the contractor shall deliver documentation that contains the contents specified in the required DRD and Products sections of this SOW. Contractor deliveries prior to Revision 5 followed the CEV Government Furnished Equipment Data Requirements Descriptions, CEV GFE DRDs, per the Attachment J-2 GFE DRDs.

The contractor shall work within the SharePoint environment including updating the CPAS project calendar, CPAS meeting Agendas, Minutes, and Actions. The contractor shall also provide the tracking, shipping, and transportation information on project equipment and coordinate and record purchases and travel expenditures.

Technical guidance can be found in the latest revision of JSC-66003, Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document. Management guidance can be found in the latest revision of JSC-66004, the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR).

5.1.2 Configuration Management (CM) and Quality Assurance (WBS 1.2) Deleted Rev 1

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
Attachment J-2-GFE-DRDs	Attachment J-2 GFE DATA REQUIREMENTS DESCRIPTION (GDRD)	06/13/2008
JPR 8500.4 Added Rev 3	Engineering Drawing System Manual	Rev. H, 11-2001
JSC 63495	Project Managment Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS)	Latest Revision
JSC 64221 Added Rev 2	Implementation Plan For the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS)	Latest Revision
JSC 64303	Configuration and Data Management Plan for CEV Parachute Assembly System	Baseline
JSC 66003 Added REV 5	Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document	Latest Revision
JSC 66004 Added REV 5	Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR)	Latest Revision

c. **Required DRDs**

5.1.1 CPAS Project Management (WBS1.1)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	bi-monthly
105	Regular Status Report/Summary Review	1/month

5.1.2 Configuration Management (CM) and Quality Assurance (WBS 1.2) Deleted Rev 1

DRD #	DRD Title	Quantity/Frequency

d. **Products**

5.1.1 CPAS Project Management (WBS1.1)

Product(s)	Quantity	Delivery Date
Integrated Project Schedule	2/month	1st and 3rd Friday of Every Month
Project Management Reports	1/month	Monthly
Project cost Performance Reports	1/month	Monthly

5.1.2 Configuration Management (CM) and Quality Assurance (WBS 1.2) Deleted Rev 1

Product(s)	Quantity	Delivery Date

e. **Product Verification**

5.1.1 CPAS Project Management (WBS1.1)

i. Integrated Project Schedule

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

ii. Project Management Reports

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

iii. Project cost Performance Reports

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

5.1.2 Configuration Management (CM) and Quality Assurance (WBS 1.2) Deleted Rev 1

5.2 Reserved (WBS 2.0)

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Reserved (WBS 2.0)

5.2.1 Reserved (WBS 2.1)
Project Code:

Reserved (WBS 2.1)

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.2.1 Reserved (WBS 2.1)

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.2.1 Reserved (WBS 2.1)

Product(s)	Quantity	Delivery Date
No products required - Reserved (WBS 2.0)	None	None

e. **Product Verification**

5.2.1 Reserved (WBS 2.1)

i. No products required - Reserved (WBS 2.0)

- None

5.3 CPAS PA1 Abort Flight (WBS 3.0) Updated REV 5

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall modify CPAS Generation 1 systems to provide positive margins of safety for PA-1 test environments and assess the system vulnerabilities. The contractor shall design and execute CPAS drop tests to provide system confidence testing. The contractor shall provide hardware for the pyro ground system tests.

For confidence testing, the contractor shall provide the design and configuration of test systems, coordinate test operations and support groups, prepare test articles (Parachutes and parachute instrumentation), and test vehicles, install and rig the CPAS, prepare Test Configuration Reviews (TCR) and Test Readiness Reviews (TRR), prepare and install the instrumentation systems, process post test data and prepare test reports.

For the PA-1 system, the contractor shall assess the safety of the test instrumentation for flight tests. Design and configure test systems, document system capabilities, perform system confidence testing, perform PA-1 test preparation activities, prepare and provide PA-1 test articles (full system ship set, including instrumentation), and installation and recovery procedures, install and rig the CPAS, provide products for internal and external test configuration and safety reviews, integrate and prepare for installation of CPAS instrumentation systems, perform recovery operations, provide post test data processing and test reports.

The contractor shall perform a CPAS fit check prior to CPAS system delivery. Updated REV 5

5.3.1 CPAS PA1 Requirements (WBS 3.1) Updated REV 5
Project Code:

The contractor shall provide a concept of operations for the CPAS PA-1 system capabilities, the operational contraints due to design, description of the operational envirnonment and describe how the CPAS PA1 design maintains positive margins of safety with respect to the PA-1 environments. The CPAS PA-1 concept of operations document shall contain the content specified in the CEV-G-005 GFE DRD.

5.3.2 CPAS PA1 Design (WBS 3.2) Updated REV 5
Project Code:

The contractor shall assess and modify Gen 1 systems to provide positive margins of safety for PA-1 test environments or document the system vulnerabilities via engineering analysis. The contractor shall provide configuration managed drawings and other documentation of the PA-1 CPAS configuration.

5.3.3 CPAS PA1 Production (WBS 3.3) Updated REV 5
Project Code:

The contractor shall provide fit check hardware and a full ship set of CPAS test hardware for PA-1. The contractor shall also provide pyro ground confidence testing hardware. The contractor shall provide hardware for any drop tests required to demonstrate system confidence or capabilities as defined by JSC 64221. The contractor shall provide hardware deliverables to the quantity and schedule defined in the Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221. The contractor shall provide an acceptance data package with content specified by GFE DRD, CEV-G-042.

5.3.4 CPAS PA1 Test (WBS 3.4) Updated REV 5
Project Code:

The contractor shall develop and execute CPAS drop tests as necessary to provide PA-1 system confidence. These tests will include at a minimum two parachute cluster drop tests, CDT2 and CDT3. The contractor shall develop and execute any additional

CPAS drop tests as necessary to provide system confidence.

For confidence testing, the contractor shall design and configure of test systems, coordinate test operations and support groups, prepare test articles (Parachute systems and instrumentation) and test vehicles, install and rig the CPAS, prepare Test Configuration Reviews (TCR) and Test Readiness Reviews (TRR), prepare and install instrumentation systems, and perform post test data processing and prepare test reports.

For Pad Abort 1(PA1) test, the contractor shall assess the safety of the test instrumentation for flight test support, perform PA-1 test preparation activities, prepare and provide test articles (full system ship set, including instrumentation) and installation and recovery procedures, install and rig the CPAS, perfrom internal and external test configuration and safety reviews, provide integration, preparation and installation of CPAS instrumentation systems, perform recovery operations, provide post test data processing and prepare test reports. The contractor shall perform an early fit check at DFRC, prior to system delivery at WSMR.

The contractor shall provide hardware for PA-1 per the test plan and schedule as defined in the Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 3	Project Management of GFE Flight Projects	Rev D 02-04
Attachment J-2-GFE-DRDs	Attachment J-2 GFE DATA REQUIREMENTS DESCRIPTION (GDRD)	06/13/2008
JPR 8500.4 Added Rev 3	Engineering Drawing System Manual	Rev. H, 11-01
JSC 63495 Added Rev 3	Project Management Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS)	Latest Version
JSC 64303 Added REV 5	Configuration and Data Management Plan for CEV Parachute Assembly System	Baseline
JSC 64421 Added Rev 2	Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221	Latest Revision

c. **Required DRDs**

5.3.1 CPAS PA1 Requirements (WBS 3.1)

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	1 set

5.3.2 CPAS PA1 Design (WBS 3.2)

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	1 set
218	Engineering Analysis	1 set

5.3.3 CPAS PA1 Production (WBS 3.3)

DRD #	DRD Title	Quantity/Frequency
230	Acceptance Data Package	1 set

5.3.4 CPAS PA1 Test (WBS 3.4)

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 set

d. **Products**

5.3.1 CPAS PA1 Requirements (WBS 3.1)

Product(s)	Quantity	Delivery Date
PA-1 Concept of Operations -System Capabilities Document Updated REV 5	1	Per JSC 64221

5.3.2 CPAS PA1 Design (WBS 3.2)

Product(s)	Quantity	Delivery Date
PA1 CPAS Drawings Updated REV 5	1 set	per JSC 64221

5.3.3 CPAS PA1 Production (WBS 3.3)

Product(s)	Quantity	Delivery Date
PA1 CPAS Hardware Deliverables Updated REV 5	Per JSC 64221	Per JSC 64221
Acceptance Data Package Updated REV 5	1	Per JSC 64221

5.3.4 CPAS PA1 Test (WBS 3.4)

Product(s)	Quantity	Delivery Date
PA-1 Test Configuration Review Data Package Updated REV 5	1	Per JSC 64221
PA-1 Test Readiness Review Package Updated REV 5	1	Per JSC 64221
PA-1 Processed Instrumentation Data (on-board) Updated REV 5	1	Per JSC 64221
PA-1 Post Flight Test Report Updated REV 5	1	Per JSC 64221
PA-1 Completed packing procedures Updated REV 5	1	Per JSC 64221
PA-1 Test Schedule Updated REV 5	1	Monthly updates
PA-1 Completed integration procedures Updated REV 5	1	Per JSC 64221
PA-1 Completed Mortar procedures Updated REV 5	1	Per JSC 64221
Confidence testing products shall be per standard product deliveries in section 5.5.6 Updated REV 5	1 set/Test	Per JSC 64221

e. **Product Verification**

5.3.1 CPAS PA1 Requirements (WBS 3.1)

i. PA-1 Concept of Operations -System Capabilities Document

- Delivery of Native File to DDMS - NASA CPAS Project Manager or Deputy Project Manager Review and Approval Updated REV 5

5.3.2 CPAS PA1 Design (WBS 3.2)

i. PA1 CPAS Drawings

- Delivery of Native File to DDMS - NASA CPAS Project Manager or Deputy Project Manager Review and Approval Updated REV 5

5.3.3 CPAS PA1 Production (WBS 3.3)

i. PA1 CPAS Hardware Deliverables

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval for delivery for Tests, DD250 to NASA approved by COTR at end of contract

ii. Acceptance Data Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMSand CPAS SharePoint Site NASA CPAS Updated REV 5

5.3.4 CPAS PA1 Test (WBS 3.4)

i. PA-1 Test Configuration Review Data Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

ii. PA-1 Test Readiness Review Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

iii. PA-1 Processed Instrumentation Data (on-board)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

iv. PA-1 Post Flight Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

v. PA-1 Completed packing procedures

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

vi. PA-1 Test Schedule

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMSand CPAS SharePoint Site NASA CPAS Updated REV 5

vii. PA-1 Completed integration procedures

- Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

viii. PA-1 Completed Mortar procedures

- Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

ix. Confidence testing products shall be per standard product deliveries in section 5.5.6

- Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

5.4 AA2 Abort Flight (WBS 4.0) Updated REV 5

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall modify CPAS Engineering Unit systems to provide positive margins of safety for AA-2 test environments or document the system vulnerabilities. The contractor shall design and execute CPAS drop tests as necessary to provide system confidence testing.

For confidence testing, the contractor shall design and configure test systems, coordinate test operations and support groups, prepare test articles (parachute systems and instrumentation) and test vehicles, install and rig the CPAS, provide products for Test Configuration Reviews (TCR) and Test Readiness Reviews (TRR), prepare and install the instrumentation systems, process post test data and prepare test reports.

For the AA-2 system, contractor shall assess the safety of the test instrumentation for flight tests, prepare and provide test articles(full system ship set, including instrumentation), and installation and recovery procedures, install and rig the CPAS, provide products for internal and external test configuration and safety reviews, integrate and prepare for installation of CPAS instrumentation systems, perform recovery operations, provide post test data processing and test reports. Contractor shall provide products for the PTR1, PTR2, and PTR3 design reviews for AA2.

The contractor shall perform an early CPAS fit check, prior to CPAS system delivery.

Note that effective Revision 3, AA2 replaces AA1 in this section 5.4 (WBS 4.0), since AA-1 flight test was cancelled.

Note that effective Revision 5, since the AA-2 flight test was cancelled no additional work on this section is required. To date work was only conducted on Section 5.4.1 (WBS 4.1). Updated REV 5

5.4.1 CPAS AA2 Requirements (WBS 4.1) Updated REV 5

Project Code:

Contractor shall document CPAS AA2 system capabilities in lieu of developing requirements. Contractor shall maintain positive margins of safety with respect to the AA2 environments or document system vulnerabilities.

The contractor shall document in a concept of operations document the CPAS AA-2 system capabilities, the operational constraints due to design, description of the operational environment and describe how the CPAS AA2 design maintains positive margins of safety with respect to the AA-2 environments. The CPAS AA-2 concept of operations document shall contain the content specified in the CEV-G-005 GFE DRD.

5.4.2 CPAS AA2 Design (WBS 4.2) Deleted REV 5

5.4.3 CPAS AA2 Production (WBS 4.3) Deleted REV 5

5.4.4 CPAS AA2 Test (WBS 4.4) Deleted REV 5

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Updated REV 5	Project Management of GFE Flight Projects	Rev D 02-04
Attachment J-2-GFE-	Attachment J-2 GFE DATA REQUIREMENTS DESCRIPTION (GDRD)	06/13/2008

DRDs Updated REV 5		
JPR 8500.4 Updated REV 5	Engineering Drawing System Manual	Rev. H, 11-01
JSC 63495 Updated REV 5	Proejct Management Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS)	Latest Revision
JSC 64221 Updated REV 5	Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Deliverable Plan	Baseline
JSC 64221 Updated REV 5	Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221	Latest revision
JSC 64303 Updated REV 5	Configuration and Data Managmeent Plan for CEV Parachute Assembly System	Baseline

c. **Required DRDs**

5.4.1 CPAS AA2 Requirements (WBS 4.1)

DRD #	DRD Title	Quantity/Frequency
218 Updated REV 5	Engineering Analysis	1

5.4.2 CPAS AA2 Design (WBS 4.2) Deleted REV 5

DRD #	DRD Title	Quantity/Frequency

5.4.3 CPAS AA2 Production (WBS 4.3) Deleted REV 5

DRD #	DRD Title	Quantity/Frequency

5.4.4 CPAS AA2 Test (WBS 4.4) Deleted REV 5

DRD #	DRD Title	Quantity/Frequency

d. **Products**

5.4.1 CPAS AA2 Requirements (WBS 4.1)

Product(s)	Quantity	Delivery Date
AA-2 Concept of Operations -System Capabilites Document Updated REV 5	1	Per JSC 64221

5.4.2 CPAS AA2 Design (WBS 4.2) Deleted REV 5

Product(s)	Quantity	Delivery Date

5.4.3 CPAS AA2 Production (WBS 4.3) Deleted REV 5

Product(s)	Quantity	Delivery Date

5.4.4 CPAS AA2 Test (WBS 4.4) Deleted REV 5

Product(s)	Quantity	Delivery Date

e. **Product Verification**

5.4.1 CPAS AA2 Requirements (WBS 4.1)

i. AA-2 Concept of Operations -System Capabilites Document

- Delivery of Native File to DDMS and CPAS SharePoint Site - NASA CPAS Project Manager or Deputy Project Manager Review and Approval Updated REV 5

5.4.2 CPAS AA2 Design (WBS 4.2) Deleted REV 5

5.4.3 CPAS AA2 Production (WBS 4.3) Deleted REV 5

5.4.4 CPAS AA2 Test (WBS 4.4) Deleted REV 5

5.5 CPAS Design, Production and Test (WBS 5.0) Updated REV 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide the design, analysis, developmental test activities, and production of the CPAS new architecture prototype parachutes. The contractor shall incorporate quality controls, processes, and inspections internally and at the subcontractor facility. The contractor shall also implement configuration management for the design, production, and test activities. Updated REV 5

5.5.1 CPAS New Architecture Requirements (WBS 5.1) Updated REV 5
Project Code:

The contractor shall provide the following CPAS project systems engineering and integration products: develop project definition and requirements, system level requirements, external and internal interface requirements, verification and validation plans and operations concept development and presentation. The review and baseline of these documents shall be through a Systems Requirements Review (SRR) per EA-WI-023. The System Requirements Review (SRR) shall meet Technical Review Entrance and Success Criteria requirements per NPR 7123.1 revision A appendix G.

5.5.2 CPAS Engineering Unit Preliminary Design (WBS 5.2) Updated REV 5
Project Code:

The contractor shall design the parachute system components in meeting specified requirements for flight. The contractor shall develop End Item Specifications, Assembly and Detailed Drawings, Design Analysis reports and interface requirements for the LAS FTA. The contractor shall initiate a reusability trade study to provide decision data for re-use of flight parachute system. The contractor shall provide design data, design, and analysis for the specified IDRs and flight Preliminary Design Review per EA-WI-023. The Preliminary Design Review (PDR) shall meet Technical Review Entrance and Success Criteria requirements per NPR 7123.1 revision A appendix G.

5.5.3 CPAS Flight Critical Design (WBS 5.3) Updated REV 5
Project Code:

The contractor shall design the parachute system components in meeting specified requirements. The contractor shall develop End Item Specifications, Assembly and Detailed Drawings, Design Analysis reports, and interface requirements to the CEV for Flight. All top assembly engineering drawings and documents shall be prepared and delivered utilizing the JSC cage Code 21356 under NASA release authority. The contractor shall provide design data, design, and analysis for the Flight design at specified IDRs and Critical Design Review, CDR per EA-WI-023 to the schedule defined in the implementation plan for the CEV Parachute Assembly System (CPAS), JSC 64221. The CDR shall meet Technical Review Entrance and Success Criteria requirements per NPR 7123.1 revision A appendix G.

Technical guidance can be found in the latest revision of JSC-66003, Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document, and management guidance can be found in the latest revision of JSC-66004, the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR).

Models and simulations shall meet NASA-STD-7009, Standard for Models and Simulations.

5.5.4 CPAS Engineering Unit Production (WBS 5.4) Updated REV 5
Project Code:

The contractor shall produce the Engineerng Unit CPAS Parachute system. The contractor shall provide oversight and inspection of processes (including GMIPS per JSC 63335), materials usage and traceability, and configuration control management. The

contractor shall provide refurbishment and modification of the parachutes of the design during the engineering unit tests. The contractor shall provide for a total production for engineering unit parachutes and parachute components to the quantity and schedule defined in the Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221. Technical guidance can be found in the latest revision of JSC-66003, Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document, and management guidance can be found in the latest revision of JSC-66004, the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR).

5.5.5 CPAS Flight Production (WBS 5.5) Updated REV 5
Project Code:

The contractor shall produce the Flight CPAS Parachute system. The contractor shall provide oversight and inspection of quality control processes (including GMIPS per JSC 63335), materials usage and traceability, and configuration control management. The contractor shall provide refurbishment and modification of the parachutes of the design during the qualification tests. The contractor shall provide for a total production for qualification and flight parachutes and parachute components to the quantity and schedule defined in the Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221. Technical guidance can be found in the latest revision of JSC-66003, Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document, and management guidance can be found in the latest revision of JSC-66004, the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR).

5.5.6 Engineering Unit Development Tests (WBS 5.6) Updated REV 5
Project Code:

The contractor shall provide the design and configuration of test systems, coordinate test operations and support groups, prepare test articles (CPAS systems), install and rig of the CPAS, provide products for the Test Configuration Reviews (TCR) and Test Readiness Reviews (TRR), prepare and install the instrumentation systems, test execution, and prepare post test data and test reports. Contractor shall provide all required test hardware, avionics, video, and instrumentation systems. Contractor shall track test objectives against an approved test matrix.

5.5.7 System Verification (WBS 5.7) Updated REV 5
Project Code:

The contractor shall provide design and configuration of qualification test systems, coordinate test operations and support groups, prepare test articles (CPAS systems), install and rig of the CPAS, provide products for the Test Configuration Reviews (TCR) and Test Readiness Reviews (TRR), prepare and install the instrumentation systems, and perform the test. The contractor shall provide post-test engineering analysis of acquired test data, produce simulation reconstructions and provide test reports of parachute performance results for each parachute system test. Contractor shall provide all required test hardware, avionics, video, and instrumentation systems. Contractor shall track test objectives against the latest revision of JSC 65885, Test Plan for the CPAS.

The contractor shall provide design data, design, and analysis for the Flight design at specified IDRs and System Acceptance Review (SAR) per EA-WI-023, to the schedule defined in the Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221. The SAR shall meet Technical Review Entrance and Success Criteria requirements per NPR 7123.1 revision A appendix G.

Contractor shall perform qualification testing and requirement verification products and services per JSC 64221. Technical guidance can be found in the latest revision of JSC-66003, Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document, and management guidance can be found in the latest revision of JSC-66004, the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR).

Models and simulations shall meet NASA-STD-7009, Standard for Models and Simulations.

5.5.8 Engineering Development Unit (EDU) Tests (WBS 5.8) Added REV 5
Project Code:

The contractor shall provide the design and configuration of test systems, coordinate test operations and support groups, prepare test articles (CPAS systems), install and rig of the CPAS, provide products for the Test Configuration Reviews (TCR) and Test Readiness Reviews (TRR), prepare and install the instrumentation systems, and perform the test. The contractor shall provide post-test engineering analysis of acquired test data, produce simulation reconstructions and provide test reports of parachute performance results for each parachute system test. Contractor shall provide any vendor-provided data analysis, procedures, or drawings. Contractor shall provide all required test hardware, avionics, video, and instrumentation systems to the quantity and schedule defined in the Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221. Contractor shall track test objectives against the latest revision of JSC 65885, Test Plan for the CPAS. Technical guidance can be found in the latest revision of JSC-66003, Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document, and management guidance can be found in the latest revision of JSC-66004, the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR).

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
Attachment J-2-GFE-DRDs Added REV 5	Attachment J-2 GFE DATA REQUIREMENTS DESCRIPTION (GDRD) (GDRD)	06/13/2008
JSC 63335 Added REV 5	Requirements for Establishing Government Mandatory Inspection Points	Latest Revision
JSC 63497 Added REV 5	PTRS for the CEV Parachute Assembly System	Latest Revision
JSC 64221 Added Rev 2	Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS),	Latest Revision
JSC 64303 Added REV 5	Configuration and Data Management Plan (CDMP) for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS)	Latest Revision
JSC 65885 Added REV 5	Test Plan for the CPAS	Latest Revision
JSC 66003 Added REV 5	Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document	Latest Revision
JSC 66004 Added REV 5	Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR)	Latest Revision
JSC-64355 Added Rev 3	Assumptions Companion Document to the Project Technical Requirements Specification for CPAS	Rev B
JSC63495	Project Management Plan for the CPAS	Latest Revision
NASA-STD-7009 Added REV 5	Standard for Models and Simulations	Latest Revision
NPR 7123.1	NASA Systems Engineering Processes and Requirements	Rev A

c. **Required DRDs**

5.5.1 CPAS New Architecture Requirements (WBS 5.1)

DRD #	DRD Title	Quantity/Frequency
201	Project Technical Requirements Specification (PTRS)	1
202	Flight Products Systems Requirements Review (SRR) Data Package	1
209	Flight Products Verification and Validation Plan	1

5.5.2 CPAS Engineering Unit Preliminary Design (WBS 5.2)

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	1 set
204	Preliminary Design Review (PDR) Data Package	1
207	Flight Products Specification	1

5.5.3 CPAS Flight Critical Design (WBS 5.3)

DRD #	DRD Title	Quantity/Frequency
102 Deleted REV 5	Engineering Drawings and Model Files	1 set
207 Deleted REV 5	Flight Products Specification	1
213 Deleted REV 5	Flight Product Critical Design Review (CDR) Data Package	1
307 Added REV 5	Project Technical Requirements Specification (PTRS)	1 draft and 1 final set / per JSC 64221
313 Added REV 5	End Item Specification	1 draft and 1 final set / per JSC 64221
323 Added REV 5	Verification and Validation Document	1 draft and 1 final set / per JSC 64221
324 Added REV 5	Safety Data Package	1 draft and 1 final set / per JSC 64221
325 Added REV	Hazardous, Key Operations List	1 draft and 1 final set / per JSC

5		
328 Added REV 5	Fault Tree Analysis	64221
329 Added REV 5	Quality Assurance (QA) Audit Report	1 draft and 1 final set / per JSC 64221
330 Added REV 5	Probabilstic Risk Assesstment Results	1 draft and 1 final set / per JSC 64221
331 Added REV 5	Ground System Safety Hazard Analysis	1 draft and 1 final set / per JSC 64221
333 Added REV 5	Drawing Tree	1 draft and 1 final set / per JSC 64221
334 Added REV 5	GFE Project Drawings	1 draft and 1 final set / per JSC 64221
335 Added REV 5	CAD Models	1 draft and 1 final set / per JSC 64221
336 Added REV 5	Engineering Models and Simulations	1 draft and 1 final set / per JSC 64221
338 Added REV 5	Design Analysis Reports	1 draft and 1 final set / per JSC 64221
339 Added REV 5	Sustaining Engineering Plan	1 draft and 1 final set / per JSC 64221
340 Added REV 5	Qualification and Acceptance Procedures	1 draft and 1 final set / per JSC 64221
343 Added REV 5	Certification Plans	1 draft and 1 final set / per JSC 64221
346 Added REV 5	Updates for Data Books	1 draft and 1 final set / per JSC 64221
349 Added REV 5	Fracture Control Report	1 draft and 1 final set / per JSC 64221
350 Added REV 5	Materials Indentification and Usage List (MIUL)	1 draft and 1 final set / per JSC 64221
351 Added REV 5	Materials Usage Agreements (MUA)	1 draft and 1 final set / per JSC 64221
352 Added REV 5	Stress Analysis	1 draft and 1 final set / per JSC 64221
353 Added REV 5	Mass Properties	1 draft and 1 final set / per JSC 64221
354 Added REV 5	GFE handling and Transportation	1 draft and 1 final set / per JSC 64221
355 Added REV 5	GFE Product Imagery Deliverables	1 draft and 1 final set / per JSC 64221
356 Added REV 5	Reliability and Maintainability (R & M) Analysis Report	1 draft and 1 final set / per JSC 64221

5.5.4 CPAS Engineering Unit Production (WBS 5.4)

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
329 Added REV 5	Quality Assurance (QA) Audit Report	Per JSC 64221

5.5.5 CPAS Flight Production (WBS 5.5)

DRD #	DRD Title	Quantity/Frequency
	No Requirement	
329 Added REV 5	Quality Assurance (QA) Audit Report	Per JSC 64221

5.5.6 Engineering Unit Development Tests (WBS 5.6)

DRD #	DRD Title	Quantity/Frequency
107 Updated REV 5	Test Report	1 set / each test

5.5.7 System Verification (WBS 5.7)

DRD #	DRD Title	Quantity/Frequency
102 Deleted REV 5	Engineering Drawings and Model Files	1 set
107 Added REV 5	Test Report	1 set / each test
207 Deleted REV 5	Flight Products Specification	1
237 Deleted REV 5	Certification Data Package	1
307 Added REV 5	Project Technical Requirements Specification (PTRS)	1 draft and 1 final set / per JSC 64221
313 Added REV 5	End Item Specification	1 draft and 1 final set / per JSC 64221
323 Added REV 5	Verification and Validation Document	1 draft and 1 final set / per JSC 64221
324 Added REV 5	Safety Data Package	1 draft and 1 final set / per JSC 64221
325 Added REV 5	Hazardous, Key Operations List	1 draft and 1 final set / per JSC 64221
328 Added REV 5	Fault Tree Analysis	1 draft and 1 final set / per JSC 64221
329 Added REV 5	Quality Assurance (QA) Audit Report	1 draft and 1 final set / per JSC 64221
330 Added REV 5	Probabilstic Risk Assesstment Results	1 draft and 1 final set / per JSC 64221
331 Added REV 5	Ground System Safety Hazard Analysis	1 draft and 1 final set / per JSC 64221
333 Added REV 5	Drawing Tree	1 draft and 1 final set / per JSC 64221
334 Added REV 5	GFE Project Drawings	1 draft and 1 final set / per JSC 64221
335 Added REV 5	CAD Models	1 draft and 1 final set / per JSC 64221
336 Added REV 5	Engineering Models and Simulations	1 draft and 1 final set / per JSC 64221
338 Added REV 5	Design Analysis Reports	1 draft and 1 final set / per JSC 64221
339 Added REV 5	Sustaining Engineering Plan	1 draft and 1 final set / per JSC 64221
340 Added REV 5	Qualification and Acceptance Procedures	1 draft and 1 final set / per JSC 64221
341 Added REV 5	Qualification and Acceptance Test Report	1 draft and 1 final set / per JSC 64221
342 Added REV 5	Acceptance Data Package	1 draft and 1 final set / per JSC 64221
343 Added REV 5	Certification Plans	1 draft and 1 final set / per JSC 64221
344 Added REV 5	Certification Data Package	1 draft and 1 final set / per JSC 64221
346 Added REV 5	Updates for Data Books	1 draft and 1 final set / per JSC 64221
349 Added REV 5	Fracture Control Report	1 draft and 1 final set / per JSC 64221
350 Added REV 5	Materials Indentification and Usage List (MIUL)	1 draft and 1 final set / per JSC 64221
351 Added REV 5	Materials Usage Agreements (MUA)	1 draft and 1 final set / per JSC 64221
352 Added REV 5	Stress Analysis	1 draft and 1 final set / per JSC 64221
353 Added REV 5	Mass Properties	1 draft and 1 final set / per JSC 64221
354 Added REV 5	GFE handling and Transportation	1 draft and 1 final set / per JSC 64221
355 Added REV	GFE Product Imagery Deliverables	1 draft and 1 final set / per JSC

5		
356 Added REV 5	Reliability and Maintainability (R & M) Analysis Report	64221 1 draft and 1 final set / per JSC 64221

5.5.8 Engineering Development Unit (EDU) Tests (WBS 5.8)

DRD #	DRD Title	Quantity/Frequency
102 Added REV 5	Engineering Drawings and Model Files	1 set / per vendor provided hardware
107 Added REV 5	Test Report	1 set / each test
218 Added REV 5	Engineering Analysis	1 set / per vendor provided hardware

d. **Products**

5.5.1 CPAS New Architecture Requirements (WBS 5.1)

Product(s)	Quantity	Delivery Date
Prototype End Item Specification New Architecture Updated REV 5	1	10 days prior to IDR
CPAS Project Technical Requirements Specification Updated REV 5	1	Draft 20 days prior to SRR Data Package, updates 1 week prior to SRR Data Package date per JSC 64221
SRR Data Packages per NPR 7123.1 revision A, Appendix G Updated REV 5	1 set	Draft 20 days prior to SRR Data Package, updates 1 week prior to SRR Data Package date per JSC 64221

5.5.2 CPAS Engineering Unit Preliminary Design (WBS 5.2)

Product(s)	Quantity	Delivery Date
CEV-G-034- New Architecture Assembly and Detailed Drawings Updated REV 5	1 Set	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-009 - CPAS to LAS FTA ICD (Final) Deleted Rev 2	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-038 - Design Analysis Reports Updated REV 5	1Set	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-053 - Mass Properties Reports Updated REV 5	1	Draft 04/20/08 Monthly updates
CEV-G-028 - Fault Tree Analysis - Draft Updated REV 5	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-030 - Probabilistic Risk Assessment Results Updated REV 5	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
PDR Data Packages per NPR 7123.1 revision A, Appendix G Updated REV 5	1 Set	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-024 - Safety Data Package Updated REV 5	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-023 - Verification and Validation Document Updated REV 5	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-033 - Drawing Tree Updated REV 5	1 Set	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-036 - Engineering Models/Sims Updated REV 5	1 Set	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-050 Materials Identification and Usage List (MIUL) Updated REV 5	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-023 - Verification and Validation Document Deleted Rev 2	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
CEV-G-056 Reliability & Maintainability (R&M) Updated REV 5	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221
Master Verification Plan Updated REV 5	1	Draft 2 weeks prior to IDRs delivery date, updates 2 weeks prior to PDR Data Package date per JSC 64221

5.5.3 CPAS Flight Critical Design (WBS 5.3)

Product(s)	Quantity	Delivery Date
CEV-G-034 - New Architecture Assembly and Detailed Drawings Deleted REV 5	1 Set	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-038 - Design Analysis Reports Deleted REV 5	1Set	Draft 10 days prior to CDR Data Package/Final CDR

		Data Package per JSC 64221
CEV-G-053 - Mass Properties Reports Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-028 - Fault Tree Analysis Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-030 - Probabilistic Risk Assessment Results Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CDR Data Packages per NPR 7123.1 revision A, Appendix G Updated REV 5	1 Set	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-023 - Verification and Validation Document Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-033 - Drawing Tree Deleted REV 5	1 Set	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-024 - Safety Data Package Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-035 - CAD Models Deleted REV 5	1 Set	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-040 - Qualification & Acceptance Procedures Deleted REV 5	1 Set	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-043 - Certification Plan Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-055 - GFE Imagery Plan/Imagery Deliverables Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
Critical Manufacturing Processes Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-036 - Engineering Models/Sims Deleted REV 5	1 set	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-031 Ground Safety Analysis Report Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-039 Sustaining Engineering Plan Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-050 Materials Identification and Usage List (MIUL) Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-051 Materials Usage Agreements Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-052 Stess Analysis Reports Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CEV-G-056 Reliability & Maintainability (R&M) Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
Master Verification Plan Deleted REV 5	1	Draft 10 days prior to CDR Data Package/Final CDR Data Package per JSC 64221
CDR Presentation Updated REV 5	1 draft / 1 final set	per JSC 64221

5.5.4 CPAS Engineering Unit Production (WBS 5.4)

Product(s)	Quantity	Delivery Date
Hardware Deliverables as specified in JSC 64221 Updated REV 5	per JSC 64221	Per JSC 64221
Government Mandatory Inspection Points (GMIPs) Updated REV 5	As agreed to	As agreed to

5.5.5 CPAS Flight Production (WBS 5.5)

Product(s)	Quantity	Delivery Date
Hardware Deliverables as specified in JSC 64221 Updated REV 5	per JSC 64221	JSC 64221
Government Mandatory Inspection Points (GMIPs) Updated REV 5	As agreed to	As agreed to

5.5.6 Engineering Unit Development Tests (WBS 5.6)

Product(s)	Quantity	Delivery Date
Initial Test Configuration Document and Test Configuration Review Data Package Updated REV 5	1 for each test per JSC 64221	30 Days prior to Test per schedule in JSC 64221
Test Readiness Review Package Updated REV 5	1 for each test per JSC	1 Day prior to Test per schedule in

	64221	JSC 64221
Processed Instrumentation Data (on-board) Updated REV 5	1 for each test per JSC 64221	2 Weeks after Test per schedule in JSC 64221
Final Test Configuration Document Updated REV 5	1 for each test per JSC 64221	2 Weeks after Test per schedule in JSC 64221
Post Flight Test Report Updated REV 5	1 for each test per JSC 64221	4 weeks after receipt of data from Range
Test Plan and Schedule Updated REV 5	1 for each test per JSC 64221	60 Days prior to Test per schedule in JSC 64221

5.5.7 System Verification (WBS 5.7)

Product(s)	Quantity	Delivery Date
CEV-G-034 New Architechure Assembly and Detailed Drawings Deleted REV 5	1 set	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-038 - Design Analysis Reports Deleted REV 5	1 set	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-053 - Mass Properties Reports Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-028 - Fault Tree Analysis Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-030 - Probabilistic Risk Assessment Results Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CDR Data Packages per NPR 7123.1 revision A, Appendix G Deleted REV 5	1 set	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-023 - Verification and Validation Document Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-033 - Drawing Tree Deleted REV 5	1 set	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-024 - Safety Data Package Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-035 - CAD Models Deleted REV 5	1 set	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-040 - Qualification and Acceptance Procedures Deleted REV 5	1 set	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-043 - Certification Plan Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-055 - GFE Imagery Plan/Imagery Deliverables Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
Critical Manufacturing Processes Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-036 - Engineering Models/Sims Deleted REV 5	1 set	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-031 - Ground Safety Analysis Report Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-039 - Sustaining Plan Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-050 - Materials Identification and Usage List (MIUL) Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-051 - Materials Usage Agreements Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-052 - Stress Analysis Reports Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
CEV-G-056 - Reliability & Maintainability (R&M) Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
Master Verification Plan Deleted REV 5	1	Draft 10 days prior to SAR Data Package/Final SAR Data Package per JSC 64221
Test Configuration Review Data Package Added REV 5	1 for each test per JSC 64221	30 days prior to Test per schedule in JSC 64221
Test Readiness Review Package Added REV 5	1 for each test per JSC 64221	1 day prior to Test per schedule in JSC 64221
Processed Instrumentation Data (on-board) Added REV 5	1 for each test per JSC 64221	2 weeks after test per schedule in JSC 64221
Vendor Quick-look Post Test Report Added REV 5	1 for each test per JSC 64221	4 Weeks after Test per schedule in JSC 64221

Preliminary Analysis and Reconstruction Post Test Report Added REV 5	1 for each test per JSC 64221	4 Weeks after Test per schedule in JSC 64221
Test and Operations Post Test Report Added REV 5	1 for each test per JSC 64221	4 Weeks after Test per schedule in JSC 64221
Test Plan and Schedule Added REV 5	1 for each test per JSC 64221	60 Days prior to Test per schedule in JSC 64221
Test Plan for the CPAS (Updates for JSC 65885) Added REV 5	1 (update)	Quarterly
SAR Data Packages per NPR 7123.1 revision A, Appendix G Added REV 5	1 draft / 1 final set	Per JSC 64221
SAR Presentation Added REV 5	1 draft / 1 final set	Per JSC 64221
Vendor Provided Test Hardware Procedures Added REV 5	1 per vendor provided hardware	30 days prior to Test per schedule in JSC 64221

5.5.8 Engineering Development Unit (EDU) Tests (WBS 5.8)

Product(s)	Quantity	Delivery Date
Test Configuration Review Data Package Added REV 5	1 for each test per JSC 64221	30 days prior to Test per schedule in JSC 64221
Test Readiness Review Package Added REV 5	1 for each test per JSC 64221	1 day prior to Test per schedule in JSC 64221
Processed Instrumentation Data (on-board) Added REV 5	1 for each test per JSC 64221	2 weeks after test per schedule in JSC 64221
Vendor Quick-look Post Test Report Added REV 5	1 for each test per JSC 64221	4 Weeks after Test per schedule in JSC 64221
Preliminary Analysis and Reconstruction Post Test Report Added REV 5	1 for each test per JSC 64221	4 Weeks after Test per schedule in JSC 64221
Test and Operations Post Test Report Added REV 5	1 for each test per JSC 64221	4 Weeks after Test per schedule in JSC 64221
Test Plan and Schedule Added REV 5	1 for each test per JSC 64221	60 Days prior to Test per schedule in JSC 64221
Test Plan for the CPAS (Updates for JSC 65885) Added REV 5	1 (update)	Quarterly
Vendor Provided Test Hardware Procedures Added REV 5	1 per vendor provided hardware	30 days prior to Test per schedule in JSC 64221

e. **Product Verification**

5.5.1 CPAS New Architecture Requirements (WBS 5.1)

i. Prototype End Item Specification New Architecture

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

ii. CPAS Project Technical Requirements Specification

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

iii. SRR Data Packages per NPR 7123.1 revision A, Appendix G

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

5.5.2 CPAS Engineering Unit Preliminary Design (WBS 5.2)

i. CEV-G-034- New Architecture Assembly and Detailed Drawings

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

ii. CEV-G-009 - CPAS to LAS FTA ICD (Final) Deleted Rev 2

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted Rev 2

iii. CEV-G-038 - Design Analysis Reports

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

iv. CEV-G-053 - Mass Properties Reports

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

v. CEV-G-028 - Fault Tree Analysis - Draft

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

vi. CEV-G-030 - Probabilistic Risk Assessment Results

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

vii. PDR Data Packages per NPR 7123.1 revision A, Appendix G

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

viii. CEV-G-024 - Safety Data Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

ix. CEV-G-023 - Verification and Validation Document

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

x. CEV-G-033 - Drawing Tree

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

xi. CEV-G-036 - Engineering Models/Sims

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

xii. CEV-G-050 Materials Identification and Usage List (MIUL)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

xiii. CEV-G-023 - Verification and Validation Document Deleted Rev 2

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted Rev 2

xiv. CEV-G-056 Reliability & Maintainability (R&M)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

xv. Master Verification Plan

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

5.5.3 CPAS Flight Critical Design (WBS 5.3)

i. CEV-G-034 - New Architecture Assembly and Detailed Drawings Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

ii. CEV-G-038 - Design Analysis Reports Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

iii. CEV-G-053 - Mass Properties Reports Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

iv. CEV-G-028 - Fault Tree Analysis Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

v. CEV-G-030 - Probabilistic Risk Assessment Results Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

vi. CDR Data Packages per NPR 7123.1 revision A, Appendix G

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

vii. CEV-G-023 - Verification and Validation Document Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

viii. CEV-G-033 - Drawing Tree Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

ix. CEV-G-024 - Safety Data Package Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

x. CEV-G-035 - CAD Models Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xi. CEV-G-040 - Qualification & Acceptance Procedures Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xii. CEV-G-043 - Certification Plan Deleted REV 5

- - NASA CPAS Project Manager or Deputy Project Manager Review and Approval for delivery of Hardware Deleted REV 5

xiii. CEV-G-055 - GFE Imagery Plan/Imagery Deliverables Deleted REV 5

- - NASA CPAS Project Manager or Deputy Project Manager Review and Approval for delivery of Hardware Deleted REV 5

xiv. Critical Manufacturing Processes Deleted REV 5

- - NASA CPAS Project Manager or Deputy Project Manager Review and Approval for delivery of Hardware Deleted REV 5

xv. CEV-G-036 - Engineering Models/Sims Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xvi. CEV-G-031 Ground Safety Analysis Report Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xvii. CEV-G-039 Sustaining Engineering Plan Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xviii. CEV-G-050 Materials Identification and Usage List (MIUL) Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xix. CEV-G-051 Materials Usage Agreements Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xx. CEV-G-052 Stess Analysis Reports Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xxi. CEV-G-056 Reliability & Maintainability (R&M) Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xxii. Master Verification Plan Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xxiii. CDR Presentation

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

5.5.4 CPAS Engineering Unit Production (WBS 5.4)

i. Hardware Deliverables as specified in JSC 64221

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval for delivery of Hardware for Tests, DD250 to NASA approved by COTR at end of contract Updated REV 5

ii. Government Mandatory Inspection Points (GMIPs)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

5.5.5 CPAS Flight Production (WBS 5.5)

i. Hardware Deliverables as specified in JSC 64221

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval for delivery of Hardware for Tests, DD250 to NASA approved by COTR at end of contract Updated REV 5

ii. Government Mandatory Inspection Points (GMIPs)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

5.5.6 Engineering Unit Development Tests (WBS 5.6)

i. Initial Test Configuration Document and Test Configuration Review Data Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

ii. Test Readiness Review Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

iii. Processed Instrumentation Data (on-board)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

iv. Final Test Configuration Document

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

v. Post Flight Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

vi. Test Plan and Schedule

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Updated REV 5

5.5.7 System Verification (WBS 5.7)

i. CEV-G-034 New Architechure Assembly and Detailed Drawings Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

ii. CEV-G-038 - Design Analysis Reports Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

iii. CEV-G-053 - Mass Properties Reports Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

iv. CEV-G-028 - Fault Tree Analysis Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

v. CEV-G-030 - Probabilistic Risk Assessment Results Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

vi. CDR Data Packages per NPR 7123.1 revision A, Appendix G Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

vii. CEV-G-023 - Verification and Validation Document Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

viii. CEV-G-033 - Drawing Tree Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

ix. CEV-G-024 - Safety Data Package Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

x. CEV-G-035 - CAD Models Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xi. CEV-G-040 - Qualification and Acceptance Procedures Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xii. CEV-G-043 - Certification Plan Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xiii. CEV-G-055 - GFE Imagery Plan/Imagery Deliverables Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xiv. Critical Manufacturing Processes Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xv. CEV-G-036 - Engineering Models/Sims Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xvi. CEV-G-031 - Ground Safety Analysis Report Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xvii. CEV-G-039 - Sustaining Plan Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xviii. CEV-G-050 - Materials Identification and Usage List (MIUL) Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xix. CEV-G-051 - Materials Usage Agreements Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xx. CEV-G-052 - Stress Analysis Reports Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xxi. CEV-G-056 - Reliability & Maintainability (R&M) Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xxii. Master Verification Plan Deleted REV 5

- ASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

xxiii. Test Configuration Review Data Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxiv. Test Readiness Review Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxv. Processed Instrumentation Data (on-board)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxvi. Vendor Quick-look Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxvii. Preliminary Analysis and Reconstruction Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxviii. Test and Operations Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxix. Test Plan and Schedule

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxx. Test Plan for the CPAS (Updates for JSC 65885)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxxi. SAR Data Packages per NPR 7123.1 revision A, Appendix G

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxxii. SAR Presentation

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xxxiii. Vendor Provided Test Hardware Procedures

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

5.5.8 Engineering Development Unit (EDU) Tests (WBS 5.8)

i. Test Configuration Review Data Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

ii. Test Readiness Review Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

iii. Processed Instrumentation Data (on-board)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

iv. Vendor Quick-look Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

v. Preliminary Analysis and Reconstruction Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

vi. Test and Operations Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

vii. Test Plan and Schedule

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

viii. Test Plan for the CPAS (Updates for JSC 65885)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

ix. Vendor Provided Test Hardware Procedures

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

5.6 CPAS Flight Services (WBS 6.0) Updated REV 5

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall produce CPAS Hardware as necessary to provide positive margins of safety for Flight test environments or document the system vulnerabilities. The contractor shall design and execute CPAS ground and airdrop tests as necessary to provide system confidence.

For confidence testing, the contractor shall provide the design and configuration of tested systems, coordinate test operations and support groups, prepare test articles (Parachutes and parachute instrumentation) and test vehicles, install and rig the CPAS, prepare Test Configuration Reviews (TCR) and Test Readiness Reviews (TRR), prepare and install of instrumentation systems, and perform post test data processing and prepare test reports.

For the flight test system(s) the contractor shall assess the safety of the test instrumentation for flight tests, provide system test preparation, prepare and provide test articles (full system ship set, including instrumentation) and installation and recovery procedures, install and rig the CPAS, provide products for internal and external test configuration and safety reviews, provide integration, preparation and installation of CPAS instrumentation systems, perform recovery operations, provide post test data processing and test reports. The contractor shall provide products for project and program level reviews for all flight tests .

The contractor shall plan for an early fit check of CPAS, prior to system delivery.

The contractor shall provide Class I flight systems for manned Orion Flight Test.

Models and simulations shall meet NASA-STD-7009, Standard for Models and Simulations. Updated REV 5

5.6.1 CPAS External Test Services (WBS 6.1) Updated REV 5

Project Code:

The contractor shall provide support for all parachute mortar development, testing and integration being performed by Lockheed Martin. The contractor shall provide support for the CPAS parachutes flight and post flight activities.

The contractor shall provide support for CPAS parachute test objectives development and requirements definition for program tests. The contractor shall develop and provide flight preparation products in support of flight readiness at the designated WBS level once the parachute test objectives and requirements definitions are established.

5.6.2 CPAS FT-1 (WBS 6.2) Updated REV 5

Project Code:

Contractor shall document CPAS FT-1 system capabilities as part of developing requirements definition. Contractor shall maintain positive margins of safety with respect to the FT-1 environments or document system vulnerabilities.

The contractor shall document in a concept of operations document the CPAS FT-1 system

capabilities, the operational constraints due to design, description of the operational environment and describe how the CPAS FT-1 design maintains positive margins of safety with respect to the FT-1 environments.

The contractor shall assess Engineering Unit systems to provide positive margins of safety for FT-1 test environments or document the system vulnerabilities via engineering analysis. The contractor shall provide configuration managed drawings and other documentation of the OFT-1 CPAS configuration. Contractor shall provide the products for project and program level reviews.

The contractor shall provide hardware for any ground or airdrop tests required to demonstrate system confidence or capabilities as defined by JSC 64221.

The contractor shall provide hardware deliverables to the quantity and schedule defined in the Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221, as well as the appropriate data packages.

For FT-1 test, the contractor shall assess the safety of the test instrumentation for flight test support, perform FT-1 test preparation activities, prepare and provide test articles and installation and recovery procedures, install and rig the CPAS, perform internal and external test configuration and safety reviews, support recovery operations, provide post test data processing and prepare test reports.

5.6.3 CPAS FT-2 (WBS 6.3) Updated REV 5
Project Code:

Reserved for future use, no current requirements.

5.6.4 CPAS Orion (WBS 6.4) Updated REV 5
Project Code:

Contractor shall document CPAS Orion system capabilities as part of developing requirements definition. Contractor shall maintain positive margins of safety with respect to the Orion environments or document system vulnerabilities.

The contractor shall document in a concept of operations document the CPAS Orion system capabilities, the operational constraints due to design, description of the operational environment and describe how the CPAS Orion design maintains positive margins of safety with respect to the Orion environments.

The contractor shall assess Class I Flight Systems to provide positive margins of safety for Orion test environments or document the system vulnerabilities via engineering analysis. The contractor shall provide configuration managed drawings and other documentation of the Orion CPAS configuration. Contractor shall provide the products for project and program level reviews.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023 Added Rev 3	Project Management of GFE Flight Projects	Rev D 02-04
JPR 8500.4 Added Rev 3	Engineering Drawing System Manual	Rev. H, 11-01
JSC 63495 Added Rev 3	Project Management Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS)	Latest Revision
JSC 64221 Added Rev 2	Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS),	Latest Revision
JSC 64303 Added REV 5	Configuration and Data Management Plan for CEV Parachute Assmebly System	Baseline

c. **Required DRDs**

5.6.1 CPAS External Test Services (WBS 6.1)

DRD #	DRD Title	Quantity/Frequency
107 Added REV 5	Test Report	Per JSC 64221
218 Updated REV 5	Engineering Analysis	Per JSC 64221

5.6.2 CPAS FT-1 (WBS 6.2)

DRD #	DRD Title	Quantity/Frequency
102 Deleted REV 5	Engineering Drawings and Model Files	1 set
107 Added REV 5	Test Report	Per JSC 64221
218 Deleted REV 5	Engineering Analysis	1 set
305 Added REV 5	Concept of Operations	Per JSC 64221
324 Added REV 5	Safety Data Package	Per JSC 64221
325 Added REV 5	Hazardous, Key Operations List	Per JSC 64221
329 Added REV 5	Quality Assurance (QA) Audit Report	Per JSC 64221
331 Added REV 5	Ground System Safety Hazard Analysis	Per JSC 64221
334 Added REV 5	GFE Project Drawings	Per JSC 64221
335 Added REV 5	CAD Models	Per JSC 64221
336 Added REV 5	Engineering Models and Simulations	Per JSC 64221
338 Added REV 5	Design Analysis Reports	Per JSC 64221
342 Added REV 5	Acceptance Data Package	Per JSC 64221
346 Added REV 5	Updates for Data Books	Per JSC 64221
349 Added REV 5	Fracture Control Report	Per JSC 64221
350 Added REV 5	Materials Indentification and Usage List (MIUL)	Per JSC 64221
352 Added REV 5	Stress Analysis	Per JSC 64221
353 Added REV 5	Mass Properties	Per JSC 64221
354 Added REV 5	GFE handling and Transportation	Per JSC 64221
356 Added REV 5	Reliability and Maintainability (R & M) Analysis Report	Per JSC 64221

5.6.3 CPAS FT-2 (WBS 6.3)

DRD #	DRD Title	Quantity/Frequency
Updated REV 5	No Requirement	NA

5.6.4 CPAS Orion (WBS 6.4)

DRD #	DRD Title	Quantity/Frequency
Deleted REV 5	No Requirement	
107 Added REV 5	Test Report	Per JSC 64221
305 Added REV 5	Concept of Operations	Per JSC 64221
324 Added REV 5	Safety Data Package	Per JSC 64221
325 Added REV 5	Hazardous, Key Operations List	Per JSC 64221
329 Added REV 5	Quality Assurance (QA) Audit Report	Per JSC 64221
331 Added REV 5	Ground System Safety Hazard Analysis	Per JSC 64221
334 Added REV 5	GFE Project Drawings	Per JSC 64221
335 Added REV 5	CAD Models	Per JSC 64221
336 Added REV 5	Engineering Models and Simulations	Per JSC 64221
338 Added REV 5	Design Analysis Reports	Per JSC 64221
342 Added REV 5	Acceptance Data Package	Per JSC 64221
346 Added REV 5	Updates for Data Books	Per JSC 64221
349 Added REV 5	Fracture Control Report	Per JSC 64221
350 Added REV 5	Materials Indentification and Usage List (MIUL)	Per JSC 64221
352 Added REV 5	Stress Analysis	Per JSC 64221
353 Added REV 5	Mass Properties	Per JSC 64221
354 Added REV 5	GFE handling and Transportation	Per JSC 64221
356 Added REV 5	Reliability and Maintainability (R & M) Analysis Report	Per JSC 64221

d. **Products**

5.6.1 CPAS External Test Services (WBS 6.1)

Product(s)	Quantity	Delivery Date
PA-2 Concept of Operations -System Capabilites Document Deleted REV 5	1	Per JSC 64221
Engineering Analysis Updated REV 5	Per JSC 64221	Per JSC 64221
Engineering Test Updated REV 5	Per JSC 64221	Per JSC 64221

5.6.2 CPAS FT-1 (WBS 6.2)

Product(s)	Quantity	Delivery Date
PA-2 CPAS Drawings Deleted REV 5	1 set	Per JSC 64221
Production Hardware Updated REV 5	Per JSC 64221	Per JSC 64221
Parachute Notebooks Updated REV 5	1 set	Per JSC 64221
Parachute Packing Procedures Updated REV 5	1 set	Per JSC 64221
Parachute Integration Procedures Updated REV 5	1	Per JSC 64221
Test Configuration Review Package Updated REV 5	1	Per JSC 64221
Test Readiness Review Package Updated REV 5	1	Per JSC 64221

Vendor Quick-Look Post Test Report Updated REV 5	1	Per JSC 64221
Preliminary Analysis and Reconstruction Post Test Report Updated REV 5	1	Per JSC 64221
Test and Operations Post Test Report Updated REV 5	1	Per JSC 64221
Test Plan and Schedule Updated REV 5	per JSC 64221	Per JSC 64221
Government Mandatory Inspection Points (GMIPs) Updated REV 5	As agreed to	As agreed to

5.6.3 CPAS FT-2 (WBS 6.3)

Product(s)	Quantity	Delivery Date
Reserved for future use, no current products.	None	NA

5.6.4 CPAS Orion (WBS 6.4)

Product(s)	Quantity	Delivery Date
Reserved for future use, no current products. Deleted REV 5	None	NA
Production Hardware Added REV 5	per JSC 64221	per JSC 64221
Parachute Notebooks Added REV 5	1 set	per JSC 64221
Parachute Packing Procedures Added REV 5	1 set	per JSC 64221
Parachute Integraton Procedures Added REV 5	1	per JSC 64221
Test Configuration Review Package Added REV 5	1	per JSC 64221
Test Readiness Review Package Added REV 5	1	per JSC 64221
Vendor Quick-look Post Test Report Added REV 5	1	per JSC 64221
Preliminary Analysis and Reconstruction Post Test Report Added REV 5	1	per JSC 64221
Test and Operations Post Test Report Added REV 5	1	per JSC 64221
Test Plan and Schedule Added REV 5	per JSC 64221	per JSC 64221
Government Mandatory Inspection Points (GMIPs) Added REV 5	As agreed to	As agreed to

e. **Product Verification**

5.6.1 CPAS External Test Services (WBS 6.1)

i. PA-2 Concept of Operations -System Capabilites Document Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

ii. Engineering Analysis

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

iii. Engineering Test

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

5.6.2 CPAS FT-1 (WBS 6.2)

i. PA-2 CPAS Drawings Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

ii. Production Hardware

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

iii. Parachute Notebooks

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

iv. Parachute Packing Procedures

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

v. Parachute Integration Procedures

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

vi. Test Configuration Review Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

vii. Test Readiness Review Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

viii. Vendor Quick-Look Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

ix. Preliminary Analysis and Reconstruction Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

x. Test and Operations Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

xi. Test Plan and Schedule

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

xii. Government Mandatory Inspection Points (GMIPs)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

5.6.3 CPAS FT-2 (WBS 6.3)

i. Reserved for future use, no current products.

- Reserved for future use, no current products and no verfications.

5.6.4 CPAS Orion (WBS 6.4)

i. Reserved for future use, no current products. Deleted REV 5

- Reserved for future use, no current products and no verfications. Deleted REV 5

ii. Production Hardware

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

iii. Parachute Notebooks

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

iv. Parachute Packing Procedures

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

v. Parachute Integraton Procedures

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

vi. Test Configuration Review Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

vii. Test Readiness Review Package

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

viii. Vendor Quick-look Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

ix. Preliminary Analysis and Reconstruction Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

x. Test and Operations Post Test Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xi. Test Plan and Schedule

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

xii. Government Mandatory Inspection Points (GMIPs)

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS

SharePoint Site NASA CPAS Added REV 5

5.7 CPAS Project Additonal Support (WBS 7.0) Updated REV 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide services and data in support of ground and airdrop test support equipment, failure analysis, facilities, analytical services including simulation and imagery analysis, CEV Technical Interchange meetings (TIM), life cycle reviews, and safety panels.

Technical guidance can be found in the latest revision of JSC-66003, Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document, and management guidance can be found in the latest revision of JSC-66004, the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR). Updated REV 5

5.7.1 CPAS Ground Support Equipment (GSE)Test Support Equipment (TSE) (WBS 7.1) Updated REV 5
Project Code:

The contractor shall provide miscellaneous Ground and Test Support Equipment to support testing to the quantity and schedule defined in the Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS), JSC 64221.

The contractor shall deliver any data analysis, procedures, drawings, and vendor provided products in support of these products.

5.7.2 CPAS Technical Studies (WBS 7.2) Updated REV 5
Project Code:

The contractor shall provide technical studies required to resolve integration issues, operational issues, or failure investigations with the CEV related to CPAS. The contractor shall provide Engineering Design Change Proposals as required, which shall include impacts to cost, schedule and technical risks.

5.7.3 CPAS Reserved (WBS 7.3) Added REV 5
Project Code:

No requirements.

5.7.4 CPAS Analytical Tech Services (WBS 7.4) Added REV 5
Project Code:

The contractor shall consolidate all parachute performance results, produce an update to the latest version of the parachute modeling memo and deliver the modeling memo to other technical groups for use in their respective simulations. The contractor shall provide imagery analysis to understand the inflation process and dynamics, sync parachute inflation events with test data and support anomaly resolution as required. The contractor shall perform aerodynamic analyses as required to support reconstruction efforts. The contractor shall provide assessments of the test article stability and associated test technique analyses to ensure a successful flight. The contractor shall prepare and present summaries of the above technical analyses at appropriate forums.

Models and simulations shall meet NASA-STD-7009, Standard for Models and Simulations.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	
EA-WI-023 Added Rev 3	Project Management of GFE Flight Projects	Rev D 02-04
JPR 8500.4 Added Rev 3	Engineering Drawing System Manual	Rev. H, 11-01
JSC 63495 Added Rev 3	Project Management Plan for the Crew Exploraiton Vehicle (CEV) Parachute Assembly System (CPAS)	Latest Revision
JSC 64221 Added Rev 3	Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS)	Latest Revision
JSC 64303 Added Rev 3	Configuration and Data Management Plan for CEV Parachute Assembly System	Baseline
JSC 65885 Added REV 5	Test Plan for the CPAS	Latest Revision
JSC 66003 Added REV 5	Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Technical Guidance Document	
JSC 66004 Added REV 5	Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) Management Integrated Product Team (IPT) Record (MIPTR)	Latest Revision
NASA-STD-7009 Added REV 5	Standard for Models and Simulations	Latest Revision

c. **Required DRDs**

5.7.1 CPAS Ground Support Equipment (GSE)Test Support Equipment (TSE) (WBS 7.1)

DRD #	DRD Title	Quantity/Frequency
102 Added REV 5	Engineering Drawings and Model Files	1 set / per Ground or Test Support Equipment
218 Updated REV 5	Engineering Analysis	1 set / per Ground or Test Support Equipment

5.7.2 CPAS Technical Studies (WBS 7.2)

DRD #	DRD Title	Quantity/Frequency
104 Added REV 5	Engineering Design Change Proposal	As required
208 Added REV 5	Flight Products Failure Analysis Report	1 set / per hardware failure
218	Engineering Analysis	1 set

5.7.3 CPAS Reserved (WBS 7.3)

DRD #	DRD Title	Quantity/Frequency
Added REV 5	No Requirement	NA

5.7.4 CPAS Analytical Tech Services (WBS 7.4)

DRD #	DRD Title	Quantity/Frequency
107 Added REV 5	Test Report	per JSC 64221
218 Added REV 5	Engineering Analysis	per JSC 64221

d. **Products**

5.7.1 CPAS Ground Support Equipment (GSE)Test Support Equipment (TSE) (WBS 7.1)

Product(s)	Quantity	Delivery Date
Ground and Test Support Equipment Updated REV 5	per JSC 64221	per JSC 64221
Ground and Test Support Equipment Procedures Updated REV 5	1 per vendor provided hardware	30 days prior to test per JSC 64221

5.7.2 CPAS Technical Studies (WBS 7.2)

Product(s)	Quantity	Delivery Date
CPAS Technical Studies Updated REV 5	per JSC 64221	per JSC 64221
Change Request evaluations Deleted REV 5	4/month	2 days after receipt

5.7.3 CPAS Reserved (WBS 7.3)

Product(s)	Quantity	Delivery Date
No requirements Added REV 5	None	NA

5.7.4 CPAS Analytical Tech Services (WBS 7.4)

Product(s)	Quantity	Delivery Date
Parachute Modeling Memo Added REV 5	1 set	Quarterly
Imagery Analysis Report Added REV 5	1 set	Quarterly
Test Technique Analysis Report Added REV 5	1 set	Quarterly

e. **Product Verification**

5.7.1 CPAS Ground Support Equipment (GSE)Test Support Equipment (TSE) (WBS 7.1)

i. Ground and Test Support Equipment

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

ii. Ground and Test Support Equipment Procedures

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

5.7.2 CPAS Technical Studies (WBS 7.2)

i. CPAS Technical Studies

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS

ii. Change Request evaluations Deleted REV 5

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Deleted REV 5

5.7.3 CPAS Reserved (WBS 7.3)

i. No requirements

- No current products and no verifications. Added REV 5

5.7.4 CPAS Analytical Tech Services (WBS 7.4)

i. Parachute Modeling Memo

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

ii. Imagery Analysis Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

iii. Test Technique Analysis Report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native File to DDMS and CPAS SharePoint Site NASA CPAS Added REV 5

5.8 Lightweight Broadcloth Main Parachute Development (WBS 8.0) Updated REV 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall build and test one modified CPAS main parachute. The modification shall be as follows: In place of the lightest weight Nylon in the current CPAS design, the developmental parachute shall utilize a lightweight fabric that meets the performance requirements and verifications specified herein.

The parachute construction shall utilize seams and joints that meet the performance requirements and verifications developed in Phase I. Data generated through test in accordance with the finalized version of JSC-64617 , "Test Plan for Developmental Materials for Parachutes" shall be provided to NASA as proof that the lightweight fabric and the seams and joints meet the necessary performance

requirements.

The contractor shall pack the developmental main parachute in a deployment bag ASNA P/N 749170, Main Parachute Cylindrical Deployment Bag. If any modifications to the deployment bag are necessary to accommodate the lighter weight main parachute, modifications must be simple and within the envelope of Main Parachute Cylindrical Deployment Bag. Modifications shall be documented using redlines to the deployment bag and/or included in packing procedures. Modifications of the deployment bag shall be approved at the CPAS Management IPT prior to manufacture/modification, and the procedure for packing shall be approved by CPAS Management IPT prior to packing. The packing procedure shall be documented and provided.

The drop test of the developmental parachute shall be conducted using existing test techniques and shall be identical to that of a test and conditions using an unmodified main parachute. The test configuration and schedule of the test week shall be approved at the CPAS Management IPT.

Coordination of test operations and support groups, preparation of test articles, installation and rigging of the lightweight parachute system, installation of the instrumentation systems, execution of test, and preparation of post-test data shall take advantage of existing activities described in this SOW, with no unnecessary duplication of effort. Some elements of the modified main parachute shall use available materials of an unmodified main parachute. Preparation of products for the test configuration and test readiness reviews will be limited to only those portions of the typical products that are unique to this developmental parachute.

In summary, the Lightweight Broadcloth Main Parachute Development includes:

Simple modification of main parachute drawing ASNA P/N 726158 to accommodate Lightweight Broadcloth Main Parachute

Parachute build of a Lightweight Broadcloth Main Parachute

Simple modification of Main Parachute Cylindrical Deployment Bag drawing ASNA P/N 749170-1, if necessary to accommodate Lightweight Broadcloth Main Parachute

Lightweight Broadcloth Main Parachute packed in Main Parachute Cylindrical Deployment Bag

Documentation of parachute pack procedure

Drop test of single Lightweight Broadcloth Main Parachute Updated REV 5

5.8.1 Lightweight Broadcloth Main Parachute Build and Pack (WBS 8.1) Updated REV 5
Project Code:

The contractor shall build one Lightweight Broadcloth Main Parachute. The modification shall include replacing the lightest weight Nylon in the canopy of the main parachute with a lightweight fabric that meets the performance requirements and verifications specified below.

Fabric requirements include:

Weight: 0.70-0.90 oz/yd^2.

Permeability: 75 - 120 cfm

Elongation (warp and fill): 20% minimum

Breaking strength (warp and fill): goal: 42 lbs., minimum: 38 ± 10% lbs.

Tear strength (warp and fill): goal: 5 lbs., minimum: 4 lbs.

The fabric requirements shall be verified through test and documented.

The parachute construction shall utilize seams and joints that meet the performance requirements and verifications specified below. Data shall be generated through test in accordance with the finalized version of JSC-64617, "Test Plan for Developmental Materials for Parachutes" and shall be provided to NASA as proof that the lightweight fabric and the seams and joints meet the necessary performance requirements.

Seam and joint requirements include:

Efficiency: 0.80 (prior to exposure to environments)

Salt fog testing

Heat set and pack demonstration of a total of 1 lb. of fabric at:

Temperature: 180 °F

Pack density: 45 pcf

Pack pressure minimum: 450 psi

The efficiency of the seam and joints shall be demonstrated and documented before and after exposure to salt fog testing, and after heat set and pack demonstrations.

The contractor shall modify the main parachute drawing, ASNA P/N 726158, to accommodate the Lightweight Broadcloth Main Parachute. The modified parachute design shall be approved by CPAS management IPT prior to manufacture/modification.

The contractor shall pack the developmental Lightweight Broadcloth Main Parachute in deployment bag ASNA P/N 749170, Main Parachute Cylindrical Deployment Bag. If any modifications to the deployment bag design are necessary to properly deploy the developmental Lightweight Broadcloth Main Parachute, the modified deployment bag design shall be approved by the CPAS Management IPT prior to manufacture/modification and documented in a redlined drawing and/or packing procedure.

The packing procedure shall be documented and provided.

5.8.2 Lightweight Broadcloth Main Parachute Test and Demonstration (WBS 8.2) Updated REV 5
Project Code:

The drop test of the developmental parachute shall be conducted using existing test techniques and shall be identical to that of a test and conditions using an unmodified main parachute. The test configuration and schedule of the test week shall be approved at the CPAS Management IPT.

Coordination of test operations and support groups, preparation of test articles, installation and rigging of the lightweight parachute system, installation of the instrumentation systems, execution of test, and preparation of post-test data shall take advantage of existing activities described in this SOW, with no unnecessary duplication of effort. Some elements of the modified main parachute shall use available materials of an unmodified main parachute. Preparation of products for the test configuration and test readiness reviews will be limited to only those portions of the typical products that are unique to this developmental parachute.

Products to complete the Test Configuration Review and Test Readiness Review shall be provided and approved by the Test/Ops IPT.

b. Applicable Documents

Document Number	Document Name	Rev.
AG-CWI-001 Added Rev 4	JSC Lessons Learned Process	10-02
ASNA P/N 726158 Added Rev 4	Main Parachute Canopy Assy	
ASNA P/N 749170-1 Added Rev 4	Main Parachute Cylindrical Deployment Bag	
JPR 8500.4 Added Rev 4	Engineering Drawing System Manual	Rev. K, 03-2006
JSC 1700.1 Added Rev 4	JSC Safety and Health Handbook	Rev. J, 04-2008
JSC-64221 Added Rev 4	Implementation Plan for the Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS)	Current
JSC-64617 Added Rev 4	Test Plan for Developmental Materials for Parachutes	Current
NPR 8715.3 Added Rev 4	NASA Safety Manual	Change 1 06-02

c. Required DRDs

5.8.1 Lightweight Broadcloth Main Parachute Build and Pack (WBS 8.1)

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 4	Engineering Drawings and Model Files	1

5.8.2 Lightweight Broadcloth Main Parachute Test and Demonstration (WBS 8.2)

DRD #	DRD Title	Quantity/Frequency
107 Added Rev 4	Test Report	1

d. **Products**

5.8.1 Lightweight Broadcloth Main Parachute Build and Pack (WBS 8.1)

Product(s)	Quantity	Delivery Date
Lightweight Broadcloth specification Updated REV 5	1	Per JSC-64221
Lightweight Broadcloth fabric verification test report Updated REV 5	1	Per JSC-64221
Modified drawing of single main parachute Updated REV 5	1	Per JSC-64221
Modified drawing of deployment bag, if modifications necessary Updated REV 5	1	Per JSC-64221
Packing procedure Updated REV 5	1	Per JSC-64221
Deployment bag, packed with Lightweight Broadcloth Main Parachute Updated REV 5	1	Per JSC-64221
Lightweight Broadcloth seam and joint efficiency test report Updated REV 5	1	Per JSC-64221

5.8.2 Lightweight Broadcloth Main Parachute Test and Demonstration (WBS 8.2)

Product(s)	Quantity	Delivery Date
Preparations complete for Test Configuration Review Updated REV 5	1	Per JSC 64221
Preparations complete for Test Readiness Review Updated REV 5	1	Per JSC 64221

e. **Product Verification**

5.8.1 Lightweight Broadcloth Main Parachute Build and Pack (WBS 8.1)

i. Lightweight Broadcloth specification

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

ii. Lightweight Broadcloth fabric verification test report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

iii. Modified drawing of single main parachute

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

iv. Modified drawing of deployment bag, if modifications necessary

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

v. Packing procedure

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

vi. Deployment bag, packed with Lightweight Broadcloth Main Parachute

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

vii. Lightweight Broadcloth seam and joint efficiency test report

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

5.8.2 Lightweight Broadcloth Main Parachute Test and Demonstration (WBS 8.2)

i. Preparations complete for Test Configuration Review

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

ii. Preparations complete for Test Readiness Review

- NASA CPAS Project Manager or Deputy Project Manager Review and Approval and Delivery of Native Files to DDMS and CPAS SharePoint Sight NASA CPAS Updated REV 5

6. Cost Summary and Revision History

DO 286 R5 Summary		ContractYear					
SLC		CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS2							
	Sum of Hrs						
	Sum of Dollars						
BS1							
	Sum of Hrs						
	Sum of Dollars						
BS3							
	Sum of Hrs						
	Sum of Dollars						
EN2							
	Sum of Hrs						
	Sum of Dollars						
EN3							
	Sum of Hrs						
	Sum of Dollars						
EN4							
	Sum of Hrs						
	Sum of Dollars						
ESS							
	Sum of Hrs						
	Sum of Dollars						
MGR							
	Sum of Hrs						
	Sum of Dollars						
PC1							
	Sum of Hrs						
	Sum of Dollars						
PC2							
	Sum of Hrs						
	Sum of Dollars						
PC3							
	Sum of Hrs						
	Sum of Dollars						
SQ1							
	Sum of Hrs						
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SV							
	Sum of Hrs						
	Sum of Dollars						

CM1	
	Sum of Hrs
	Sum of Dollars
EN1	
	Sum of Hrs
	Sum of Dollars
ETS	
	Sum of Hrs
	Sum of Dollars
BS2	
	Sum of Hrs
	Sum of Dollars
QE1	
	Sum of Hrs
	Sum of Dollars
SE	
	Sum of Hrs
	Sum of Dollars
SE3	
	Sum of Hrs
	Sum of Dollars
TN2	
	Sum of Hrs
	Sum of Dollars
CM2	
	Sum of Hrs
	Sum of Dollars
QA2	
	Sum of Hrs
	Sum of Dollars
QE3	
	Sum of Hrs
	Sum of Dollars
QA1	
	Sum of Hrs
	Sum of Dollars
AS1	
	Sum of Hrs
	Sum of Dollars
IT2	
	Sum of Hrs
	Sum of Dollars
IT3	
	Sum of Hrs
	Sum of

Dollars	
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**89,011,022.75**

64

DO 286 revision history	Total cost	Reason for revision
Original	21,842,196	
Revision 1	15,897,190	De-Scoped to reflect changes in out of scope work and realignment of tasks
Revision 2	19,624,784	Adds two new parachute subsystems, fabricates additional test and test delivery vehicles, develops new test avionics and instrumentation, and increases the budget for additional trade studies. This change now implements an Implementation/Execution Plan method to manage the work efficiently in a developmental environment.
Revision 3	75,874,507	Extends period of performance through 1/31/2013 Changes WBS 4.0 from AA-1 to AA-2 Eliminates Auxiliary Chutes Changes WBS 5.7 from Qualification Tests to System Qualification Adds WBS 5.7.14 System Verification Adds capability for concurrent testing Changes WBS 6.0 from PA-2, AA2 and AA3 to PA-2 and AA3 Adds WBS 7.3 Facilities
Revision 4	79,468,039	Adds WBS 8.0 Lightweight Broadcloth Rephase WBS 5.3 Critical Design Adds funds to WBS 5.2 Preliminary Design
Revision 5	89,011,022	Added WBS 5.8 Engineering Development unit (EDU) Tests Deleted the Master Verification Plan from WBS 5.2, 5.3 Added Products to WBS 5.7 System Verification Changed WBS 6.0 title from: "PA2 and AA3 Abort Flight" to: "Flight Changed WBS 6.1 title from: "PA2 and AA3 Abort Flights Requirements" to: "External Test Services" and modified the description Changed WBS 6.2 title from: "PA2 and AA3 Abort Flights Design" to: "FT-1" and modified the description Changed WBS 6.3 title from: "PA2 and AA3 Abort Flights Production" to: "FT-2" and modified the description Changed WBS 6.4 title from: "PA2 and AA3 Abort

		Flights Test" to: "Orion" and modified the description Added WBS 7.4 CPAS Analytical Tech Services Added WBS 5.1.2 Forward Bay Cover Paracute (FBCP) Requirements Development Added WBS 5.2.6 FBCP Engineering Unit Preliminary Design Added WBS 5.3.6 FBCP Critical Design Added WBS 5.4.5 FBCP Engineering Unit Production Added 7.2M to the subcontractors in support of testing and design. Added 2.7M in materials in support of testing

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ08HC60D DO 292 R5

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 5/1/2008 - 09/30/2011

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: **09/30/2010**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**CxTF Engineering Services**					
DO	**292 R5**					
	Est. Labor Costs	64			64	
	Materials/Subcontracts					
	Travel/NLR Misc					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the orders requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$3,979,670.51

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ08HC60D-DO292 REV 5

Originator: Toby Martin (ER5) (281) 244-5133 **TMR:** Jared Woodfill (ER) (281) 483-6331

Revision Summary:
DO period of performance is extended through FY11

1. Title of Effort: CxTF Engineering Services

2. Date of Request: 09/14/2010

3. Statement of Work Task Description

a. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

b. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

c. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 5

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 04/07/2008 and ends 09/30/2011.

5. Product Requirements

5.1 Orion/Ares Engineering Services for Cx Training Facility (CxTF) Updated Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide products and services related to the development, implementation and validation of Orion and Ares models in the CxTF. Updated Rev 3

5.1.1 Orion/Ares Subsystem design data Updated Rev 3

Project Code:

The contractor shall gather, assess and synthesize the subsystem design, milestone (or schedule) and performance data. The contractor shall provide (directly or indirectly) the design, milestone (or schedule) and performance data.

5.1.2 Orion/Ares engineering analyses Updated Rev 3

Project Code:

The contractor shall provide subject matter engineering analyses related to the Orion and Ares systems for developing the CxTF models to assess the model requirements, make recommendations regarding model requirements, and provide detailed information regarding subsystem performance and features.

5.1.3 Orion/Ares software model development Updated Rev 3

Project Code:

The contractor shall design, develop, integrate and test software models related to the Orion and Ares systems and subsystems.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPD 2800.4 Added Rev 3	JSC Information Technology (IT) Program Management	03-01
JPG 2800.3 Added Rev 3	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JSC 26648 Added Rev 3	JSC Automated Information System User?s Security Guide	7-94
NASA-STD-2101-91 Added Rev 3	NASA Software Documentation Standard	7-91
NASA-STD-2201.93 Added Rev 3	Software Assurance Standard	11/92
NASA-STD-2202-93 Added Rev 3	Software Formal Inspections	3/01
NPR 8715.3 Added Rev 3	NASA Safety Manual	Change 1 06-02
ER7 - TM292	CxTF Project Requirements and Schedule	current
JPR 1700.1 Added Rev 3	JSC Safety & Health Handbook	Rev. J, 04-2008
JPR 2810.1 Added Rev 3	JSC Information Technology Security Handbook	Rev. C, 10-2004
NPR 2810.1 Added Rev 3	Security of Information Technology	Rev. A, 05-2006
NT-CWI-001 Added Rev 3	Task Performance Sheet (TPS)	Rev. C, 07-2008
NT-CWI-003 Added Rev 3	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev. C, 11-2006
SSP 50287 Added Rev 3	Hardware/Software Acceptance Process	Rev. A, 01-2007

c. **Required DRDs**

5.1.1 Orion/Ares Subsystem design data

DRD #	DRD Title	Quantity/Frequency
102 Added Rev 3	Engineering Drawings and Model Files	Quarterly
105	Regular Status Report/Summary Review	Monthly on the 15th of each month
218 Updated Rev 3	Engineering Analysis	1 set (completed)
218 Added Rev 3	Engineering Analysis	Quarterly

5.1.2 Orion/Ares engineering analyses

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Monthly on the 15th of each month
218 Added Rev 3	Engineering Analysis	Quarterly

5.1.3 Orion/Ares software model development

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Monthly on the 15th of each month
215 Added Rev 3	Software Code	Quarterly

d. **Products**

5.1.1 Orion/Ares Subsystem design data

Product(s)	Quantity	Delivery Date
Subsystem Technical White Papers	4	Quarterly
Subsystem Technical Presentations	4	Quarterly
White Paper with Systems Contact Information	4	Quarterly
White Paper with Systems Development Schedule	1	Quarterly
White Paper with forward staffing recommendations	1	7/1/10
Assessment Reports	One set	8/30/2008

5.1.2 Orion/Ares engineering analyses

Product(s)	Quantity	Delivery Date
Subsystem Technical White Papers	4	Quarterly
Subsystem Technical Presentations	4	8/30/2008

5.1.3 Orion/Ares software model development

Product(s)	Quantity	Delivery Date
Subsystem Design	4	Quarterly
Software	4	Quarterly
Subsystem Tests Added Rev 3	4	Quarterly
Code Peer Review Added Rev 3	4	Quarterly

e. **Product Verification**

5.1.1 Orion/Ares Subsystem design data

i. Subsystem Technical White Papers

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products

ii. Subsystem Technical Presentations

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products

iii. White Paper with Systems Contact Information

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products

iv. White Paper with Systems Development Schedule

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products

v. White Paper with forward staffing recommendations

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products

vi. Assessment Reports

- AR&SD Simulation and Simulation and Graphics Branch review, witness and acceptance of products

5.1.2 Orion/Ares engineering analyses

i. Subsystem Technical White Papers

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products

ii. Subsystem Technical Presentations

- AR&SD Simulation and Simulation and Graphics Branch review, witness and acceptance of products

5.1.3 Orion/Ares software model development

i. Subsystem Design

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products

ii. Software

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products

iii. Subsystem Tests

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products Added Rev 3

iv. Code Peer Review

- SR&SD Simulation and Graphics Branch review, witness and acceptance of products Added Rev 3

6. Cost Summary and Revision History

DO 292 R5 Summary						
SLC		CY4	CY5	CY6	CY7	**Grand Total**
AS2						
	Sum of Hrs					
	Sum of Dollars					
EN1						
	Sum of Hrs					
	Sum of Dollars					
EN2						
	Sum of Hrs					
	Sum of Dollars					
EN3						
	Sum of Hrs					
	Sum of Dollars					
EN4						
	Sum of Hrs					
	Sum of Dollars					
ESS						
	Sum of Hrs					
	Sum of Dollars					
ETS						
	Sum of Hrs					
	Sum of Dollars					
IT2						
	Sum of Hrs					
	Sum of Dollars					

64

IT3	
Sum of Hrs	
Sum of Dollars	
IT4	
Sum of Hrs	
Sum of Dollars	
PC1	
Sum of Hrs	
Sum of Dollars	
PC2	
Sum of Hrs	
Sum of Dollars	
SC4	
Sum of Hrs	
Sum of Dollars	
SQ4	
Sum of Hrs	
Sum of Dollars	
SV	
Sum of Hrs	
Sum of Dollars	
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**$3,979,670.51**

64

DO Revision History

DO-292 revision history	Total cost	Reason for revision
Original	**3,076,982**	Original CxTF Training Facility
Revision 1	**2,046,998**	Revised requirements to implement a prioritized approach to obtaining and providing the systems data.
Revision 2	**1,584,393**	Revised requirements ER7-TM292 (version 10/1/2008)
Revision 3	**2,339,876**	Revised requirements ER7-TM292 R3 (including addition of Requirements for CxTF Simulation and Modeling development as related to Orion systems and subsystems. Extended period of performance through FY2010.
Revision 4	**2,312,462**	Revised requirements ER7-TM292 R4 (included deletion of requirements for development and maintenance of EDGE graphics tree). Re-phase of labor dollars to material dollars per customer's request.
Revision 5	**$3,979,671**	Extended period of performance through FY2011.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ08HF07D DO 295 R2	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2/ Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 10/01/2008 – 09/30/2012

7. BILLING ADDRESS:
NSSC – FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: Adrian D. Clayton

Signtature: Adrian D. Clayton Date: 04/28/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	EA Transition & Retirement of Shuttle Property					
DO	**295 R2**					
	Est. Labor Costs	64			64	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the orders requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$3,192,769

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ08HF07D-DO295 REVISION 2

Originator: Stephen Lamkin (EA) (281) 483-8264 **TMR:** Stephen Lamkin (EA) (281) 483-8264

Revision Summary:

Reduce the number of Shuttle Program STE demolitions conducted under this DO and extend the period of performance because of Shuttle Program extension.

1. Title of Effort: EA Transition & Retirement of Shuttle Property

2. Date of Request: 01/19/2011

3. Statement of Work Task Description

a. **2.1.2-Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REVISION 2

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2008 and ends 09/30/2012.

5. Product Requirements

5.1 Identification and Assessment of Shuttle Property for Transition & Retirement (T&R) Updated REVISION 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall identify and perform engineering assessments of Shuttle property scheduled for transition and retirement. Assume the following for planning purposes:
Bonded Items and Hardware - 25,000 items
General Purpose Equipment - 5,000 items
Materials - 85,000 items
Special Test Equipment/Facilities - 9 items Updated REVISION 2

5.1.1 Identify and Assess EA Owned Shuttle Property for Disposition Updated REVISION 2

Project Code:

The contractor shall:

a. Identify Government property (including hardware, materials, software, documents, and records) not required for Shuttle missions beyond 2011 that require assessment and disposition for transition and retirement.
b. Perform engineering assessments of the government property, software, documents, and records that is identified for transition & retirement.
c. Prepare recommendations for the dispositioning of government property associated with the SSP. Recommendations should be provided to the technical representative (TR) using a Project Directive Request form.
d. Upon receipt of a Project Directive request approved by the TR, prepare a cost and schedule estimate for contractor efforts associated with dispositioning government Shuttle property.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.1.1 Identify and Assess EA Owned Shuttle Property for Disposition

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Quarterly
105	Regular Status Report/Summary Review	Monthly

d. **Products**

5.1.1 Identify and Assess EA Owned Shuttle Property for Disposition

Product(s)	Quantity	Delivery Date
Completed cost and schedule plans associated with Project Directives	50	Per Project Directive

e. **Product Verification**

5.1.1 Identify and Assess EA Owned Shuttle Property for Disposition

i. Completed cost and schedule plans associated with Project Directives
- Review by NASA Asset Management FAM

5.2 Preparation and Disposition of EA-Owned Shuttle Property

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall prepare and disposition all Shuttle government property (including hardware, materials, software, documents, and records) in accordance with approved Project Directives.

5.2.1 Preparation and Disposition of EA-Owned Shuttle Property

Project Code:

The contractor shall perform all dispositioning tasks authorized by an approved Project Directive, including system dismantling, safing, and excessing of government property.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.2.1 Preparation and Disposition of EA-Owned Shuttle Property

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Monthly

d. **Products**

5.2.1 Preparation and Disposition of EA-Owned Shuttle Property

Product(s)	Quantity	Delivery Date
Complete all tasks associated with dispositioning of property following established and approved procedures	50	As specified in Project Directive
List of Government Property and associated dispositioning (excessed, dismantled, etc.)	50	For each Project Directive

e. **Product Verification**

5.2.1 Preparation and Disposition of EA-Owned Shuttle Property

i. Complete all tasks associated with dispositioning of property following established and approved procedures

- Reviewed by NASA Asset Management FAM

ii. List of Government Property and associated dispositioning (excessed, dismantled, etc.)

- Reviewed by NASA Asset Management FAM

6.0 Cost Summary and Revision History

DO 295 R2 Summary							
SLC		CY4	CY5	CY6	CY7	CY8	**Grand Total**
AS2							
	Sum of Hrs						
	Sum of Dollars						
BS1							
	Sum of Hrs						
	Sum of Dollars						
BS2							
	Sum of Hrs						
	Sum of Dollars						
BS3							
	Sum of Hrs						
	Sum of Dollars						
EN1							
	Sum of Hrs						
	Sum of Dollars						
EN2							
	Sum of Hrs						
	Sum of Dollars						
EN3							
	Sum of Hrs						
	Sum of Dollars						
EN4							
	Sum of Hrs						
	Sum of Dollars						
ESS							
	Sum of Hrs						
	Sum of Dollars						
ET3							
	Sum of Hrs						
	Sum of Dollars						
ETS							
	Sum of Hrs						
	Sum of Dollars						
IT3							
	Sum of Hrs						
	Sum of Dollars						
MGR							
	Sum of Hrs						
	Sum of Dollars						
PC1							
	Sum of Hrs						
	Sum of Dollars						
PC3							
	Sum of Hrs						
	Sum of Dollars						
QA1							
	Sum of Hrs						
	Sum of Dollars						
QA2							

64

	Sum of Hrs
	Sum of Dollars
QE1	
	Sum of Hrs
	Sum of Dollars
QE2	
	Sum of Hrs
	Sum of Dollars
SV	
	Sum of Hrs
	Sum of Dollars
TN2	
	Sum of Hrs
	Sum of Dollars
TN3	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	

64

3,192,769

Revision History	Total Cost	Reason for Revision
Original	**1,488,930**	Original Cost
Rev 1	**4,284,139**	DO Extension
Rev 2	**3,192,769**	DO Extension

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HB41D DO 325 Rev 4

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 02/01/2010 – 01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: **10/13/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ISS Systems Management Products					
DO	**325 Rev. 4**					
	Est. Labor Costs		b4			
	Materials/Subcontracts					
	Travel				b4	
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total
$13,296,682.81

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ10HB41D-DO325 REV 4

Originator: Robin Osborn (Jacobs) (281) 333-6807 **TMR:** Larry Moon (EA) (281) 483-8178

Revision Summary:
This rev adds Section 5.8 for an AES program subtask for FY12.

1. Title of Effort: ISS Systems Management Products

2. Date of Request: 09/07/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

d. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

e. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

f. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 02/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Vehicle Office (OB) System Management Products and Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide hardware and software engineering assessments of DDT&E to verify compliance with Program requirements, and perform sustaining engineering, ie. console monitoring and assessment of performance, trend analysis, failure investigations, etc. for the EA4 Program Engineering Integration Office and NASA Engineering Division Systems listed below, in accordance with RD-EA4-2010-0001/Technical Integration Requirements Document.

5.1.1 System Management Products - Active Thermal Control System (ATCS) Updated Rev 2
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Active Thermal Control System.

5.1.2 System Management Products - Environmental Control and Life Support (ECLS) Updated Rev 2
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Environmental Control and Life Support System.

5.1.3 System Management Products - Flight Crew System (FCS) Updated Rev 2
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Flight Crew System.

5.1.4 System Management Products - Passive Thermal Control System (PTCS) Updated Rev 2
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Passive Thermal Control System.

5.1.5 System Management Products - Structures & Mechanisms (S&M) Updated Rev 2
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Structures and Mechanisms System.

5.1.6 System Management Products - Crew Health Care System (CHeCS) Updated Rev 2
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Crew Health Care System.

5.1.7 System Management Products - Materials & Processes (M&P) (The activities in this section are work stopped as of October 1, 2010.) Updated Rev 2
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Materials and Processes.

b. **Applicable Documents**

Document Number	Document Name	Rev.
RD-EA4-2010-0001	Technical Integration Requirements Document	Rev A, 8/2010

c. **Required DRDs**

5.1.1 System Management Products - Active Thermal Control System (ATCS)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.1.2 System Management Products - Environmental Control and Life Support (ECLS)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.1.3 System Management Products - Flight Crew System (FCS)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.1.4 System Management Products - Passive Thermal Control System (PTCS)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.1.5 System Management Products - Structures & Mechanisms (S&M)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.1.6 System Management Products - Crew Health Care System (CHeCS)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.1.7 System Management Products - Materials & Processes (M&P) (The activities in this section are work stopped as of October 1, 2010.)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

d. **Products**

5.1.1 System Management Products - Active Thermal Control System (ATCS)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly

5.1.2 System Management Products - Environmental Control and Life Support (ECLS)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly

5.1.3 System Management Products - Flight Crew System (FCS)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly
Console Report	1	Daily

5.1.4 System Management Products - Passive Thermal Control System (PTCS)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly

5.1.5 System Management Products - Structures & Mechanisms (S&M)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly

5.1.6 System Management Products - Crew Health Care System (CHeCS)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly
Console Report	1	Daily

5.1.7 System Management Products - Materials & Processes (M&P) (The activities in this section are work stopped as of October 1, 2010.)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly

e. **Product Verification**

5.1.1 System Management Products - Active Thermal Control System (ATCS)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

5.1.2 System Management Products - Environmental Control and Life Support (ECLS)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

5.1.3 System Management Products - Flight Crew System (FCS)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

iii. Console Report

- Technical Integration Office Manager Review and Acceptance

5.1.4 System Management Products - Passive Thermal Control System (PTCS)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

5.1.5 System Management Products - Structures & Mechanisms (S&M)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

5.1.6 System Management Products - Crew Health Care System (CHeCS)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

iii. Console Report

- Technical Integration Office Manager Review and Acceptance

5.1.7 System Management Products - Materials & Processes (M&P) (The activities in this section are work stopped as of October 1, 2010.)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

5.2 Avionics & Software Office (OD) System Management Products Updated Rev 3

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide hardware and software engineering assessments of DDT&E to verify compliance with Program requirements, and perform sustaining engineering, ie. console monitoring and assessment of performance, trend analysis, failure investigations, etc. for the EA4 Program Engineering Integration Office and NASA Engineering Division Systems listed below, in accordance with RD-EA4-2010-0001/Technical Integration Requirements Document. Updated Rev 3

5.2.1 System Management Products - Guidance, Navigation & Control (GN&C) Updated Rev 3
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Guidance, Navigation, and Control System.

5.2.2 System Management Products - Communication & Tracking (C&T) Updated Rev 3
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Communication and Tracking System.

5.2.3 System Management Products - Command & Data Handling (C&DH) Updated Rev 3
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems of the ISS Command and Data Handling System.

This section/requirement is work stopped effective January 31, 2011, through remainder of the contract.

5.2.4 System Management Products - Hardware/Software Integration (HSI) Updated Rev 3
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in the assigned area of Hardware/Software Integration and Testing.

5.2.5 System Management Products ? International Partner (IP) Integration Updated Rev 3
Project Code:

Contractor shall provide engineering assessments and sustaining engineering as defined above in assigned area of International Partner Integration.

b. Applicable Documents

Document Number	Document Name	Rev.
RD-EA4-2010-0001	Technical Integration Requirements Document	Rev A, 8/2010

c. Required DRDs

5.2.1 System Management Products - Guidance, Navigation & Control (GN&C)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.2.2 System Management Products - Communication & Tracking (C&T)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.2.3 System Management Products - Command & Data Handling (C&DH)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.2.4 System Management Products - Hardware/Software Integration (HSI)

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 2	Project Schedule	1 per month
105 Added Rev 2	Regular Status Report/Summary Review	1 per month

5.2.5 System Management Products ? International Partner (IP) Integration

DRD #	DRD Title	Quantity/Frequency
Added Rev 3	No Requirement	

d. Products

5.2.1 System Management Products - Guidance, Navigation & Control (GN&C)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly

5.2.2 System Management Products - Communication & Tracking (C&T)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly

On-Orbit Hardware/Software Status Report	1	Weekly

5.2.3 System Management Products - Command & Data Handling (C&DH)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly
On-Orbit Hardware/Software Status Report	1	Weekly

5.2.4 System Management Products - Hardware/Software Integration (HSI)

Product(s)	Quantity	Delivery Date
HSI Summary of Test Activities and Results Added Rev 2	1	Monthly

5.2.5 System Management Products ? International Partner (IP) Integration

Product(s)	Quantity	Delivery Date
COFR, FRR, SORR Endorsement Summary Added Rev 2	1 per 6 weeks	Every 6 weeks
IRMA Risk Assessment Summary Added Rev 2	1 per 6 weeks	Every 6 weeks
IP SIF Summary Added Rev 2	1 per week	Weekly
Delivery Integration Summary Added Rev 2	1 per week	Weekly

e. **Product Verification**

5.2.1 System Management Products - Guidance, Navigation & Control (GN&C)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

5.2.2 System Management Products - Communication & Tracking (C&T)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

5.2.3 System Management Products - Command & Data Handling (C&DH)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

ii. On-Orbit Hardware/Software Status Report

- Technical Integration Office Manager Review and Acceptance

5.2.4 System Management Products - Hardware/Software Integration (HSI)

i. HSI Summary of Test Activities and Results

- Technical Integration Office Manager Review and Acceptance Added Rev 2

5.2.5 System Management Products ? International Partner (IP) Integration

i. COFR, FRR, SORR Endorsement Summary

- Technical Integration Office Manager Review and Acceptance Added Rev 2

ii. IRMA Risk Assessment Summary

- Technical Integration Office Manager Review and Acceptance Added Rev 2

iii. IP SIF Summary

- Technical Integration Office Manager Review and Acceptance Added Rev 2

iv. Delivery Integration Summary

- Technical Integration Office Manager Review and Acceptance Added Rev 2

5.3 Constellation Program Office (ZA) System Management Products Updated Rev 2

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide hardware and software engineering assessments of DDT&E to verify compliance with Program requirements, and perform sustaining engineering, ie. console monitoring and assessment of performance, trend analysis, failure investigations, etc. for the EA4 Program Engineering Integration Office and NASA Systems listed below, in accordance with RD-EA4-2010-0001/Technical Integration Requirements Document.

This section/requirement is work stopped effective July 31, 2010, through remainder of the contract. Updated Rev 2

5.3.1 System Management Products - Constellation Project (CxP) Updated Rev 2
Project Code:

The contractor shall provide engineering assessments to ensure technical accuracy and verify compliance to Program requirements for Constellation Systems Engineering and Integration as related to: Constellation CRs/DCNs, CSERP packages and products, and make technical judgements of non-decisional materal at appropriate Program level Boards and Panels

b. **Applicable Documents**

Document Number	Document Name	Rev.
RD-EA4-2010-0001	Technical Integration Requirements Document	Current

c. **Required DRDs**

5.3.1 System Management Products - Constellation Project (CxP)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

d. **Products**

5.3.1 System Management Products - Constellation Project (CxP)

Product(s)	Quantity	Delivery Date
CERB IRE DCN Status Report	1	Weekly
CSERP Status Report	1	Weekly
EA Top Risk Summary Report	1	Quarterly

e. **Product Verification**

5.3.1 System Management Products - Constellation Project (CxP)

i. CERB IRE DCN Status Report
- Technical Integration Office Manager Review and Acceptance

ii. CSERP Status Report
- Technical Integration Office Manager Review and Acceptance

iii. EA Top Risk Summary Report
- Technical Integration Office Manager Review and Acceptance

5.4 Space Shuttle Program Office (MA) System Management Products

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide hardware and software engineering assessments of DDT&E to verify compliance with Program requirements, and perform sustaining engineering, ie. console monitoring and assessment of performance, trend analysis, failure investigations, etc. for the EA4 Program Engineering Integration Office and NASA Systems listed below, in accordance with RD-EA4-2010-0001/Technical Integration Requirements Document.

5.4.1 System Management Products - Space Shuttle SE&I (MS) Updated Rev 3
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above for the Flight Test Plan Working Group (FTPWG) as they relate to Shuttle integration which will include the

development of the NSTS 60556, Space Shuttle Flight Test Plan.

This section/requirement is work stopped effective July 31, 2011 through remainder of the contract.

5.4.2 System Management Products - Orbiter Project Office (MV) Updated Rev 3
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above for flight readiness preparation and flight assessment and Shuttle mission activities.

This section/requirement is work stopped effective July 31, 2011 through remainder of the contract.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NSTS 60556	Space Shuttle Flight Test Plan	Current
RD-EA4-2010-0001	Technical Integration Requirements Document	Current

c. **Required DRDs**

5.4.1 System Management Products - Space Shuttle SE&I (MS)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

5.4.2 System Management Products - Orbiter Project Office (MV)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

d. **Products**

5.4.1 System Management Products - Space Shuttle SE&I (MS)

Product(s)	Quantity	Delivery Date
Shuttle Console Report	1	Daily during flights

5.4.2 System Management Products - Orbiter Project Office (MV)

Product(s)	Quantity	Delivery Date
ISS Technical Tag Agenda	1	Weekly

e. **Product Verification**

5.4.1 System Management Products - Space Shuttle SE&I (MS)

i. Shuttle Console Report

- Technical Integration Office Manager Review and Acceptance

5.4.2 System Management Products - Orbiter Project Office (MV)

i. ISS Technical Tag Agenda

- Technical Integration Office Manager Review and Acceptance

5.5 Safety & Mission Assurance Office (NA) System Management Products Updated Rev 3

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineeering assessments of Hazard Analyses and Safety Review Packages as they relate to technical coordination and integration for the EA4 Program Engineering Integration Office and NASA Systems listed below

This section/requirement is work stopped effective March 31, 2011, through remainder of the contract. Updated Rev 3

5.5.1 System Management Products - Safety & Mission Assurance (S&MA) Updated Rev 3

Project Code:

The contractor shall evaluate and deliver statements of EA4 payload safety assessments to aid the PSRP and SRP decision making; track payload safety issues, actions, resolutions, and schedules; develop payload design feature evaluations against payload safety requirements; organize, report, and document payload design safety issues at safety review meetings; track readiness of payload design safety evaluation process and identify analysis scheduling shortfalls.

b. **Applicable Documents**

Document Number	Document Name	Rev.
RD-EA4-2010-0001	Technical Integration Requirements Document	Current

c. **Required DRDs**

5.5.1 System Management Products - Safety & Mission Assurance (S&MA)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

d. **Products**

5.5.1 System Management Products - Safety & Mission Assurance (S&MA)

Product(s)	Quantity	Delivery Date
S&MA Board and Panel Status Report	1	Weekly

e. **Product Verification**

5.5.1 System Management Products - Safety & Mission Assurance (S&MA)

i. S&MA Board and Panel Status Report

- Technical Integration Office Manager Review and Acceptance

5.6 Extravehicular Activity Office (XA) System Management Products

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide hardware and software engineering assessments of DDT&E to verify compliance with Program requirements, and perform sustaining engineering, ie. console monitoring and assessment of performance, trend analysis, failure investigations, etc. for the EA4 Program Engineering Integration Office and NASA Systems listed below, in accordance with RD-EA4-2010-0001/Technical Integration Requirements Document.

5.6.1 System Management Products - Extravehicular Activity (EVA)

Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems as they relate to the EVA Configuration Control Board.

b. **Applicable Documents**

Document Number	Document Name	Rev.
RD-EA4-2010-0001	Technical Integration Requirements Document	Rev A, 8/2010

c. **Required DRDs**

5.6.1 System Management Products - Extravehicular Activity (EVA)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per month
105	Regular Status Report/Summary Review	1 per week

d. **Products**

5.6.1 System Management Products - Extravehicular Activity (EVA)

Product(s)	Quantity	Delivery Date
SORR/FRR Readiness Report	1	Weekly

e. **Product Verification**

5.6.1 System Management Products - Extravehicular Activity (EVA)

i. SORR/FRR Readiness Report

- Technical Integration Office Manager Review and Acceptance

5.7 Office of ISS Chief Engineer (OCE) System Management Products Added Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform engineering assessments and sustaining engineering as defined for flight readiness preparation and flight assessment for the EA4 ISS Office of Chief Engineer and NASA Systems listed below, in accordance with RD-EA4-2010-0001/Technical Integration Requirements Document.

This section/requirement will begin on August 1, 2011 and end on September 30, 2012. Added Rev 3

5.7.1 System Management Products ? Office of Chief Engineer (OCE) Added Rev 3
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as defined above in assigned subsystems as they relate to the ISS Office of Chief Engineer.

b. **Applicable Documents**

Document Number	Document Name	Rev.
RD-EA4-2010-0001 Added Rev 3	Technical Integration Requirements Document	Rev A, 8/2010

c. **Required DRDs**

5.7.1 System Management Products ? Office of Chief Engineer (OCE)

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	1 per month
105 Added Rev 3	Regular Status Report/Summary Review	1 per week

d. **Products**

5.7.1 System Management Products ? Office of Chief Engineer (OCE)

Product(s)	Quantity	Delivery Date
Flight Rule Status Report Added Rev 3	1	weekly
ISS Technical Tag Agenda Added Rev 3	1	weekly

e. **Product Verification**

5.7.1 System Management Products ? Office of Chief Engineer (OCE)
i. Flight Rule Status Report
- Technical Integration Office Manager Review and Acceptance Added Rev 3
ii. ISS Technical Tag Agenda
- Technical Integration Office Manager Review and Acceptance Added Rev 3

5.8 Advanced Exploration Systems (AES) Office System Management Products Added REV 4

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform engineering assessments and sustaining engineering as defined for flight readiness preparation and flight assessment for the Advanced Exploration Systems Office, in accordance with RD-EA4-2010-0001/Technical Integration Requirements Document.

This section/requirement will begin on October 14, 2011 and end on September 30, 2012. Added REV 4

5.8.1 Advanced Exploration Systems Products Added REV 4
Project Code:

The contractor shall provide engineering assessments and sustaining engineering as they relate to the Advanced Exploration Systems Office. These tasks include AES/Advanced Development Logistics Integration, AES and Advanced Development Development Forum meeting documentation and AES OASIS administration.

b. **Applicable Documents**

Document Number	Document Name	Rev.
RD-EA-2010-0001 Added REV 4	Technical Integration Requirements Document	Rev A, 8/2010

c. **Required DRDs**

5.8.1 Advanced Exploration Systems Products

DRD #	DRD Title	Quantity/Frequency
101 Added REV 4	Project Schedule	1 per month
105 Added REV 4	Regular Status Report/Summary Review	1 per week

d. **Products**

5.8.1 Advanced Exploration Systems Products

Product(s)	Quantity	Delivery Date
AES Project Tagup Agendas Added REV 4	1	Weekly
AES/Advanced Development Forum Meeting notes Added REV 4	1	Weekly

e. **Product Verification**

5.8.1 Advanced Exploration Systems Products

i. AES Project Tagup Agendas
- Technical Integration Office Manager Review and Acceptance Added REV 4
ii. AES/Advanced Development Forum Meeting notes
- Technical Integration Office Manager Review and Acceptance Added REV 4

6.0 Cost Summary and Revision History

SLC	Type	CY6	CY7	CY8	G Total
AS2	Sum of Hours				
	Sum of Dollars				
EN1	Sum of Hours				
	Sum of Dollars				
EN2	Sum of Hours				
	Sum of Dollars				
EN3	Sum of Hours				
	Sum of Dollars				
EN4	Sum of Hours				
	Sum of Dollars				
ESS	Sum of Hours				
	Sum of Dollars				
ET1	Sum of Hours				
	Sum of Dollars				
PC1	Sum of Hours				
	Sum of Dollars				
SC2	Sum of Hours				
	Sum of Dollars				
SC3	Sum of Hours				
	Sum of Dollars				
SC4	Sum of Hours				
	Sum of Dollars				
Total Direct Labor Hours					
Total Direct Labor Costs					
Travel Costs					
Subcontract					
NLR Misc					
Materials					
Burden on Non-Labor					
Total Non Labor					
Total Costs					
Fee					
Total					$13,296,682.81

64

DO 425 revision history	Total cost	Reason for revision
Original	13,383,500	Original Release - Conversion of TO34
R1	13,362,321	Temporary work interruption in section 5.3.1
R2	13,685,944	Added sections 5.2.4 and 5.2.5, made reduction in 5.3 permanent, and made other adjustments
R3	13,219,786	Added section 5.7.1 and made adjustments to 5.4.1, 5.4.2, and 5.5.1
R4	13,296,683	Added section 5.8.1.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ09HB41D DO 327 Rev. 3

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 07/10/2009 –01/31/2013

7. BILLING ADDRESS:
NSSC-FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Miyoshi J. Thompson**

Signtature: **Miyoshi J. Thompson** Date: **05/17/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	OCE Engineering Products and Services					
DO	327 Rev 3					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

b4

b4

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total
$1,783,965.47

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ09HB41D-DO327 REV 3

Originator: Robin Osborn (Jacobs) (281) 333-6807 **TMR:** Larry Moon (EA4) (281) 483-8178

Revision Summary:

The significant change is the revision of section 5.1.4 which increases the scope required for the RMT tasks. The adjustment in section 5.3.2 also requires a slight scope increase.

1. FROM Title of Effort: OCE Engineering Services Updated Rev 1

1. Title of Effort: OCE Engineering Products and Services

2. Date of Request: 04/21/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

d. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

e. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

f. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 1

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 06/01/2009 and ends 01/31/2013.

5. Product Requirements

5.1 Project Requirements Traceability Tool

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide a requirements trace tool for Project Management, Systems Engineering and Software Engineering requirements.

5.1.1 Develop a Requirements Traceability Tool (RTT) populated with NASA & JSC requirements Updated REV 3

Project Code:

The NASA Office of Chief Engineer has developed new NASA Procedural Requirements that include requirements for Programs and Project in the areas of Project Management (NPR 7120.5D), Systems Engineering (NPR 7123.1A) and Software Engineering (NPR 7150.2). There is currently not a method for tracing the requirements in these documents to the implementing documents in the EA organization, i.e. Work Instructions.

This effort will populate a requirements traceability tool for use by the Directorate to show compliance with the NASA Office of Chief Engineer NPR's. The populated tool will be used as a pilot for assessment of usability of the tool. Phase 1 prototype activity is complete, but the tool will be enhanced to move the Requirements Trace Project towards EA implementation.

1. The populated tool shall include all requirements from the following NPR's:
    a. NPR 7120.5D, NASA Space Flight Program and Project Management Requirements
    b. NPR 7123.1 A, NASA Systems Engineering Requirements
    c. NPR 7150.2, NASA Software Engineering Requirements
2. The populated tool shall include the applicable JSC Center documentation as part of the flow down of requirements. This includes JPD's and JPR's applicable for Space Flight Programs and Projects.
3. The populated tool shall include the requirements in all EA work instructions using the latest released version in the QMS (Quality Management System).
4. The contractor shall use data previously developed by NASA for the initial implementation of the tool.
    a. NPR 7123.1A to WI-023
    b. NPR 7120.5 D to WI-023
    c. Excel files for a list of requirements in 7123.1 A and 7120.5D.
5. The contractor shall populate the tool with the available data and provide an analysis of the final tool.
    a. The analysis shall identify all NPR requirements, in the three applicable NPRs, that do not trace to work instructions.
    b. The analysis shall discuss the strengths and weakness of the populated tool and identify areas of improvement for use.

5.1.2 Systems Engineering Management Plan Evaluation Services - activities completed as of Revision 3 Updated REV 3

Project Code:

1. The NASA Systems Engineering Working Group is establishing a team to assess the implementation of the Systems Engineering Management Plans (SEMP) across the agency. This effort is being lead by the JSC representative to the Systems Engineering Working Group. JSC will provide the contractor with the draft charter for the SEMP evaluation team. This group meets by telecom bimonthly.
2. The contractor shall collect project SEMPs and load them onto the established secure website.
3. The contractor shall develop an evaluation methodology and a process for collecting the data from the evaluations.
4. The contractor shall perform trend analysis on the data collected according to instructions from the NASA team.

5. The contractor shall deliver charts and presentations necessary to communicate the results of the evaluation to NASA management in the Office of Chief Engineer.

5.1.3 Systems Engineering Training Gap Report Updated REV 3
Project Code:

1. Systems Engineering training is available through APPEL and through the JSC Engineering Academy. There are currently some gaps in the training program
2. The contractor shall review the currently available training and compare it to the SE competency model, provided by JSC, to identify skills areas where there is currently no training available.
3. The contractor shall research and recommend material to fill the appropriate gaps, so that there is a comprehensive Systems Engineering curriculum, to be added to the EA Academy, after NASA approval.
4. The contractor shall present technical data at Net Meetings and provide updates to Defense Acquisition University System Engineering course SYS101, to tailor SYS101 for NASA training use.
5. This section will be maintained for future training activities, particularly as the product is enhanced and semi-automated for requirements input and for finding links/relationships between requirements.

5.1.4 NASA System Engineering Documentation Generation and Updates Updated REV 3
Project Code:

There is a scheduled five-year maintenance update of the NPR that articulates and establishes the requirement on the implementing organization for performing, supporting, and evaluating systems engineering. There is also a scheduled update of the SE Handbook following the NPR update. In addition, other System Engineering documents will be generated during the maturation process for NASA System Engineering. All software engineering activities have been terminated as of revision 1 of this Delivery Order.

This effort will coordinate the consolidation of NPR 7123.1 updates from the various centers and assist in the development and release of NPR 7123.1B and the update of the SE Handbook, Revision 2. - Completed as of Revision 3

1. The contractor shall serve as focal point for inputs to the update of NPR 7123.1. - Completed as of Revision 3
2. The contractor shall serve as focal point for inputs to the update of SP-6105, Rev. 2. - Completed as of Revision 3.
3. The contractor shall provide draft updates to NPR 7123.1B and future revisions for review and approval. - Completed as of Revision 3.
4. The contractor shall provide draft updates to SP-6105, Rev. 2 and future revision for review and approval. - Completed as of Revision 3.
5. Added in Revision 3 - The contractor shall provide updates to the Requirements Traceability Tool (RTT) Concept of Operations (ConOps) document.
6. Added in Revision 3 - The contractor shall provide updates to the RTT SEMP.
7. Added in Revision 3 – The contractor shall add capability to parse MS Word documents into Excel spreadsheets and add pertinent information so that requirements from new documents can be added to CRADLE.
8. Added in Revision 3 – The contractor shall use Microsoft Visual C++ software to experiment and test possible pull-down menus and or forms so a non-Cradle user could initiate Cradle queries to produce gap reports and/or other info. This includes finalizing menus and applications.
9. Added in Revision 3 – The contractor shall add semi-automated software to assist in determining which requirement can be potentially linked/related in the Cradle database.
10. Added in Revision 3 – The contractor shall parse JPR 7120.3 into Cradle and print out reports of possible/suggested links for EA to review and approve.
11. Added in Revision 3 – The contractor shall add three fields (Contract Name, Contract Number and Contract type (flight, non flight, GSE, etc.).
12. Added in Revision 3 – The contractor shall add default fields for categories and already agreed-to ownerships to each database requirement item.
13. Added in Revision 3 – The contractor shall add default fields/values for WI categories until EA catches up.
14. As other System Engineering documentation is identified, the contractor shall assist the OCE in developing these documents.

5.1.5 JSC Standards Program - Completed as of Revision 3 Updated REV 3
Project Code:

The contractor shall develop a database to be used for the JSC Standards Program.

1. The populated tool shall include the standards in JPR 8080.5, JSC Design and Procedural Standards
2. The contractor shall develop the architecture necessary to track the JSC Standards Program

b. **Applicable Documents**

Document Number	Document Name	Rev.
NPR 7150.2	NASA Software Engineering Requirements	Basic 09-04
	SEWG SEMP Evaluation Team Charter	Draft
	System Engineering Competency Model	Draft
EA-WI-023 Added Rev 1	Project Management of GFE Flight Projects	Rev E, Feb. 2006
JPR 8080.5 Added Rev 2	JSC Design and Procedural Standards	Rev. A, 15 March 2005
None Added Rev 1	NASA SEWG Operational Plan FY09-FY14	None
NPR 7120.5 D	NASA Space Flight Program and Project Management Requirements	6 March 2007
NPR 7123.1A	NASA Systems Engineering Processes and Requirements	26 March 2007

c. **Required DRDs**

5.1.1 Develop a Requirements Traceability Tool (RTT) populated with NASA & JSC requirements

DRD #	DRD Title	Quantity/Frequency
101 Updated Rev 1	Project Schedule	1 update/month
105 Updated Rev 1	Regular Status Report/Summary Review	1 update/month

5.1.2 Systems Engineering Management Plan Evaluation Services - activities completed as of Revision 3

DRD #	DRD Title	Quantity/Frequency
101 Updated Rev 1	Project Schedule	1 update/month
105 Updated Rev 1	Regular Status Report/Summary Review	1 update/month

5.1.3 Systems Engineering Training Gap Report

DRD #	DRD Title	Quantity/Frequency
101 Updated Rev 1	Project Schedule	1 update/month
105 Updated Rev 1	Regular Status Report/Summary Review	1 update/month

5.1.4 NASA System Engineering Documentation Generation and Updates

DRD #	DRD Title	Quantity/Frequency
101 Added Rev	Project Schedule	1 update/month

1		
105 Added Rev 1	Regular Status Report/Summary Review	1 update/month

5.1.5 JSC Standards Program - Completed as of Revision 3

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 2	Project Schedule	1 update/month
105 Added Rev 2	Regular Status Report/Summary Review	1 update/month

d. **Products**

5.1.1 Develop a Requirements Traceability Tool (RTT) populated with NASA & JSC requirements

Product(s)	Quantity	Delivery Date
Requirements Tool Populated with required data	1 basic with 1 update	Per the NASA SEWG Operational Plan
Assessment of Requirements Traceability Tool	1	Per the NASA SEWG Operational Plan
Training for NASA Personnel on requirement tool	3 training sessions	Per the NASA SEWG Operational Plan

5.1.2 Systems Engineering Management Plan Evaluation Services - activities completed as of Revision 3

Product(s)	Quantity	Delivery Date
SEMP Evaluation Tracking matrix	1 basic with annual updates	Per the NASA SEWG Operational Plan
SEMP Evaluation Trend Analysis	1 basic with annual updates	Per the NASA SEWG Operational Plan

5.1.3 Systems Engineering Training Gap Report

Product(s)	Quantity	Delivery Date
SE Training Gap Report	1 with 1 updates	Per the NASA SEWG Operational Plan
Content for Training Gaps	1 set with 1 update	Per the NASA SEWG Operational Plan

5.1.4 NASA System Engineering Documentation Generation and Updates

Product(s)	Quantity	Delivery Date
Updates to NPR 7123.1 - completed as of Revision 3. Updated REV 3	2	Per the NASA SEWG Operational Plan
Updates to SP-6105 - completed as of Revision 3. Updated REV 3	2	Per the NASA SEWG Operational Plan
Updates to RTT ConOps document Updated REV 3	2	Per the NASA SEWG Operational Plan
Updates to RTT SEMP Updated REV 3	2	Per the NASA SEWG Operational Plan
Evaluation and testing of commercial parsing software Updated REV 3	1	Per the NASA SEWG Operational Plan
Development of pull-down menus and/or forms for Cradle inquiries Updated REV 3	As required	Per the NASA SEWG Operational Plan
Evaluation of semi-automated software to assist in relating Cradle database requirements Updated REV 3	2	Per the NASA SEWG Operational Plan
Parsing of EA JPR 7120.3 into Cradle Updated REV 3	1	Per the NASA SEWG Operational Plan
Updating of Contract Specific Metadata Updated REV 3	As required	Per the NASA SEWG Operational Plan
Updating of Functional Category and Ownership Capabilities Updated REV 3	2	Per the NASA SEWG Operational Plan
Updating of Work Instruction Added REV 3	As required	Per the NASA SEWG Operational Plan

Updates to other System Engineering documentation Added REV 3	4	Per the NASA SEWG Operational Plan

5.1.5 JSC Standards Program - Completed as of Revision 3

Product(s)	Quantity	Delivery Date
Tool populated with JPR 8080.5 Standards Added Rev 2	1	Per the NASA SEWG Operational Plan
Tool Architecture Added Rev 2	1	Per the NASA SEWG Operational Plan

e. **Product Verification**

5.1.1 Develop a Requirements Traceability Tool (RTT) populated with NASA & JSC requirements

i. Requirements Tool Populated with required data
- Acceptance by NASA TM and NASA TMR

ii. Assessment of Requirements Traceability Tool
- Acceptance by NASA TM and NASA TMR

iii. Training for NASA Personnel on requirement tool
- Acceptance by NASA TM and NASA TMR

5.1.2 Systems Engineering Management Plan Evaluation Services - activities completed as of Revision 3

i. SEMP Evaluation Tracking matrix
- Acceptance by NASA TM and NASA TMR

ii. SEMP Evaluation Trend Analysis
- Acceptance by NASA TM and NASA TMR

5.1.3 Systems Engineering Training Gap Report

i. SE Training Gap Report
- Acceptance by NASA TM and NASA TMR

ii. Content for Training Gaps
- Acceptance by NASA TM and NASA TMR

5.1.4 NASA System Engineering Documentation Generation and Updates

i. Updates to NPR 7123.1 - completed as of Revision 3.
- Acceptance by NASA TM and NASA TMR

ii. Updates to SP-6105 - completed as of Revision 3.
- Acceptance by NASA TM and NASA TMR

iii. Updates to RTT ConOps document
- Acceptance by NASA TM and NASA TMR

iv. Updates to RTT SEMP
- Acceptance by NASA TM and NASA TMR

v. Evaluation and testing of commercial parsing software
- Acceptance by NASA TM and NASA TMR

vi. Development of pull-down menus and/or forms for Cradle inquiries
- Acceptance by NASA TM and NASA TMR

vii. Evaluation of semi-automated software to assist in relating Cradle database requirements
- Acceptance by NASA TM and NASA TMR

viii. Parsing of EA JPR 7120.3 into Cradle
- Acceptance by NASA TM and NASA TMR

ix. Updating of Contract Specific Metadata
- Acceptance by NASA TM and NASA TMR

x. Updating of Functional Category and Ownership Capabilities
- Acceptance by NASA TM and NASA TMR

xi. Updating of Work Instruction
- Acceptance by NASA TM and NASA TMR Added REV 3

xii. Updates to other System Engineering documentation

- Acceptance by NASA TM and NASA TMR Added REV 3

5.1.5 JSC Standards Program - Completed as of Revision 3

i. Tool populated with JPR 8080.5 Standards

- Acceptance by NASA TM and NASA TMR Added Rev 2

ii. Tool Architecture

- Acceptance by NASA TM and NASA TMR Added Rev 2

5.2 JSC SEPG Services Updated Rev 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide the following products.

REQUIREMENTS CONCLUDE 1/31/2010 - NO PRODUCTS OR SERVICES ARE REQUIRED AFTER 1/31/2010. Updated Rev 1

5.2.1 Configuration Management for JSC SEPG Updated Rev 1
Project Code:

The contractor shall implement configuration management for JSC SEPG in accordance with JSC SEPG CM requirements document (current version).

5.2.2 Website Management Updated Rev 1
Project Code:

The Contractor shall manage current JSC SEPG site in accordance with maintenance document (current version).

5.2.3 Website Development Updated Rev 1
Project Code:

The contractor shall design and establish JSC SEPG site in accordance with specifications in website requirements document (current version).

5.2.4 JPR Development for Software Engineering Updated Rev 1
Project Code:

The contractor shall draft a document, to be submitted as JPR, that covers all ground and flight software at JSC, including templates. The completed document should be delivered in native format.

5.2.5 Software Metrics Updated Rev 1
Project Code:

The contractor shall conduct survey of selected projects and recommend figures of merit related to software engineering, quality and design through implementation of NPR 7150.2.

b. **Applicable Documents**

Document Number	Document Name	Rev.
DDMS # 0001040318	DO327 SEPG Master Product List/Schedule	Original, May 2009
JSC SEPG-TBD	JSC SEPG Configuration Management Plan	Current
JSC SEPG-TBD	JSC SEPG Integrated Project Schedule	Current
JSC SEPG-TBD	JSC SEPG Website Development Requirements	Current
JSC SEPG-TBD	JSC SEPG Website Maintenance Document	Current
NPR 7150.2	NASA Software Engineering Requirements	Basic 09-04 and Draft Revision B (Expected Release Date 9-09)

c. **Required DRDs**

5.2.1 Configuration Management for JSC SEPG

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

5.2.2 Website Management

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Per DO327 SEPG Master Product List/Schedule, DDMS # 0001040318

5.2.3 Website Development

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Per DO327 SEPG Master Product List/Schedule, DDMS # 0001040318
105	Regular Status Report/Summary Review	Per DO327 SEPG Master Product List/Schedule, DDMS # 0001040318

5.2.4 JPR Development for Software Engineering

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Per DO327 SEPG Master Product List/Schedule, DDMS # 0001040318
105	Regular Status Report/Summary Review	Per DO327 SEPG Master Product List/Schedule, DDMS # 0001040318

5.2.5 Software Metrics

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Per DO327 SEPG Master Product List/Schedule, DDMS # 0001040318
105	Regular Status Report/Summary Review	Per DO327 SEPG Master Product List/Schedule, DDMS # 0001040318

d. **Products**

5.2.1 Configuration Management for JSC SEPG

Product(s)	Quantity	Delivery Date
Configuration Management for JSC SEPG - Deleted	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318

5.2.2 Website Management

Product(s)	Quantity	Delivery Date
Products detailed in Maintenance Plan	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318

5.2.3 Website Development

Product(s)	Quantity	Delivery Date
Completed Website	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318
User's Guide	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318
Test Report Results	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318

5.2.4 JPR Development for Software Engineering

Product(s)	Quantity	Delivery Date
Document Draft	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318
Final Document	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318

5.2.5 Software Metrics

Product(s)	Quantity	Delivery Date
Report of Survey Results	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318
Report of Recommendations	Per SEPG Master Product List/Schedule, DDMS # 0001040318	Per SEPG Master Product List/Schedule, DDMS # 0001040318

e. **Product Verification**

5.2.1 Configuration Management for JSC SEPG

i. Configuration Management for JSC SEPG - Deleted

- No product

5.2.2 Website Management

i. Products detailed in Maintenance Plan

- Acceptance of updates/changes by JSC SEPG Chair

5.2.3 Website Development

i. Completed Website

- Acceptance of each module and final website configuration by JSC SEPG Chair.

ii. User's Guide

- Acceptance of documentation by JSC SEPG Chair.

iii. Test Report Results

- Acceptance of resolutions by JSC SEPG Chair.

5.2.4 JPR Development for Software Engineering

i. Document Draft

- Acceptance of draft document via review by JSC SEPG.

ii. Final Document

- Acceptance of final document via review by JSC SEPG.

5.2.5 Software Metrics

i. Report of Survey Results

- Review by JSC SEPG and acceptance by JSC SEPG Chair.

ii. Report of Recommendations

- Review by JSC SEPG and acceptance by JSC SEPG Chair.

5.3 Technology Portfolio Process Management Added Rev 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide technology portfolio process management for the JSC Engineering Directorate. Added Rev 1

5.3.1 Technology Strategy and Portfolio Management Updated REV 3
Project Code:

The contractor shall provide technical services for the development of the JSC technology strategy and the management the JSC R&D portfolio. Specifically, this requirement includes:

1. Reviewing, analyzing, developing and/or evaluating decision making tools, methodologies, processes, and procedures as they pertain to current and future research and development projects. Areas to address include technology needs assessment, technology portfolio process management and infusion planning and execution;
2. Perform special studies - analyzing, evaluating, documenting and reporting;
3. Identify risk and develop risk mitigation plans for specific technology developments.

5.3.2 Technical Integration Updated REV 3
Project Code:

The contractor shall provide technology integration to the following working groups:

1. JSC Technology Working Group (JTWG)

- · Provide oversight to the annual technology funded proposal reviews including the NASA Innovation Fund, Innovative Partnership Program, and the Center Investment account.
- · Provide inputs to the RFP criteria for technology development consistent with JSC human spaceflight mission strategy needs

2. **Completed as of Revision 3**- Engineering Directorate Exploration Technology Development Program System Engineering Working Group (EA ETDP SEWG)

- · Provide ongoing Systems engineering for Program/Project integration, including requirements traceability and analysis.

3. **Completed as of Revision 3**- EA Advanced Developments Working Group (EA ADWG)

- Develop and distribute a NASA EA Technology Development Guidebook
  - Guidebook will encompass processes and schedules to successfully propose technology development of projects at the Engineering Directorate level in support of Human Spaceflight Programs managed at JSC.
- Provide oversight to the annual EA technology funded projects including the Independent Research and Development mid-term reviews from 2010 and new request for proposals (RFP) Call for 2011.
  - Provide inputs to the RFP criteria for technology development consistent with JSC human spaceflight mission strategy needs.
  - Coordinate Technical, Cost, Schedule Reviews on a scheduled basis to report back on progress and development of funded projects.
- Coordinate and facilitate the bi-weekly ADWG meetings, maintain and archive meeting minutes.
  - Distribute EA Action Items as directed
- Manage the Technology Development Portfolio annual updates to funded projects for technology development to the Engineering Directorate.
  - Solicit inputs, and updates to comprehensively maintain relevancy and accuracy for the EA Technology Development portfolio4.

4. Conferences and Expositions

- · Attend the International Space Development Conference to maintain awareness of commercial space technology development efforts.
- · Prepare and submit a trip report detailing new developments and potential relationships for NASA and commercial space business cooperation.
- · Attend the AIAA Space Conference to maintain awareness of new initiatives and broad based space technology development efforts.
- · Prepare and submit a trip report detailing new technology development areas with respect to Human Spaceflight identified needs areas.

b. **Applicable Documents**

Document Number	Document Name	Rev.
Added Rev 1	No Requirement	

c. **Required DRDs**

5.3.1 Technology Strategy and Portfolio Management

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	Monthly
105 Added Rev 1	Regular Status Report/Summary Review	Monthly

5.3.2 Technical Integration

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 1	Project Schedule	Monthly
105 Added Rev 1	Regular Status Report/Summary Review	Monthly

d. **Products**

5.3.1 Technology Strategy and Portfolio Management

Product(s)	Quantity	Delivery Date
EA Technology Development Handbook Outline Added Rev 1	1 basic with annual updates	Final basic 6/30/10
EA Technology Development Handbook Release and Updates Added Rev 1	1 basic with annual updates	Final basic 8/31/10

5.3.2 Technical Integration

Product(s)	Quantity	Delivery Date
JSC Technology Development Guidebook Release and Updates Added Rev 1	1 basic with annual updates	Final basic 7/31/10
Completed as of Revision 3 - EA Technology Development Guidebook Release and Updates Updated REV 3	1 basic with annual updates	Final basic 12/31/10
Technology Development Portfolio Release and Updates Added Rev 1	1 basic with annual updates	Final basic 8/31/10
International Space Development Conference Trip Reports Added Rev 1	1/year	Annually November 30
AIAA Space Conference Trip Reports Added Rev 1	1/year	Annually June 30

e. **Product Verification**

5.3.1 Technology Strategy and Portfolio Management

i. EA Technology Development Handbook Outline

- Review and Approval by NASA Project Manager or Designee Added Rev 1

ii. EA Technology Development Handbook Release and Updates

- Review and Approval by NASA Project Manager or Designee Added Rev 1

5.3.2 Technical Integration

i. JSC Technology Development Guidebook Release and Updates

- Review and Approval by NASA Project Manager or Designee Added Rev 1

ii. Completed as of Revision 3 - EA Technology Development Guidebook Release and Updates

- Review and Approval by NASA Project Manager or Designee

iii. Technology Development Portfolio Release and Updates

- Review and Approval by NASA Project Manager or Designee Added Rev 1

iv. International Space Development Conference Trip Reports

- Review and Approval by NASA Project Manager or Designee Added Rev 1

v. AIAA Space Conference Trip Reports

- Review and Approval by NASA Project Manager or Designee Added Rev 1

6.0 Cost Summary and Revision History

ROM C327%R3

SLC	Type	CY5	CY6	CY7	CY8	G Total
EN3	Sum of Hours					
	Sum of Dollars					
EN4	Sum of Hours					
	Sum of Dollars					
ESS	Sum of Hours					
	Sum of Dollars					
IT1	Sum of Hours					
	Sum of Dollars					
IT2	Sum of Hours					
	Sum of Dollars					
MGR	Sum of Hours					
	Sum of Dollars					
PC2	Sum of Hours					
	Sum of Dollars					
SC4	Sum of Hours					
	Sum of Dollars					
SV	Sum of Hours					
	Sum of Dollars					
Total Direct Labor Hours						
Total Direct Labor Costs						
Travel Costs						
Subcontract						
NLR Misc						
Materials						
Burden on Non-Labor						
Total Non Labor						
Total Costs						
Fee						
Total						$1,783,965.47

DO327 revision history	Total cost	Reason for revision
Original	$181,126	Original
Revision 1	$1,536,670	Terminated Section 5.2, added Section 5.3
Revision 2	$1,580,754	Added Section 5.1.4
Revision 3	$1,783,965	Revised Section 5.1.4, Completed Sections 5.1.2 and 5.1.5. Removed EA component of Section 5.3.2

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ09HB44D DO 338 R3

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2009 – 1/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: **08/23/2011**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Engineering Services for Electromagnetic Systems					
DO	338 R3					
	Est. Labor Costs				b4	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				b4	
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However, the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$4,447,504.78

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ09HB44D-DO338 REV 3

Originator: Cordelia Foster (EV) (281) 483-5265 **TMR:** Cordelia Foster (EV) (281) 483-5265

Revision Summary:
Additional software network requirements

1. Title of Effort: Engineering Services for Electromagnetic Systems

2. Date of Request: 04/27/2011

3. Statement of Work Task Description

a. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

b. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

c. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

d. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

e. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 1

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2009 and ends 01/31/2013.

5. Product Requirements

5.1 Test and Analysis Engineering Services Updated Rev 2

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide test and analysis engineering services for electromagnetic and thermal systems. Typical test systems include antenna and RF, optical, and thermal chambers. Analysis includes computational electromagnetic simulation and associated post-processing. Detailed requirements are provided in EV requirements document JSC 64753.

Work in computational electromagnetics has been completed as of R2, October 1, 2010.
Updated Rev 2

5.1.1 Antenna Test Services
Project Code:

Specific tasks are defined in JSC 64753.

5.1.2 Six Degree of Freedom Sensor Testing
Project Code:

Specific tasks are defined in JSC 64753.

5.1.3 CEM Analysis Updated Rev 2
Project Code:

Specific tasks are defined in JSC 64753.

Works has been completed as of R2, October 1, 2010.

5.1.4 Thermal Chamber Maintenance and Operation Added Rev 2
Project Code:

Specific tasks are defined in JSC 64753.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
ANSI/IEEE Std 149-1979	IEEE Std. Test Procedures for Antenna Testing	

c. **Required DRDs**

5.1.1 Antenna Test Services

DRD #	DRD Title	Quantity/Frequency
Deleted Rev 1	No Requirement	
107 Added Rev 1	Test Report	1 per test

5.1.2 Six Degree of Freedom Sensor Testing

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1 per test

5.1.3 CEM Analysis

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

5.1.4 Thermal Chamber Maintenance and Operation

DRD #	DRD Title	Quantity/Frequency

Added Rev 2	No Requirement	

d. **Products**

5.1.1 Antenna Test Services		
Product(s)	**Quantity**	**Delivery Date**
Antenna test data package (includes test procedure with configuration, TRR record, reduced data, and summary)	1 per test, i.a.w. JSC 64753	within 5 days after test completion

5.1.2 Six Degree of Freedom Sensor Testing		
Product(s)	**Quantity**	**Delivery Date**
Test Report	1 per test, i.a.w. JSC 64753	within 5 days of test completion

5.1.3 CEM Analysis		
Product(s)	**Quantity**	**Delivery Date**
Computational Engineering Analysis package (model definition and raw data)	1/simulation, i.a.w. JSC 64753	within 5 days of simulation completion

5.1.4 Thermal Chamber Maintenance and Operation		
Product(s)	**Quantity**	**Delivery Date**
Thermal Test Data Package Added Rev 2	1 per test i.a.w. JSC 64753	within 3 days of test

e. **Product Verification**

5.1.1 Antenna Test Services
i. Antenna test data package (includes test procedure with configuration, TRR record, reduced data, and summary)
- Test Data Package will be reviewed and approved by TMR

5.1.2 Six Degree of Freedom Sensor Testing
i. Test Report
- NASA technical expert will review test report to verify quality and completeness.

5.1.3 CEM Analysis
i. Computational Engineering Analysis package (model definition and raw data)
- NASA technical expert will review analysis package to verify quality and completeness.

5.1.4 Thermal Chamber Maintenance and Operation
i. Thermal Test Data Package
- NASA technical expert will review test data package to verify quality and completeness. Added Rev 2

5.2 CEV RF Services Updated Rev 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services to analyze RF systems for CEV Orion. Typical RF systems include S-band and Ka-band communications, Search-and-rescue communicatins, Emergency voice communications, and GPS. Detailed requirements are provided in EV requirements document JSC 64753.

Works has been completed as of R2 in Ka-band communications, search-and-rescue communications, emergency voice communications, and GPS. October 1, 2010. Updated Rev 2

5.2.1 CEV S-Band Subsystem Engineering Services Updated Rev 2
Project Code:

Task details are contained in JSC 64753.

5.2.2 CEV S-Band RF Engineering Services Updated Rev 2
Project Code:

Task details are contained in JSC 64753.

Works has been completed as of R2, October 1, 2010.

5.2.3 CEV GPS RF Engineering Services Updated Rev 2
Project Code:

Task details are contained in JSC 64753.

Works has been completed as of R2, October 1, 2010.

5.2.4 CEV Search-and-Rescue RF and Antenna Engineering Services Updated Rev 2
Project Code:

Task details are contained in JSC 64753.

Works has been completed as of R2, October 1, 2010.

5.2.5 CEV CEM Analysis Services
Project Code:

Task details are contained in JSC 64753.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.2.1 CEV S-Band Subsystem Engineering Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

5.2.2 CEV S-Band RF Engineering Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

5.2.3 CEV GPS RF Engineering Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

5.2.4 CEV Search-and-Rescue RF and Antenna Engineering Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

5.2.5 CEV CEM Analysis Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

d. **Products**

5.2.1 CEV S-Band Subsystem Engineering Services

Product(s)	Quantity	Delivery Date
Biannual Summary Report	2/year	March 31 and August 31

5.2.2 CEV S-Band RF Engineering Services

Product(s)	Quantity	Delivery Date
Biannual Summary Report	2/year	March 31 and August 30

5.2.3 CEV GPS RF Engineering Services

Product(s)	Quantity	Delivery Date
Biannual Summary Report	2/year	March 31 and August 30

5.2.4 CEV Search-and-Rescue RF and Antenna Engineering Services

Product(s)	Quantity	Delivery Date
Biannual Summary Report	2/year	March 31 and August 30

5.2.5 CEV CEM Analysis Services

Product(s)	Quantity	Delivery Date
Biannual Summary Report	2/year	March 31 and August 31

e. **Product Verification**

5.2.1 CEV S-Band Subsystem Engineering Services

i. Biannual Summary Report

- NASA subsystem manager or project engineer will review Summary Report.

5.2.2 CEV S-Band RF Engineering Services

i. Biannual Summary Report

- NASA subsystem manager or project engineer will review Summary Report.

5.2.3 CEV GPS RF Engineering Services

i. Biannual Summary Report

- NASA subsystem manager or project engineer will review Summary Report.

5.2.4 CEV Search-and-Rescue RF and Antenna Engineering Services

i. Biannual Summary Report

- NASA subsystem manager or project engineer will review Summary Report.

5.2.5 CEV CEM Analysis Services

i. Biannual Summary Report

- NASA subsystem manager or project engineer will review Summary Report.

5.3 Wireless Systems, Standards, and Technology Updated REV 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services to analyze wireless systems, standards, and technologies. Typical content includes study and recommendation of wireless standards for space and ground operations. Engineering services shall also include provisions for the development and maintenance of network protocols, software applications and the test bec presentations of these applications and technologies. Detailed requirements are provided in JSC 64753.

Work in UWB Tracking and Communications and Lunar Wireless Systems Technologies has been completed as of R2, October 1, 2010. Updated REV 3

5.3.1 UWB Tracking and Communications Technology Updated REV 3
Project Code:

Specific task requirements are stated in JSC 64753.

Works has been completed as of R2, October 1, 2010.

5.3.2 Engineering Services in Wireless Sensor Networks Updated REV 3
Project Code:

Specific task requirements are stated in JSC 64753.

5.3.3 Network Technology Services Updated REV 3
Project Code:

The contractor shall apply wireless and network engineering in the design, services, and implementation of multiple project areas. Technology areas shall include at a minimum Radio Frequency Identification and Detection (RFID), JSC Wireless Analog System (JAWS), and Delay / Disruption Tolorant Network (DTN). They shall demonstrate, modify and maintain the existing wireless test beds, and implement experimental network for Intra-Agency communications.

5.3.4 Lunar Wireless Systems Technology Services Updated REV 3
Project Code:

Specific task requirements are stated in JSC 64753.

Works has been completed as of R2, October 1, 2010.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.3.1 UWB Tracking and Communications Technology

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

5.3.2 Engineering Services in Wireless Sensor Networks

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

5.3.3 Network Technology Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

5.3.4 Lunar Wireless Systems Technology Services		
DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	2/year

d. **Products**

5.3.1 UWB Tracking and Communications Technology		
Product(s)	Quantity	Delivery Date
Summary Review	2/year	March 31 and Aug. 30

5.3.2 Engineering Services in Wireless Sensor Networks		
Product(s)	Quantity	Delivery Date
Summary Review	2/year	March 31 and Aug. 31

5.3.3 Network Technology Services		
Product(s)	Quantity	Delivery Date
Summary Review	2/year	March 31 and Aug. 31

5.3.4 Lunar Wireless Systems Technology Services		
Product(s)	Quantity	Delivery Date
Summary Review	2/year	March 31 and Aug. 30

e. **Product Verification**

5.3.1 UWB Tracking and Communications Technology
i. Summary Review
- NASA technical experts will review summary report.

5.3.2 Engineering Services in Wireless Sensor Networks
i. Summary Review
- NASA technical experts will review summary report.

5.3.3 Network Technology Services
i. Summary Review
- NASA technical experts will review summary report.

5.3.4 Lunar Wireless Systems Technology Services
i. Summary Review
- NASA technical experts will review summary report.

5.4 Project Management Reports Updated Rev 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide project management reporting on the work contained herein, and that work specified in the JSC 64753, "Engineering Services and Products in Support of Electromagnetic Systems". Updated Rev 1

5.4.1 Project Management Reporting of Cost and Schedule Updated REV 3

Project Code:

The Contractor shall prepare, provide, and present a technical, cost, and schedule report (TCSR) on a monthly basis. Cost and schedule reporting shall be provided within 5 days of the delivery of the 533, and should address each product area identified in JSC 64753 and herein, including:

Operation of J14/J18 Antenna Test Facilities

Six Degree of Freedom Sensor Test Facility

Maintenance and Operation of the J14 Thermal Chamber

CEV S-Band Subsystem Services

CEV CEM Analysis Services

Engineering Services inWireless Sensor Network Systems

Network Technology Engineering Services

Computational Electromagnetics Facility Capability

Computational Electromagnetics Engineering Analysis Services

Microwave Technology Development

Engineering Services in Microwave Technology

The Contractor shall provide "sub-reports" within 5 days after delivery of the 533.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	
JSC 64753	Electromagnetics Systems Branch Engineering Services and Product Support	Basic

c. **Required DRDs**

5.4.1 Project Management Reporting of Cost and Schedule		
DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/month
105	Regular Status Report/Summary Review	1/month

d. **Products**

5.4.1 Project Management Reporting of Cost and Schedule		
Product(s)	Quantity	Delivery Date
TCSR Report	1/month	within 5 days of 533 delivery

e. **Product Verification**

5.4.1 Project Management Reporting of Cost and Schedule
i. TCSR Report
- NASA technical monitor will review the TCSR for quality and accuracy

5.5 Computational Electromagnetics Engineering Services and Capability Added Rev 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall In compliance with the above identified SOW(s) the contractor shall provide Computational Electromagnetics (CEM) analysis engineering services for various projects and programs. Such services comprise maintenance and upgrade of the CEM facility capability and maintenance and upgrade of the CEM analytical tools. Detailed requirements are provided in EV requirements document JSC 64753.

Added Rev 2

5.5.1 Computational Electromagnetics Facility Capability Added Rev 2
Project Code:

Detailed requirements are provided in EV requirements document JSC 64753.

5.5.2 Computational Electromagnetics Engineering Analysis Services Added Rev 2
Project Code:

Detailed requirements are provided in EV requirements document JSC 64753.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1 Added Rev 2	JSC Safety & Health Handbook	Rev I 07-02

c. **Required DRDs**

5.5.1 Computational Electromagnetics Facility Capability		
DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

5.5.2 Computational Electromagnetics Engineering Analysis Services		
DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

d. **Products**

5.5.1 Computational Electromagnetics Facility Capability		
Product(s)	Quantity	Delivery Date
Biannual Summary Report Added Rev 2	2/yr i.a.w. JSC 64753	Mar. 31 and Aug. 31 each yr.

5.5.2 Computational Electromagnetics Engineering Analysis Services		
Product(s)	Quantity	Delivery Date
Computational Engineering Analysis package (model definition and raw data) Added Rev 2	1/simulation, i.a.w. JSC 64753	within 5 days of simulation completion

e. **Product Verification**

5.5.1 Computational Electromagnetics Facility Capability
i. Biannual Summary Report
- NASA technical expert will review summary report to verify quality and completeness. Added Rev 2

5.5.2 Computational Electromagnetics Engineering Analysis Services
i. Computational Engineering Analysis package (model definition and raw data)
- NASA technical expert will review analysis package to verify quality and completeness. Added Rev 2

5.6 Advanced Microwave Technology Development Added Rev 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services to design, develop, and test advanced microwave technologies in accordance with JSC 64753. Added Rev 2

5.6.1 Design, Development, and Testing of Microwave Technologies Updated REV 3
Project Code: Specific tasks are defined in JSC 64753.

Provide design, development, and testing of advanced microwave technologies as defined in JSC 64753.

5.6.2 Engineering Services in Microwave Technology Updated REV 3
Project Code: Specific tasks are defined in JSC 64753.

Provide engineering services in advanced microwave technology development as defined in JSC 64753.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1 Added Rev 2	JSC Safety & Health Handbook	Rev I 07-02

c. **Required DRDs**

5.6.1 Design, Development, and Testing of Microwave Technologies		
DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

5.6.2 Engineering Services in Microwave Technology		
DRD #	DRD Title	Quantity/Frequency
Added Rev 2	No Requirement	

d. **Products**

5.6.1 Design, Development, and Testing of Microwave Technologies		
Product(s)	Quantity	Delivery Date
Biannual summary report Added Rev 2	2/yr i.a.w. JSC 64753	Aug. 31 and Feb. 28 of ea. yr

5.6.2 Engineering Services in Microwave Technology		
Product(s)	Quantity	Delivery Date
Biannual summary report Added Rev 2	2/yr i.a.w. JSC 64753	Aug. 31 and Feb. 28 ea. yr.

e. **Product Verification**

5.6.1 Design, Development, and Testing of Microwave Technologies
i. Biannual summary report
- NASA technical expert will review summary reports. Added Rev 2

5.6.2 Engineering Services in Microwave Technology
i. Biannual summary report
- NASA technical expert will review summary reports. Added Rev 2

6.0 Cost Summary and Revision History

SLC	Type	CY5	CY6	CY7	CY8	G Total
AS1	Sum of Hours					
	Sum of Dollars					
AS2	Sum of Hours					
	Sum of Dollars					
BS1	Sum of Hours					
	Sum of Dollars					
EN1	Sum of Hours					
	Sum of Dollars					
EN2	Sum of Hours					
	Sum of Dollars					
EN3	Sum of Hours					
	Sum of Dollars					
EN4	Sum of Hours					
	Sum of Dollars					
ESS	Sum of Hours					
	Sum of Dollars					
ET1	Sum of Hours					
	Sum of Dollars					
ETS	Sum of Hours					
	Sum of Dollars					
IT2	Sum of Hours					
	Sum of Dollars					
IT3	Sum of Hours					
	Sum of Dollars					
IT4	Sum of Hours					
	Sum of Dollars					
MGR	Sum of Hours					
	Sum of Dollars					
PC1	Sum of Hours					
	Sum of Dollars					
PC2	Sum of Hours					
	Sum of Dollars					
QA1	Sum of Hours					
	Sum of Dollars					
QA2	Sum of Hours					
	Sum of Dollars					
QE1	Sum of Hours					
	Sum of Dollars					
QE4	Sum of Hours					
	Sum of Dollars					
TN3	Sum of Hours					
	Sum of Dollars					
Total Direct Labor Hours						
Total Direct Labor Costs						
Travel Costs						
Subcontract						
NLR Misc						
Materials						
Burden on Non-Labor						
Total Non Labor						
Total Costs						
Fee						
Total						$4,447,504.78

DO 338 revision history	Total cost	Reason for revision
Original	$415,806	Work Transition from DO192
Revision 1	3,951,417	Extension of ESCG contract to January 2013
Revision 2	4,013,319	Reorganize existing work and add CEM Facility Capability and Advanced Microwave Technology Development.
Revision 3	$4,447,505	Adds additional IT personnel to Wireless Systems Standards and Technology.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ09HB39D DO 347 Rev.2

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / William Myers
Tel. No.: (281) 483-4108 FAX: (281) 483-7890
E-Mail: william.t.myers@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 05/15/2009 – 01/31/2013

7. BILLING ADDRESS:
NSSC –FMD Accounts Payable
Building 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name:

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: **07/20/2010**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Eng. High-availability Web Architecture Installation Completion					
DO	347 Rev. 2					
	Est. Labor Costs				b4	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				b4	
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total
$ 309,753

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

JSC Form 1429 (Rev November 10, 2004) (MSword August 1995)

Engineering and Science Contract

NNJ09HB39D-DO347 REV. 2

Originator: Richard Weller (EA2) (281) 483-7666 **TMR:** Stephen Lamkin (EA) (281) 483-8264

Revision Summary:
Update to include new work for evaluation and implementation of Project Server 2010

1. Title of Effort: Engineering High-availability Web Architecture Installation Completion

2. Date of Request: 06/25/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.1.4 Website Development**
The contractor shall design, develop, modify, test and install Websites. The contractor shall provide configuration documentation and training on new and modified websites.

e. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

f. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated Rev 1

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 05/01/2009 and ends 01/31/2013.

5. Product Requirements

5.1 EHWA Blade Server Installation

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall complete the installation, configuration, testing, and documentation of all components and interfaces identified in Delivery Order 243 per NASA-provided EHWA Configuration documentation.

5.1.1 Hardware & software installation Updated Rev 1
Project Code:

The contractor shall install two F5 Big-IP 8800 Load Balancers (configured to support SSL encryption), sixteen HP Blade Servers, Microsoft Windows Server 2003 operating systems, Microsoft SQL Server 2005 Enterprise (in two active/passive clusters), Microsoft Internet Information Server (IIS) 6.0, Microsoft Office SharePoint Server 2007, Microsoft Project Server 2007, Microsoft .Net 3.5, Coldfusion 8 Enterprise (in a clustered pair), VMWare virtualization software, and all Agency-, Center-, and Directorate-required server software including Patchlink, ConfigureSoft, and Netbackup. Powerpath and HP Altiris software shall be installed and connectivity shall be established with the IRD Storage Area Network, the HP Rapid Deployment Pack (per WBS 5.6), and all required supporting services including the institutional Active Directory, Domain Name Service, Exchange servers, and backup services. In accordance with the other requirements of this Delivery Order, these components shall be installed with the most recent version and patches available, with post-installation updates being required by WBS 5.7 below, per NASA design configuration documents.

Note: Due to technical difficulties beyond contractor's control, contractor cannot meet connectivity requirements for the HP Rapid Deployment Pack. Therefore, the connectivity requirement for the HP Rapid Deployment Pack is deleted this revision.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NPR 2810.1	Security of Information Technology	08-99
(none)	Engineering High-Availability Web Architecture Design Configuration	2/13/2009
DDMS# 0001037378	Master Product Schedule	Current
SPEA0001	IT Security Plan, EA IT Infrastructure	9/2007

c. **Required DRDs**

5.1.1 Hardware & software installation

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/mo
105	Regular Status Report/Summary Review	1/mo
218 Added Rev 1	Engineering Analysis	1

d. **Products**

5.1.1 Hardware & software installation

Product(s)	Quantity	Delivery Date
System Test Plans & Results	1	Per Master Products Schedule, DDMS #0001037378
Application Security Architecture	1	Per Master Products Schedule, DDMS #0001037378
As-Configured Design Information (w/Data Storage Specification)	1	Per Master Products Schedule, DDMS #0001037378
Acceptance & Closeout Review Presentation	1	Per Master Products Schedule, DDMS #0001037378 or 45 days after final DO approval
Training Program Plan update	1	Per Master Products Schedule, DDMS #0001037378
Security Plan Modifications	1	Per Master Products Schedule, DDMS #0001037378
System Backup, Recovery, & Rebuild Plan	1	Per Master Products Schedule, DDMS #0001037378

e. **Product Verification**

5.1.1 Hardware & software installation

i. System Test Plans & Results

- Product review and acceptance by NASA Project Manager

ii. Application Security Architecture

- Product review and acceptance by NASA Project Manager

iii. As-Configured Design Information (w/Data Storage Specification)

- Product review and acceptance by NASA Project Manager

iv. Acceptance & Closeout Review Presentation

- Acceptance of Development-Ready System by NASA Project Manager

v. Training Program Plan update

- Product review and acceptance by NASA Project Manager

vi. Security Plan Modifications

- Product review and acceptance by NASA Project Manager & EA OCSO

vii. System Backup, Recovery, & Rebuild Plan

- Product review and acceptance by NASA Project Manager

5.2 Custom Applications Services

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall , following completion of the prerequisite elements of WBS 5.1, provide installation and configuration of all custom applications servers and associated software.

5.2.1 Custom Applications Services

Project Code:

This includes installation of IIS 6.0, ColdFusion Server 8, and .NET versions 2.0, 3.0, and 3.5 on the development, staging, and production servers identified in NASA configuration documents. These services shall be configured in clustered server pairs to provide load balancing and seamless client session continuity plus database connectivity and load balancer interaction (the latter for Domain Name Service and Secure Sockets Layer (encryption) purposes). Development platforms shall be completed prior to staging platforms and production platforms.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NPR 2810.1	Security of Information Technology	08-99
(none)	Engineering High-Availability Web Architecture Design Configuration	2/13/2009
DDMS# 0001037378	Master Product Schedule	Current
SPEA0001	IT Security Plan, EA IT Infrastructure	9/2007

c. **Required DRDs**

5.2.1 Custom Applications Services

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/mo
105	Regular Status Report/Summary Review	1/mo
218 Added Rev 1	Engineering Analysis	1

d. **Products**

5.2.1 Custom Applications Services

Product(s)	Quantity	Delivery Date
As-Configured Design Information	1	Per Master Products Schedule, DDMS #0001037378
Acceptance & Closeout Review Presentation	1	Per Master Products Schedule, DDMS #0001037378 or 30 days after final DO approval, or as reflected in Master Products Schedule

e. **Product Verification**

5.2.1 Custom Applications Services

i. As-Configured Design Information

- Product review and acceptance by NASA Project Manager

ii. Acceptance & Closeout Review Presentation

- Authority to Operate by NASA Project Manager

5.3 Oasis SharePoint Configuration, Backup, & Migration

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall analyze the implemented design of Microsoft Office SharePoint Server for Engineering Oasis and develop recommendations for optimization, data backup, and data migration.

5.3.1 Oasis SharePoint Configuration, Backup, & Migration
Project Code:

This analysis shall include server role assignments (such as content indexing, query services, and Excel services), plus SharePoint-specific backup and restoration plans. In addition, the contractor shall determine what options exist for migration of sites, content, and security from the NASA Data Center instance of SharePoint Portal Server 2003 to the EHWA SharePoint Server 2007, with a recommendation, supporting rationale, and step-by-step procedure for the preferred method.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NPR 2810.1	Security of Information Technology	08-99
(none)	Engineering High-Availability Web Architecture Design Configuration	2/13/2009
DDMS# 0001037378	Master Product Schedule	Current
SPEA0001	IT Security Plan, EA IT Infrastructure	9/2007

c. **Required DRDs**

5.3.1 Oasis SharePoint Configuration, Backup, & Migration

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/mo
105	Regular Status Report/Summary Review	1/mo
218 Added Rev 1	Engineering Analysis	1

d. **Products**

5.3.1 Oasis SharePoint Configuration, Backup, & Migration

Product(s)	Quantity	Delivery Date
SharePoint Migration Procedure	1	Per Master Products Schedule, DDMS #0001037378
Oasis Backup & Recovery Plan	1	Per Master Products Schedule, DDMS #0001037378
As-Configured Design Information	1	Per Master Products Schedule, DDMS #0001037378
Oasis Configuration Recommendations	1	Per Master Products Schedule, DDMS #0001037378
Acceptance & Closeout Review Presentation	1	Per Master Products Schedule, DDMS #0001037378 or 60 days after Acceptance of EHWA Requirements Document

e. **Product Verification**

5.3.1 Oasis SharePoint Configuration, Backup, & Migration

i. SharePoint Migration Procedure
- Product review and acceptance by NASA Project Manager

ii. Oasis Backup & Recovery Plan
- Product review and acceptance by NASA Project Manager

iii. As-Configured Design Information
- Product review and acceptance by NASA Project Manager

iv. Oasis Configuration Recommendations
- Product review and acceptance by NASA Project Manager

v. Acceptance & Closeout Review Presentation
- Product review and acceptance by NASA Project Manager

5.4 Architectural Design Analysis

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform a detailed technical, multi-disciplinary, top-to-bottom analysis of the current configuration of all components of the Engineering High-availability Web Architecture (EHWA) and provide feasible recommendations to optimize the design within existing (or marginally expanded) hardware and software assets and to improve management of known failure modes.

5.4.1 Architectural Design Analysis

Project Code:

In particular, this study shall investigate existing design and capabilities and provide assumptions and recommendations for improvement in these technical areas: network configuration (cables, switches, load balancers, external interfaces (SAN), etc.), power (conversion, phasing, isolation, etc.), physical environment (safety hazards, cooling, monitoring, auto-safing, etc.), continuity (after each possible failure mode), system administration support (expertise and number of personnel), current and expected future load capacity (including load testing methods), and system security (internal firewalls, encryption method and level, physical protection, etc.). These analyses shall assume primary service delivery to the JSC Engineering community of 3500 people, access by the entire NASA population, availability of operational services during 99.99% of business hours (8a-5p M-F), and a maximum server replacement/recovery time of two hours. The analyses shall specifically address the identification of any single-point failures (and their judged likelihood) that would result in any user service interruption or significant performance degradation, analysis of user session continuity in clustered-server services, and preferred monitoring and reconfiguration techniques to detect and respond to these failures. These operating assumptions shall be captured in a basic system requirements document.
Finally, using corporate experience gained in ESCG configuration management efforts, the contractor shall provide a draft Configuration Management Plan for NASA adoption, which details a recommended process for configuration control of the EHWA, identifies each type of change that warrants configuration control, and classifies each type of configuration change as to its appropriate approval authority (change board, project manager, system administrator, customer user, etc.). Aside from these requirements and general recommendations on best practices, detailed work instructions, change procedures, and/or construction of an electronic change request system are not required.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NPR 2810.1	Security of Information Technology	08-99
(none)	Engineering High-Availability Web Architecture Design Configuration	2/13/2009
DDMS# 0001037378	Master Product Schedule	Current
SPEA0001	IT Security Plan, EA IT Infrastructure	9/2007

c. **Required DRDs**

5.4.1 Architectural Design Analysis

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/mo
105	Regular Status Report/Summary Review	1/mo
218 Added Rev 1	Engineering Analysis	1

d. **Products**

5.4.1 Architectural Design Analysis

Product(s)	Quantity	Delivery Date
EHWA Requirements (1st Phase)	1	Per Master Products Schedule, DDMS #0001037378 or 30 days after final DO approval, or as reflected in Master Products Schedule
Draft Configuration Management Plan	1	Per Master Products Schedule, DDMS #0001037378
Design Analysis Recommendations	1	Per Master Products Schedule, DDMS #0001037378
Acceptance & Closeout Review Presentation	1	Per Master Products Schedule, DDMS #0001037378 or 60 days after Acceptance of EHWA Requirements Document
EHWA Requirements Update (2nd Phase)	1	Per Master Products Schedule, DDMS #0001037378

e. **Product Verification**

5.4.1 Architectural Design Analysis

i. EHWA Requirements (1st Phase)
- Product review and acceptance by NASA Project Manager
ii. Draft Configuration Management Plan
- Product review and acceptance by NASA Project Manager
iii. Design Analysis Recommendations
- Product review and acceptance by NASA Project Manager
iv. Acceptance & Closeout Review Presentation
- Product review and acceptance by NASA Project Manager
v. EHWA Requirements Update (2nd Phase)
- Product review and acceptance by NASA Project Manager

5.5 Active Directory Migration

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall perform all reconfiguration actions required in order to restore the EHWA to fully operational status after the EHWA resources are migrated by NASA to the NASA Data Center Windows domain.

5.5.1 Active Directory Migration Support
Project Code:

Specifically, the contractor shall (1) research the full impact of the migration of the EHWA resources to the NDC Windows domain, (2) rebuild the SQL Server and custom applications server clusters if necessary as determined in (1), and (3) reconfigure all EHWA components to use new NDC-required service and administrative accounts, passwords, and security groups.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NPR 2810.1	Security of Information Technology	08-99
(none)	Engineering High-Availability Web Architecture Design Configuration	2/13/2009
DDMS# 0001037378	Master Product Schedule	Current
SPEA0001	IT Security Plan, EA IT Infrastructure	9/2007

c. **Required DRDs**

5.5.1 Active Directory Migration Support

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/mo
105	Regular Status Report/Summary Review	1/mo

d. **Products**

5.5.1 Active Directory Migration Support

Product(s)	Quantity	Delivery Date
Acceptance & Closeout Review	1	Per Master Products Schedule, DDMS #0001037378 or 30 Days after Completion of Migration

e. **Product Verification**

5.5.1 Active Directory Migration Support

i. Acceptance & Closeout Review
- Product review and acceptance by NASA Project Manager

5.6 Rapid Deployment Pack Services

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall develop and implement capabilities of the Hewlett Packard Rapid Deployment Pack (RDP).

5.6.1 Rapid Deployment Pack Services Updated Rev 1
Project Code:

The contractor shall enable & demonstrate rapid deployment of an image of any failed EHWA production server, including recovery of all operating system services, middleware (ColdFusion & .NET) services, and application software services (SharePoint, Project Server, SQL Server), plus reconstruction of SQL Server, .NET, and ColdFusion server clusters and restoration of normal connectivity with interfaces including the F5 load balancers, the IRD Storage Area Network, and the JSC institutional Exchange servers, Domain Name Service, and Active Directory. An RDP Operations Plan shall be provided to detail the desired operating strategy for use by maintenance personnel, including frequency of server imaging, image storage location, deployment technique, etc.

This task is deleted with approval of revision 1.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NPR 2810.1	Security of Information Technology	08-99
(none)	Engineering High-Availability Web Architecture Design Configuration	2/13/2009
DDMS# 0001037378	Master Product Schedule	Current
SPEA0001	IT Security Plan, EA IT Infrastructure	9/2007

c. **Required DRDs**

5.6.1 Rapid Deployment Pack Services

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/mo
105	Regular Status Report/Summary Review	1/mo

d. **Products**

5.6.1 Rapid Deployment Pack Services

Product(s)	Quantity	Delivery Date
RDP Test Plan & Results	1	Per Master Products Schedule, DDMS #0001037378
Acceptance & Closeout Review	1	Per Master Products Schedule, DDMS #0001037378 or 60 days after Acceptance of EHWA Requirements Document
RDP Operations Plan	1	Per Master Products Schedule, DDMS #0001037378

e. **Product Verification**

5.6.1 Rapid Deployment Pack Services

i. RDP Test Plan & Results
- Product review and acceptance by NASA Project Manager

ii. Acceptance & Closeout Review
- Product review and acceptance by NASA Project Manager

iii. RDP Operations Plan
- Product review and acceptance by NASA Project Manager

5.7 Interim Maintenance

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide routine maintenance of all items covered in WBS 5.1.

5.7.1 Interim Maintenance
Project Code:

The contractor shall maintain awareness of and implement all security patches to eliminate vulnerabilities as new fixes become available from the vendors. After review with and direction by the NASA Project Manager, installation of feature patches and hot fixes will also be required, in an effort to keep the EHWA as current as is safe and practical. Routine security monitoring and vulnerability scanning of the relevant systems are also required.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
(none)	Engineering High-Availability Web Architecture Configuration	2/13/2009
DDMS# 0001037378	Master Product Schedule	Current
SPEA0001	IT Security Plan, EA IT Infrastructure	9/2007

c. **Required DRDs**

5.7.1 Interim Maintenance

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/mo

d. **Products**

5.7.1 Interim Maintenance

Product(s)	Quantity	Delivery Date
EHWA Monthly Maintenance Report	9	Per Master Product Schedule, DDMS# 0001037378

e. **Product Verification**

5.7.1 Interim Maintenance

i. EHWA Monthly Maintenance Report

- Product review and acceptance by NASA Project Manager.

5.8 Evaluate and Implement Project Server 2010 Added REV. 2

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall Evaluate the capabilities of Project Server (PS) 2010 and identify, analyze, and recommend changes to EA's current PS 2007 implementation. Upon approval to proceed, implement PS 2010 (including migration/verification of existing data and customization) per approved requirements and implementation plan and update existing products (e.g., "as built" documentation, training plan). Added REV. 2

5.8.1 Evaluate Project Server 2010 Added REV. 2
Project Code:

Requirements include: installation of PS 2010 in virtual machines created by Engineering High-availability Web Architecture (EHWA) Baseline M&O team; coordination of activities with the SharePoint 2010 evaluation, evaluating PS 2010's new capabilities (e.g., using Project Web Access to create/update schedules, Backwards Compatibility Mode, portfolios); determining changes required to current configuration & data (if translation, migration, verification is required); determining changes required to existing products (e.g., training plan & material, installation procedures) and drafting initial updates to the products; determining changes to existing processes; develop estimate of ?non-direct? (to EA2) impacts (e.g., cost to users to upgrade to Project Pro 2010, temporary productivity impact to ESCG & PIPS schedulers); determining the upgrade method and developing the implementation plan based on products from this evaluation; and presenting to the EA2 project manager and the EA2 Configuration

Control Board (CCB) the recommended changes to the existing configuration and approach for implementation of PS 2010.

5.8.2 Implement Project Server 2010 Added REV. 2
Project Code:

Requirements include: implementing new configuration in Development; testing and performing data migrations; verifying data migrations; developing acceptance test plan and user test plan; preparing operational readiness review presentations & getting EA2 CCB approvals; implementing approved configuration in Staging (& testing) and then in Production; executing test plans; updating existing products; training Help Desk (if required) and M&O personnel; and documenting lessons learned.

b. **Applicable Documents**

Document Number	Document Name	Rev.
DDMS #001037378 Added REV. 2	Master Product Schedule	Current
NPR 2810.1 Added REV. 2	Security of Information Technology	A
SPEA0001 Added REV. 2	EA IT Security Plan	

c. **Required DRDs**

5.8.1 Evaluate Project Server 2010

DRD #	DRD Title	Quantity/Frequency
101 Added REV. 2	Project Schedule	1/mth
105 Added REV. 2	Regular Status Report/Summary Review	1/mth
218 Added REV. 2	Engineering Analysis	1

5.8.2 Implement Project Server 2010

DRD #	DRD Title	Quantity/Frequency
101 Added REV. 2	Project Schedule	1/mth
105 Added REV. 2	Regular Status Report/Summary Review	1/mth
107 Added REV. 2	Test Report	1/completion of test

d. **Products**

5.8.1 Evaluate Project Server 2010

Product(s)	Quantity	Delivery Date
Draft Update to IT Security Plan (SPEA0001) Added REV. 2	1	Per Master Schedule
Analysis of PS 2010 New Capabilities and Recommended Usage Added REV. 2	1	Per Master Schedule
Recommended Changes to Existing PS 2007 Configuration and Processes Added REV. 2	1	Per Master Schedule
Estimate of Schedule and Resources Required to Implement PS 2010 Added REV. 2	1	Per Master Schedule
Presentations Added REV. 2	2	Per Master Schedule
Draft Update to Training Program Plan Added REV. 2	1	Per Master Schedule
Draft Update to Maintenance & Operations documentation set Added REV. 2	1	Per Master Schedule
Draft Update to Concept of Operations Added REV. 2	1	Per Master

		Schedule
Acceptance & Closeout Review Presentation Added REV. 2	1	Per Master Schedule
Implementation Plan Added REV. 2	1	Per Master Schedule

5.8.2 Implement Project Server 2010

Product(s)	Quantity	Delivery Date
Final Training Program Plan Added REV. 2	1	Per Master Schedule
Operational Readiness Review Presentation Added REV. 2	1	Per Master Schedule
Test Plans Added REV. 2	2	Per Master Schedule
Test Reports Added REV. 2	2	Per Master Schedule
Final Update to IT Security Plan (SPEA0001) Added REV. 2	1	Per Master Schedule
CCB Presentations Added REV. 2	2	Per Master Schedule
Final Maintenance & Operations documentation set Added REV. 2	1	Per Master Schedule
Final Concept of Operations Added REV. 2	1	Per Master Schedule
Acceptance & Closeout Review Presentation Added REV. 2	1	Per Master Schedule
Lessons Learned Added REV. 2	1	Per Master Schedule

e. **Product Verification**

5.8.1 Evaluate Project Server 2010

i. Draft Update to IT Security Plan (SPEA0001)

- Product review and acceptance by EA OCSO Added REV. 2

ii. Analysis of PS 2010 New Capabilities and Recommended Usage

- Product review and acceptance by NASA project manager Added REV. 2

iii. Recommended Changes to Existing PS 2007 Configuration and Processes

- Product review and acceptance by NASA project manager Added REV. 2

iv. Estimate of Schedule and Resources Required to Implement PS 2010

- Product review and acceptance by NASA project manager Added REV. 2

v. Presentations

- Product review and acceptance by NASA project manager Added REV. 2

vi. Draft Update to Training Program Plan

- Product review and acceptance by NASA project manager Added REV. 2

vii. Draft Update to Maintenance & Operations documentation set

- Product review and acceptance by NASA project manager Added REV. 2

viii. Draft Update to Concept of Operations

- Product review and acceptance by NASA project manager Added REV. 2

ix. Acceptance & Closeout Review Presentation

- Product review and acceptance by NASA project manager Added REV. 2

x. Implementation Plan

- Product review and acceptance by NASA project manager Added REV. 2

5.8.2 Implement Project Server 2010

i. Final Training Program Plan

- Product review and acceptance by NASA project manager Added REV. 2

ii. Operational Readiness Review Presentation

- Product review and acceptance by NASA project manager Added REV. 2

iii. Test Plans
- Product review and acceptance by NASA project manager Added REV. 2
iv. Test Reports
- Product review and acceptance by NASA project manager Added REV. 2
v. Final Update to IT Security Plan (SPEA0001)
- Product review and acceptance by EA OCSO Added REV. 2
vi. CCB Presentations
- Authority to Proceed from Board Chair Added REV. 2
vii. Final Maintenance & Operations documentation set
- Product review and acceptance by NASA project manager Added REV. 2
viii. Final Concept of Operations
- Product review and acceptance by NASA project manager Added REV. 2
ix. Acceptance & Closeout Review Presentation
- Product review and acceptance by NASA project manager Added REV. 2
x. Lessons Learned
- Product review and acceptance by NASA project manager Added REV. 2

6.0 Cost Summary and Revision History

DO 347 R2 Summary				
SLC		CY5	CY6	**Grand Total**
BS2				
	Sum of Hrs			
	Sum of Dollars			
IT3				
	Sum of Hrs			
	Sum of Dollars			
IT4				
	Sum of Hrs			
	Sum of Dollars			
IT2				
	Sum of Hrs			
	Sum of Dollars			
PC1				
	Sum of Hrs			
	Sum of Dollars			
PC2				
	Sum of Hrs			
	Sum of Dollars			
TN2				
	Sum of Hrs			
	Sum of Dollars			
Total Direct Labor Hrs				
Total Direct Labor Cost				
Subcontract				
Material				
Travel				
NLR Misc				
Burden on Non-Labor				
Total Non-Labor				
Total Costs				
Fee (100% of Pool)				
Total				**309,753**

Revision History:

Rev No.	Date	Summary
REV. 2	06/09/2010	Update to include new work for evaluation and implementation of Project Server 2010
R1	09/16/2009	Extends period of performance through 1/31/2013, deletes the requirements of section 5.6, which also includes deletion of 5.1 requirement for connectivity with HP Rapid Deployment Pack, and extends the request for interim maintenance services through the new period of performance.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HB44 D DO 374 Rev. 1	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 01/26/2010 – 01/31/2013

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Stephen Janney**

Signtature: **Stephen Janney** Date: **04/21/2010**
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	CTSD Systems Management					
DO	**374 Rev.1**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$2,330,649

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

JSC Form 1429 (Rev November 10, 2004) (MSword August 1995)

Engineering and Science Contract

NNJ10HB44D-DO374 Rev. 1

Originator: Victor Untalan (EC3) (281) 483-9145 **TMR:** Jennifer Villarreal (EC) (281) 483-7306

Revision Summary:
Remove Shuttle ECLSS technical engineering services effective March 2010.

1. Title of Effort: CTSD System Management

2. Date of Request: 03/24/2010

3. Statement of Work Task Description

a. **2.1.2-Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated RBP1

This delivery order period of performance starts 01/26/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Vehicle Integration Project Engineering Services for CEV

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide project engineering services associated with the Vehicle Integration Office.

5.1.1 Vehicle Integration Project Engineering Services for CEV

Project Code: n/a

Task requirements include project planning of SE&I milestones, tracking of project board action items, assembly and distribution of technical status reports, maintaining accuracy of project website, scheduling technical reviews, meeting coordination, and development of outreach materials including multimedia products, newsletters, and exhibits materials.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.1.1 Vehicle Integration Project Engineering Services for CEV

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.1.1 Vehicle Integration Project Engineering Services for CEV

Product(s)	Quantity	Delivery Date
Quarterly Activity Report	12	quarterly for duration of contract

e. **Product Verification**

5.1.1 Vehicle Integration Project Engineering Services for CEV

i. Quarterly Activity Report

- Receipt by email and acceptance by EC6 branch chief or delegate

5.2 Shuttle ECLSS Technical Engineering Services Updated RBP1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering assessments and technical services for the Shuttle Environmental Control and Life Support Systems (ECLSS) subsystem. In Revision 1, Shuttle ECLSS technical engineering services will be discontinued. Updated RBP1

5.2.1 Shuttle ECLSS Technical Engineering Services

Project Code:

The contractor shall provide engineering assessments and technical engineering services associated with Shuttle ECLSS subsystems to include the following:

- Monitor the technical status of development activities, testing, and flight operations
- Identify and/or evaluate technical issues, changes, or concerns
- Analyze the information
- Formulate recommendations
- Prepare responses and presentations
- Present to appropriate boards, panels, etc.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.2.1 Shuttle ECLSS Technical Engineering Services

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.2.1 Shuttle ECLSS Technical Engineering Services

Product(s)	Quantity	Delivery Date
Quarterly Activity Report Updated RBP1	0	Quarterly for duration the program (March 2011)

e. **Product Verification**

5.2.1 Shuttle ECLSS Technical Engineering Services

i. Quarterly Activity Report

- EC6 branch management or designee review of report. Note: Task was discontinued prior to receiving first report. Updated RBP1

5.3 CEV ECLSS Systems Engineering Services

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering assessments and technical services related to the Environmental Control and Life Support Systems (ECLSS) for Orion.

5.3.1 CEV ECLSS Systems Engineering Services

Project Code: n/a

The contractor shall provide engineering assessments and technical engineering services for CEV ECLSS systems including but not limited to the following:

- Monitor the technical status of engineering development activities, testing, and operations planning
- Identify and/or evaluate technical issues, changes, or concerns
- Analyze the information
- Formulate recommendations
- Prepare responses and presentations
- Present to appropriate boards, panels, etc.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.3.1 CEV ECLSS Systems Engineering Services

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.3.1 CEV ECLSS Systems Engineering Services

Product(s)	Quantity	Delivery Date
Quarterly Activity Report	12	quarterly for duration of contract
Task Plan Deleted REV. 1	1	30 days after contract approval

e. **Product Verification**

5.3.1 CEV ECLSS Systems Engineering Services
i. Quarterly Activity Report
- EC6 branch management or designee review of report
ii. Task Plan Deleted REV. 1
- Signature of NASA System Manager Deleted REV. 1

5.4 Orion EVA Integration Engineering Services

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering assessments and technical engineering services related to Orion EVA integration.

5.4.1 Orion EVA Integration Engineering Services
Project Code:

The contractor shall provide engineering assessments and technical services for Orion EVA integration to include the following:

- Monitor the technical status of development activities, testing, and operations planning
- Identify and/or evaluate technical issues, changes, or concerns
- Analyze the information
- Formulate recommendations
- Prepare responses and presentations
- Present to appropriate boards, panels, etc.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.4.1 Orion EVA Integration Engineering Services		
DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.4.1 Orion EVA Integration Engineering Services		
Product(s)	Quantity	Delivery Date
Quarterly Activity Reports	12	Quarterlyfor duration of contract
Task Plan Deleted REV. 1	1	30 days from contract approval

e. **Product Verification**

5.4.1 Orion EVA Integration Engineering Services
i. Quarterly Activity Reports
- EC6 branch management or designee review of report

ii. Task Plan Deleted REV. 1
- Signature of NASA subsystem manager Deleted REV. 1

5.5 CEV Habitation Systems Engineering Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering assessments and technical services related to the Crew Module's Habitation Accommodations System.

5.5.1 CEV Habitation Systems Engineering Services

Project Code: n/a

The contractor shall provide engineering assessments and technical engineering services for Habitation Accommodations to include the following:

- Monitor the technical status of engineering development activities, testing, and operations planning
- Identify and/or evaluate technical issues, changes, or concerns
- Analyze the information
- Formulate recommendations
- Prepare responses and presentations
- Present to appropriate boards, panels, etc.

Habitation Accommodations includes the hygiene systems, seats, stowage, sleep accommodations, galley, privacy accommodations, internal restraints and mobility aids, and flight crew equipment interfaces.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.5.1 CEV Habitation Systems Engineering Services

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.5.1 CEV Habitation Systems Engineering Services

Product(s)	Quantity	Delivery Date
Quarterly Activity Report (delivered to EC Share folder)	12	Quarterly for duration of contract
Task Plan Deleted REV. 1	1	30 days from contract approval

e. **Product Verification**

5.5.1 CEV Habitation Systems Engineering Services

i. Quarterly Activity Report (delivered to EC Share folder)
- EC6 branch management or designee review of report
ii. Task Plan Deleted REV. 1
- NASA System Manager's signature on the plan Deleted REV. 1

6.0 Cost Summary and Revision History:

DO 374 R1 Summary					
SLC		CY6	CY7	CY8	**Grand Total**
AS2					
	Sum of Hrs				
	Sum of Dollars				
BS2					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
EN2					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
EN1					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR					
Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**2,330,649**

64

Revision History:

Rev No.	Date	Summary	
RBP1	03/24/2010	Remove Shuttle ECLSS technical engineering services effective March 2010.	Summary
Original	12/21/2009	Incorporate changes in system management to engineering services	
Original			

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HB48D DO 378 R2	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 05/17/2010-09/30/2012

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: 09/06/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	LONESTAR Project Engineering Services					
DO	378 R1					
	Est. Labor Costs	b4			b4	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$311,975.00

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ10HB48D-DO378 REV 2

Originator: Tuyen Hua (EG) (281) 483-8296 **TMR:** Tuyen Hua (EG) (281) 483-8296

Revision Summary:

The purpose of Revision 2 is:
1) Re-phase task due to delays in identifying the payload launch provider.
2) Additional products in FY12 for reviewing hardware designs and extending period of performance thru 9/30/2012.

1. Title of Effort: LONESTAR Project Engineering Services

2. Date of Request: The date of request will be assigned upon TMR approval.

3. Statement of Work Task Description

a. **2.5-Education, Commercialization, and Technology Outreach**
The contractor shall plan and implement educational, commercialization, and technology outreach activities including special projects, curriculum development, demonstrations, displays, seminars, and presentations.

The contractor shall develop outreach materials including brochures, multi-media products, exhibit materials, and newsletters. These materials shall be disseminated through activities including web based and educational forums, and other public events.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 2

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 05/17/2010 and ends 09/30/2012.

Product Requirements

5.1 Project Engineering Services

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering services to develop the detailed project plan and associated basis of estimate to accomplish all integration, safety, and vehicle interface-build work identified for a TBD vehicle flight integration template.

A revision to this DO is anticipated for a follow-on effort to execute the project plan developed as part of this DO.

5.1.1 Payload Integration Project Plan Updated REV 2
Project Code:

The Aeroscience & Flight Mechanics (EG) Division has a requirement to provide engineering services for payload integration required to integrate two satellites being built by the University of Texas (UT) and Texas A&M (A&M) University, respectively, for flight and deployment in a TBD vehicle. Additionally, services will be required to deploy these satellites, each of which will carry the JSC/EG DRAGON experiment.

The contractor will develop a detailed project plan and associated basis of estimate to accomplish all integration, safety, and vehicle interface-build work identified for a TBD vehicle flight integration template.

In addition, the contractor will provide engineering services to review and provide feedback on the respective university satellite designs.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	LONESTAR Project Requirements Document	

c. **Required DRDs**

5.1.1 Payload Integration Project Plan

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly
105	Regular Status Report/Summary Review	Monthly

d. **Products**

5.1.1 Payload Integration Project Plan

Product(s)	Quantity	Delivery Date
Kickoff Meeting Data Package	1	ATP + 1-Month
Project Schedule	17	Monthly
Monthly Status Report	17	Monthly
Payload Integration Project Plan and BOE	1	3/31/2011
Preliminary Design Review Assessment Data Packages Added Rev 1	2	11/30/2010
Critical Design Review Assessment Data Packages Added Rev 1	2	3/31/2011
Delta - Preliminary Design Review Assessment Data Packages Added REV 2	2	9/1/2011
Delta - Critical Design Review Assessment Data Packages Added REV 2	2	11/1/2011
Phase 0/I Safety Review Data Packages Added REV 2	2	12/1/2011
Phase II Safety Review Data Packages Added REV 2	2	1/15/2012
Phase III Safety Review Data Packages Added REV 2	2	9/1/2012

e. **Product Verification**

5.1.1 Payload Integration Project Plan

i. Kickoff Meeting Data Package

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

ii. Project Schedule

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iii. Monthly Status Report

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

iv. Payload Integration Project Plan and BOE

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate.

v. Preliminary Design Review Assessment Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 1

vi. Critical Design Review Assessment Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added Rev 1

vii. Delta - Preliminary Design Review Assessment Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added REV 2

viii. Delta - Critical Design Review Assessment Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added REV 2

ix. Phase 0/I Safety Review Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added REV 2

x. Phase II Safety Review Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added REV 2

xi. Phase III Safety Review Data Packages

- Deliverables shall be reviewed for technical content by the NASA TM. When the deliverable is accepted, it will be approved by the EG TM and reported to the EG TMR or EG TMR alternate. Added REV 2

.0 Cost Summary and Revision History

SLC	Type	CY6	CY7	CY8	G Total
EN1	Sum of Hours				
	Sum of Dollars				
EN3	Sum of Hours				
	Sum of Dollars				
ESS	Sum of Hours				
	Sum of Dollars				
PC2	Sum of Hours				
	Sum of Dollars				
Total Direct Labor Hours					
Total Direct Labor Costs					
Travel Costs					
Subcontract					
NLR Misc					
Materials					
Burden on Non-Labor					
Total Non Labor					
Total Costs					
Fee					
Total					$311,975.00

DO378 revision history	Total cost	Reason for revision
Original	$99,424	Original
Revision 1	$204,427	1) Re-phase task due to delay in project start-up as result of delays in identifying the payload launch provider. 2) Additional products for Design Review Assessment Data Packages and extending period of performance thru 9/30/2011.
Revision 2	$311,975	1) Re-phase task due to delays in identifying the payload launch provider. 2) Additional products in FY12 for reviewing hardware designs and extending period of performance thru 9/30/2012.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HC82D DO 384	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / William Myers
Tel. No.: (281) 483-4108 FAX: (281) 244-5331
E-Mail: william.t.myers@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 06/25/2010-09/30/2010

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: 07/30/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ARES Advanced Exploration Science					
DO	**384**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. **Total**

$29,269.44

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

JSC Form 1429 (Rev November 10, 2004) (MSword August 1995)

Engineering and Science Contract

NNJ10HC82D-DO384

Originator: Michael Cooke (EV) (281) 483-4710 **TMR:** Cordelia Foster (EV) (281) 483-5265

1. Title of Effort: Avionic Systems Division Research and Development (R&D)

2. Date of Request: 06/25/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

e. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

f. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

g. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software

integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

h. **2.5 Education, Commercialization, and Technology Outreach**
The contractor shall plan and implement educational, commercialization, and technology outreach activities including special projects, curriculum development, demonstrations, displays, seminars, and presentations.

The contractor shall develop outreach materials including brochures, multi-media products, exhibit materials, and newsletters. These materials shall be disseminated through activities including web based and educational forums, and other public events.

i. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 06/25/2010 and ends 09/30/2010.

5. Product Requirements

5.1 Avionic Syetems Research

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform the research outlined in JSC 65888, Avionic Systems Research Action Plan, and in accordance with referenced documents. The contractor shall provide services and invitational travel for visiting scientists and researchers when so requested by the NASA Principal Investigators for each project. Includes drawings, analysis, test procedures, test preparation, laboratory setup, data collection, fabrication, test, assembly, research reports papers and publications.

No flight products will be required.

5.1.1 Human-Machine Interaction (HMI) Research
Project Code:

Perform the research outlined in the research plans listed in document JSC 65888

Smart Fabric Research - Section 3.1

Human Cognitive Technology (HCT) Research - Section 3.2

b. **Applicable Documents**

Document Number	Document Name	Rev.
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
EV010	ASD Documentation Control Work Instruction	Current
JSC 65888	Avionic Systems Research Action Plan	Current

c. **Required DRDs**

5.1.1 Human-Machine Interaction (HMI) Research

DRD #	DRD Title	Quantity/Frequency
	No Requirement	EV tailored DRD025-1/quarter

d. **Products**

5.1.1 Human-Machine Interaction (HMI) Research		
Product(s)	**Quantity**	**Delivery Date**
Delivery/Acceptance Report (per DRD 25 as amended per Attachment in the Supporting Documents	1	quarter
Data, abstracts, and presentation materials per research plans outlined in JSC 65888	1	per JSC65888

e. **Product Verification**

5.1.1 Human-Machine Interaction (HMI) Research
i. Delivery/Acceptance Report (per DRD 25 as amended per Attachment in the Supporting Documents
- -NASA Principal Investigator approval in DDMS of Delivery/Acceptance Report
ii. Data, abstracts, and presentation materials per research plans outlined in JSC 65888
- -Nasa Principal Investigator for each product, as outlined in document JSC 65888 sections will review/accept data, abstracts, publications, and presentation materials. Acceptance by TM will be documented through TMR/Alternate.

6.0 Cost Summary

DO 384 Summary			
SLC		CY6	**Grand Total**
EN2			
	Sum of Hrs		
	Sum of Dollars		
EN4			
	Sum of Hrs		
	Sum of Dollars		
IT3			
	Sum of Hrs		
	Sum of Dollars		
QA2			
	Sum of Hrs		
	Sum of Dollars		
Total Direct Labor Hrs			
Total Direct Labor Cost			
Subcontract			
Material			
Travel			
NLR Misc			
Burden on Non-Labor			
Total Non-Labor			
Total Costs			
Fee (100% of Pool)			
Total			**29,269.44**

64

Revision History:

DO 384 revision history	Total cost	Reason for revision
Original	$29,269.00	Add scope to complete R&D services.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No. **NNJ10HB47D DO 385 R2**

2. Date Of Order See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 05/04/2010-03/31/2012

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: 04/27/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ARES Advanced Exploration Science					
DO	385 R2					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$886,020.90

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ10HB47D-DO385 REV 2

Originator: Susan Runco (KA) (281) 244-8848 **TMR:** Susan Runco (KA) (281) 244-8848

Revision Summary:

Extend period of performance to March 31, 2012, replan field science, instrument development, and mission planning tasks for FY11, and to include DRATS, NEEMO, GeoLab, AMASE, ISRU, LADTAG, and NEO.

1. Title of Effort: ARES Advanced Exploration Science

2. Date of Request: 03/21/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

d. **2.1.6 Astromaterials Research and Exploration Science**
The contractor shall conduct scientific research and peer reviews in space related scientific fields such as astromaterials, astrobiology and Earth science. The contractor shall provide assessments of geological and planetary science projects in these and other related fields. Assessments shall include but not be limited to curation of samples, acquisition of analytical data, evaluation of findings, and providing technical data for abstracts, presentations, peer-review publications, and research proposals.

e. **2.1.6.2 Earth and Space Science**
The contractor shall perform Earth and space science research for human space flight and other activities. The contractor shall collect and catalog data, conduct analyses, update databases, and provide analytical products in the areas of Earth science, image science and analysis, hypervelocity debris impacts of spacecraft and in orbital debris monitoring.

f. **2.1.6.2.1 Earth Science**
The contractor shall perform tasks for ongoing real-time and on-call (24/7 as needed) services including: ephemeris planning for the International Space Station?s (ISS?s) Window Observational Research Facility (WORF) and its Earth Science remote sensing payloads; the ISS's Earth Science Toward Exploration Research (ESTER) payload; Crew Earth Observation (CEO) photography (Shuttle & ISS); and other means of photographic and imagery collection for all crewed vehicles. The contractor shall operate the Earth Observation Laboratory and the JSC Telescience Center. The contractor shall geolocate, interpret, catalog, maintain, and distribute returned WORF, ESTER, CEO and other imagery. The contractor shall train astronauts in earth science and remote sensing mission objectives for WORF, ESTER, and CEO.

g. **2.1.6.2.2 Image Science and Analysis**
The contractor shall perform quantitative engineering image analyses utilizing the Video Digital Analysis System (VDAS) laboratory and other

tools for NASA programs for problem solving, mission safety, vehicle maintenance, vehicle performance and the Certification of Flight Readiness Process. Analyses shall be performed on film (still and motion), video, and electronic imagery acquired from both ground and flight cameras. The contractor shall provide 24-hour, on-call support for vehicle anomaly investigations and damage assessments.

h. **2.1.6.2.3 Hypervelocity Impact**
The contractor shall perform research in the measurement and modeling of orbital debris for NASA Programs. The contractor shall define the orbital debris environment and assess its risks. The contractor shall maintain and verify orbital debris environmental models, which include long-term prediction models for evaluating debris mitigation practices. The contractor shall assess short and long term risks to orbiting spacecraft and provide spacecraft and reentry risk assessments for satellite breakups as needed 24/7. The contractor shall develop debris mitigation techniques and practices to limit the generation of debris.

i. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

j. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

k. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

l. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

m. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 2

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 05/01/2010 and ends 03/31/2012.

5. Product Requirements

5.1 Advanced Exploration Science

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide scientific assessments of future missions, spacecraft and payload instruments, landing sites, and surface operations; provide scientific assessments and recommendations for samples and processes used in exploration, including simulants, lunar dust, and analog field sites; provide laboratory and field testing and assessment of science instruments under mission relevant conditions; provide basic and applied research in the geological and planetary sciences by preparing samples, acquiring data, providing databases, evaluating findings, and providing materials for abstracts, presentations, peer-review publications, and research proposals, and provide technical management to include overall cost and resource management, schedules, implementation of safety policies, and coordination with the NASA technical personnel.

The contractor will provide specialized science, engineering, and technical products for ARES Advanced Exploration Science as detailed in the following specific product requirements and in accordance with applicable documents - controlled per ARES Configuration Control Process. No flight products are required.

5.1.1 Services listed in the ARES Advanced Exploration Science Plan (KX-AES-01). Updated REV 2
Project Code:

The contractor will perform the services listed in the ARES Advanced Exploration Science Plan (KX-AES-01):
Future Mission Science-Section 3.1
Scientific Analysis, Instrument and Technology Development-Section 3.2
Field Science Operations & Training-Section 3.3

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001	JSC Lessons Learned Process	10-02
JPD 2800.4	JSC Information Technology (IT) Program Management	03-01
JPR 1700.1	JSC Safety & Health Handbook	Current
KA-WI-001	ARES Master Work Instruction	Current
KA-WI-002	ARES Configuration Management	Current
KA-WI-003	ARES Management of Research Proposals	Current
KX-001	Office for Human Exploration Science Configuration Management Process	Current
KX-AES-01	ARES Advanced Exploration Science Plan	Current

c. **Required DRDs**

5.1.1 Services listed in the ARES Advanced Exploration Science Plan (KX-AES-01).		
DRD #	DRD Title	Quantity/Frequency
	No Requirement	Per DRD 25 KA/ARES Delivery/Acceptance Report

d. **Products**

5.1.1 Services listed in the ARES Advanced Exploration Science Plan (KX-AES-01).		
Product(s)	Quantity	Delivery Date
Scientific and Technical Assessment Reports and Recommendations for Future Mission Science per KX-AES-01	per KX-AES-01	per KX-AES-01
Data, Analyses, and Assessment Reports for Scientific Analysis, Instrument and Technology Development per KX-AES-01	per KX-AES-01	per KX-AES-01
Field Operation and Training Plans for Field Science Operations & Training per KX-AES-01	per KX-AES-01	per KX-AES-01
Delivery/Acceptance Report (per DRD 25)	1/quarter	Quarterly

e. **Product Verification**

5.1.1 Services listed in the ARES Advanced Exploration Science Plan (KX-AES-01).
i. Scientific and Technical Assessment Reports and Recommendations for Future Mission Science per KX-AES-01
- Acceptance/closure will be documented by NASA TM and TMR approval of contractor Delivery/Acceptance Report.
ii. Data, Analyses, and Assessment Reports for Scientific Analysis, Instrument and Technology Development per KX-AES-01
- Acceptance/closure will be documented by NASA TM and TMR approval of contractor Delivery/Acceptance Report.
iii. Field Operation and Training Plans for Field Science Operations & Training per KX-AES-01

- Acceptance/closure will be documented by NASA TM and TMR approval of contractor Delivery/Acceptance Report.

iv. Delivery/Acceptance Report (per DRD 25)

- Acceptance/closure will be documented by NASA TM and TMR approval of contractor Delivery/Acceptance Report.

6.0 Cost Summary and Revision History

DO 385 R2 Summary	ContractYear			
SLC	CY6	CY7	CY8	**Total**
BS2				
Sum of Hrs				
Sum of Dollars				
EN3				
Sum of Hrs				
Sum of Dollars				
IT4				
Sum of Hrs				
Sum of Dollars				
QA1				
Sum of Hrs				
Sum of Dollars				
SC2				
Sum of Hrs				
Sum of Dollars				
SC3				
Sum of Hrs				
Sum of Dollars				
SC4				
Sum of Hrs				
Sum of Dollars				
SCS				
Sum of Hrs				
Sum of Dollars				
Total Direct Labor Hrs				
Total Direct Labor Cost				
Subcontract				
Material				
Travel				
NLR Misc				
Burden on Non-Labor				
Total Non-Labor				
Total Costs				
Fee (100% of Pool)				
Total				**$886,020.90**

DO385 revision history	Total cost	Reason for revision
Original	$359,785	
Revision 1	$468,941	To extend period of performance to March 31, 2011, and replan field science, instrument development, and mission planning tasks for FY11.
Revision 2	$886,021	To extend period of performance to March 31, 2012, replan field science, instrument development, and mission planning tasks for FY11, and to include DRATS, NEEMO, GeoLab, AMASE, ISRU, LADTAG, and NEO.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HE53D DO 389 Rev 1	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 10/01/2010-01/31/2013

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Herbert H. Baker**

Signtature: **Herbert H. Baker** Date: 09/22/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Structural Engineering Division Manufacturing Services					
DO	**389 Rev 1**					
	Est. Labor Costs	b4				
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				b4	
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$2,236,312.10

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ10HE53D-DO389 REV 1

Originator: Samuel Daugherty (ES1) (281) 244-8450 **TMR:** Rhonda Moore (ES) (281) 483-5282

Revision Summary:

Revision A Summary:
This revision modifies all subtasks to include clarifications on the product delivery methodology. It increases the total value of the DO and modifies the products and services in FY11 as follows:

Subtask 1 increases the Fabrication Services for Non-EA customers
Subtask 2 increases the Fabrication Services for ES2 Structures Branch
Subtask 3 increases the Fabrication Services for ES3 Thermal Design Branch
Subtask 4 increases the Fabrication Services for ES4 Materials and Processes Branch
Subtask 5 increases the Fabrication Services for ES5 Mechanical Design and Analysis Branch
Subtask 6 increases the Fabrication Services for ES6 Loads and Structural Dynamics Branch

This revision removes scope on subtask 7 fabrication Services for Commercial Customers for FY11

This revision also increases /decreases the products and services required during FY12 and 13 as follows
Subtask 1 increases the Fabrication Services for Non-EA customers
Subtask 2 increases the Fabrication Services for ES2 Structures Branch
Subtask 3 decreases the Fabrication Services for ES3 Thermal Design Branch
Subtask 5 increases the Fabrication Services for ES5 Mechanical Design and Analysis Branch
Subtask 6 decreases the Fabrication Services for ES6 Loads and Structural Dynamics Branch
Subtask 7 decreases the Fabrication Services for Commercial Customers

1. Title of Effort: Structural Engineering Division Manufacturing Services

2. Date of Request: 08/24/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

c. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

d. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

e. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Manufactured Products and Services for Non- ES Customer Projects

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide manufactured products related to the Space Shuttle, International Space Station, and other spacecraft programs for projects of customers in non-EA organizations, in accordance with the requirements of SOP-001.31. Products shall be planned, fabricated, and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.1.1 Manufactured Products and Services for Non- EA Customer Projects Updated REV 1

Project Code: None

Requirements same as 5.1

b. **Applicable Documents**

Document Number	Document Name	Rev.
ISO 10012	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27472	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
NPR 8735.1	Procedures for Exchanging Parts, Materials, and Safety Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories	Rev A 08-02
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
EA-WI-024	General Operating Procedures Manual for EA Tesing Facilities	Baseline
JPR 1440.3	JSC Files and Records Management Procedures	Rev B 12-04
JPR 8500	Engineering Drawing System Manual	Current
NASA-STD-6016	Standard Materials and Processing requirements for Spacecraft	original
NPR 1441.1	NASA Records Retention Schedules	Rev D 02-03
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.1.1 Manufactured Products and Services for Non- EA Customer Projects

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.1.1 Manufactured Products and Services for Non- EA Customer Projects

Product(s)	Quantity	Delivery Date
Manufactured Products per NASA Approved VWAR Deleted REV 1	11,700	Per VWAR
Manufactured Products per NASA Approved VWAR Added REV 1	18,500	Per VWAR

e. **Product Verification**

5.1.1 Manufactured Products and Services for Non- EA Customer Projects

i. Manufactured Products per NASA Approved VWAR Deleted REV 1
- Signed acceptance of products from requester or ES CCB approved alternate Deleted REV 1
ii. Manufactured Products per NASA Approved VWAR
- Signed acceptance of products from requester or ES CCB approved alternate Added REV 1

5.2 ES2 Manufactured Products and Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide manufactured products related to the Space Shuttle, International Space Station, and other spacecraft programs for projects benefitting the Structures Branch (ES2), in accordance with the requirements of SOP-001.31. Products shall be planned, fabricated, and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.2.1 ES2 Manufactured Products and Services Updated REV 1
Project Code: None

Requirements same as 5.2

b. **Applicable Documents**

Document Number	Document Name	Rev.
ISO 10012	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27472	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
NPR 8735.1	Procedures for Exchanging Parts, Materials, and Safety Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories	Rev A 08-02
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
EA-WI-024	JSC Files and records management procedures	baseline
JPR 1440.3	JSC Files and records management procedures	Rev B 12-04
NASA-STD-6016	Standard Materials and Processes Requirements for Spacecraft	original
NPR 1441.1	NASA Records Retention Schedules	Rev D
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.2.1 ES2 Manufactured Products and Services

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.2.1 ES2 Manufactured Products and Services

Product(s)	Quantity	Delivery Date
Manufactured products per project directive (PD) Deleted REV 1	7	Per PD
Manufactured products Added REV 1	19	Per Request

e. **Product Verification**

5.2.1 ES2 Manufactured Products and Services
i. Manufactured products per project directive (PD) Deleted REV 1
- Signed acceptance of products by PD initiator or ES CCB approved alternate Deleted REV 1
ii. Manufactured products
- Signed acceptance of products from requester or ES CCB approved alternate Added REV 1

5.3 ES3 Manufactured Products and Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide manufactured products related to the Space Shuttle, International Space Station, and and other spacecraft programs for projects benefitting the Thermal Design Branch (ES3), in accordance with the requirements of SOP-001.31, Products shall be planned, fabricated, and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.3.1 ES3 Manufactured Products and Services Updated REV 1
Project Code: None

Requirements same as 5.3

b. **Applicable Documents**

Document Number	Document Name	Rev.
ISO 10012	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27472	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
NPR 8735.1	Procedures for Exchanging Parts, Materials, and Safety Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories	Rev A 08-02
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	baseline
JPR 1440.3	JSC Files and Records Management Procedures	Rev B 12-04
NASA-STD-6016	Standard Materials and Processing Requirements for Spacecraft	original
NPR 1441.1	NASA Records Retention	Rev D 02-03
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.3.1 ES3 Manufactured Products and Services

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.3.1 ES3 Manufactured Products and Services

Product(s)	Quantity	Delivery Date
Manufactured products per project directive (PD) Deleted REV 1	10	Per PD
Manufactured products Added REV 1	3	Per Request

e. **Product Verification**

5.3.1 ES3 Manufactured Products and Services

i. Manufactured products per project directive (PD) Deleted REV 1

- Signed acceptance of products by an ES CCB approved delegate. Deleted REV 1

ii. Manufactured products

- Signed acceptance of products from requester or ES CCB approved alternate Added REV 1

5.4 ES4 Manufactured Products and Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide manufactured products related to the Space Shuttle, International Space Station, and and other spacecraft programs for the Materials and Processes Branch (ES4), in accordance with the requirements of SOP-001.31, Products shall be planned, fabricated, and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.4.1 ES4 Manufactured Products and Services Updated REV 1
Project Code: None

Requirements same as 5.4

b. **Applicable Documents**

Document Number	Document Name	Rev.
ISO 10012	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27472	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
NPR 8735.1	Procedures for Exchanging Parts, Materials, and Safety Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories	Rev A 08-02
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Baseline
JPR 1440.3	JSC Files and Records Management Procedures	Rev B 12-04
NASA-STD-6016	Standard Meterials and Processes Requirements for Spacecraft	Original
NPR 1441.1	NASA Records Retention Schedules	Rev D 02-03
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.4.1 ES4 Manufactured Products and Services

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.4.1 ES4 Manufactured Products and Services		
Product(s)	**Quantity**	**Delivery Date**
Manufactured products per project directive (PD) Deleted REV 1	23	Per PD
Manufactured products Added REV 1	10	Per Request

e. **Product Verification**

5.4.1 ES4 Manufactured Products and Services
i. Manufactured products per project directive (PD) Deleted REV 1
- Signed acceptance of PD Deleted REV 1
ii. Manufactured products
- Signed acceptance of products from requester or ES CCB approved alternate Added REV 1

5.5 ES5 Manufactured Products and Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide manufactured products related to the Space Shuttle, International Space Station, and other spacecraft programs for the Mechanical Design and Analysis Branch (ES5), in accordance with the requirements of SOP-001.31. Products shall be planned, fabricated, and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.5.1 ES5 Manufactured Products and Services Updated REV 1
Project Code: None

Requirement same as 5.5

b. **Applicable Documents**

Document Number	Document Name	Rev.
ISO 10012	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27472	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
NPR 8735.1	Procedures for Exchanging Parts, Materials, and Safety Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories	Rev A 08-02
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Baseline
JPR 1440.3	JSC Files and Records Management Procedures	Rev B 12-04
NASA-STD-6016	Standard Materials and Processes Requirements for Spacecraft	original
NPR 1441.1	NASA Records Retention Schedules	Rev D 02-03
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.5.1 ES5 Manufactured Products and Services		
DRD #	**DRD Title**	**Quantity/Frequency**

No Requirement	

d. **Products**

5.5.1 ES5 Manufactured Products and Services		
Product(s)	**Quantity**	**Delivery Date**
Manufactured products per project directive (PD) Deleted REV 1	10	Per PD
Manufactured products Added REV 1	9	Per Request

e. **Product Verification**

5.5.1 ES5 Manufactured Products and Services
i. Manufactured products per project directive (PD) Deleted REV 1
- Signed acceptance of products by PD initiator or ES CCB approved alternate Deleted REV 1
ii. Manufactured products
- Signed acceptance of products from requester or ES CCB approved alternate Added REV 1

5.6 ES6 Manufactured Products and Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide manufactured products related to the Space Shuttle, International Space Station, and and other spacecraft programs for the LOADS AND STRUCTURAL DYNAMICS Branch (ES6), in accordance with the requirements of SOP-001.31. Products shall be planned, fabricated, and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.6.1 ES6 Manufacturing Services Updated REV 1
Project Code: None

Requirement same as 5.6

b. **Applicable Documents**

Document Number	Document Name	Rev.
ISO 10012	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 27472	Requirements for Submission of Data Needed For Toxicological Assessment of Chemicals and Biologicals To Be Flown on Manned Spacecraft	Rev A 03-99
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
NPR 8735.1	Procedures for Exchanging Parts, Materials, and Safety Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories	Rev A 08-02
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	baseline
JPR-1440.3	JSC Files and Records Management Procedures	Rev B 12-04
NASA-STD-6016	Standard Materials and Processes Requirements for Spacecraft	original
NPR 1441.1	NASA Records Retention Schedules	Rev D 02-03
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.6.1 ES6 Manufacturing Services

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.6.1 ES6 Manufacturing Services

Product(s)	Quantity	Delivery Date
Manufactured products per project directive (PD) Deleted REV 1	6	Per PD
Manufactured products Added REV 1	3	Per Request

e. **Product Verification**

5.6.1 ES6 Manufacturing Services

i. Manufactured products per project directive (PD) Deleted REV 1

- Signed acceptance of products by PD initiator or ES CCB approved alternate. Deleted REV 1

ii. Manufactured products

- Signed acceptance of products from requester or ES CCB approved alternate Added REV 1

5.7 Manufactured Products and Services for Commercial Customers

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide manufactured products related to the Space Shuttle, International Space Station, and other spacecraft programs JSC Institutional customers, in accordance with the requirements of SOP-001.31. Products shall be planned, fabricated, and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.7.1 Manufactured Products and Services for Commercial Customers Updated REV 1
Project Code: None

Requirement same as 5.7

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.7.1 Manufactured Products and Services for Commercial Customers

DRD #	DRD Title	Quantity/Frequency
	No Requirement	

d. **Products**

5.7.1 Manufactured Products and Services for Commercial Customers

Product(s)	Quantity	Delivery Date
Manufactured Products per NASA Approved VWAR Deleted REV 1	4	Per VWAR
Manufactured Products Added REV 1	2	Per Request

e. **Product Verification**

5.7.1 Manufactured Products and Services for Commercial Customers
i. Manufactured Products per NASA Approved VWAR Deleted REV 1
- Signed acceptance of products from requester or ES CCB approved alternate Deleted REV 1
ii. Manufactured Products
- Signed acceptance of products from requester or ES CCB approved alternate Added REV 1

6.0 Cost Summary and Revision History

DO 389 R1 Summary					
SLC		CY6	CY7	CY8	**Grand Total**
AS2					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
TN2					
	Sum of Hrs				
	Sum of Dollars				
TN3					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**$2,236,312.10**

DO 389 revision history	Total cost	Reason for revision
Original	1,226,545	N/A
Revision 1	2,236,312	This revision increases the total value of the DO by $1,009,767. Subtask 1, 2, and 5 increased by $294,282, $428,944, and $415,433 respectively. Subtask 3, 4, 6, and 7 decreased by $76,777, $304, $26,357, and $25,453 respectively.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HC81D DO 386	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi J. Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 06/29/2010-01/31/2013

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: 06/30/10
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Outreach and Commercialization Products					
DO	386					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$759,436

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

JSC Form 1429 (Rev November 10, 2004) (MSword August 1995)

Engineering and Science Contract

NNJ10HC81D-DO386

Originator: Rudy Balciunas (EA2) (281) 483-3017 **TMR:** Rudy Balciunas (EA) (281) 483-3017

1. Title of Effort: Outreach and Commercialization Products

2. Date of Request: 04/26/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.1.4 Website Development**
The contractor shall design, develop, modify, test and install Websites. The contractor shall provide configuration documentation and training on new and modified websites.

e. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

f. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

g. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

h. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

i. **2.5 Education, Commercialization, and Technology Outreach**

The contractor shall plan and implement educational, commercialization, and technology outreach activities including special projects, curriculum development, demonstrations, displays, seminars, and presentations.

The contractor shall develop outreach materials including brochures, multi-media products, exhibit materials, and newsletters. These materials shall be disseminated through activities including web based and educational forums, and other public events.

j. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 06/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Outreach and Commercialization Products Planning and Control

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform planning and control for outreach activities to facilitate use of EA capabilities by 3rd party users including preparing and presenting informational material to prospective users as well as scheduling and coordinating facility tours. The contractor shall also deliver a quarterly report summarizing the work completed during the quarter, PD(s) execution status, and work planned for subsequent quarters.

5.1.1 Project Directive Planning and Control

Project Code:

In compliance with the above identified SOW(s) the contractor shall perform planning and control activities and obtain authorization for outreach activities.

Project Directives will define specific product deliverables and services, their requirements, schedule and milestones, value, changes to applicable documents or reference documents, process tailoring, etc. Project Directives (PDs) will be approved by the EA Associate Director (or designee). The contractor shall track and maintain all PDs and report costs at the PD level.

DRDs will also be defined in PDs.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.1.1 Project Directive Planning and Control

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1 / quarter

d. **Products**

5.1.1 Project Directive Planning and Control

Product(s)	Quantity	Delivery Date
Quarterly Status Report	1 / quarter	End of Quarter + 30 days
Outreach Products and Services	As defined in PD	Per PD

e. **Product Verification**

5.1.1 Project Directive Planning and Control
i. Quarterly Status Report
- NASA Receipt in DDMS by EA Associate Director or designee
ii. Outreach Products and Services
- NASA Review and Acceptance by EA Associate Director or designee

5.2 Outreach Materials

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall and Associate Director approved PD, the contractor shall develop and provide documentation and outreach materials including presentations, brochures, multi-media products, and exhibit materials. These materials shall be provided to the EA Associate Director (or designee) for approval.

DRDs will be defined in PDs.

5.2.1 Outreach Materials
Project Code:

Same as in 5.2

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.2.1 Outreach Materials		
DRD #	DRD Title	Quantity/Frequency
No Required DRDs Found		

d. **Products**

5.2.1 Outreach Materials		
Product(s)	Quantity	Delivery Date
Outreach Materials	As defined in PD	Per PD

e. **Product Verification**

5.2.1 Outreach Materials
i. Outreach Materials
- NASA Review and Acceptance by the EA Associate Director or designee

5.3 Commercialization Evaluations

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall and Associate Director approved PD the contractor shall formulate and deliver an integrated plan, including fabrication products and engineering, test, and analysis services, for use in the Engineering Directorate response to a commercial customer.

DRDs will be defined in PDs.

5.3.1 Commercialization Evaluations
Project Code:

Same as in 5.3.

b. **Applicable Documents**

Document Number	Document Name	Rev.
	No Requirement	

c. **Required DRDs**

5.3.1 Commercialization Evaluations

DRD #	DRD Title	Quantity/Frequency
No Required DRDs Found		

d. **Products**

5.3.1 Commercialization Evaluations

Product(s)	Quantity	Delivery Date
Commercialization Evaluations	As defined in PD	Per PD

e. **Product Verification**

5.3.1 Commercialization Evaluations

i. Commercialization Evaluations

- NASA Review and Acceptance by EA Associate Director or designee

6.0 Cost Summary

DO 386 Summary					
SLC		CY6	CY7	CY8	**Grand Total**
BS1					
	Sum of Hrs				
	Sum of Dollars				
EN2					
	Sum of Hrs				
	Sum of Dollars				
PC2					
	Sum of Hrs				
	Sum of Dollars				
IT3					
	Sum of Hrs				
	Sum of Dollars				
BS2					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
MGR					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**759,436**

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No. NNJ10HC83D DO 391

2. Date Of Order See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi J. Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 09/16/2010-01/31/2013

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: 9/24/10
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	EVA Technology Development					
DO	391					
	Est. Labor Costs	b4				
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				b4	
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$13,842,000

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

JSC Form 1429 (Rev November 10, 2004) (MSword August 1995)

Engineering and Science Contract

NNJ10HC83D-DO391 B1P2

Originator: Cinda Chullen (EA25) (281) 483-8384 **TMR:** Jennifer Villarreal (EC) (281) 483-7306

1. Title of Effort: EVA Technology Development

2. Date of Request: 08/18/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

d. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

e. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Extravehicular Activity (EVA) Research and Development

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide highly specialized engineering and technical services to accomplish the research and development objectives needed to advance key technologies for future human space flight Extravehicular Activity (EVA) systems. The WBS for this activity shall include project management, systems engineering, trade studies, analysis, hardware fabrication and testing tasks. These tasks should be organized as follows:

1. EVA Technology Development Foundational Domain
1.1 Project Management
1.2 EVA Systems SE&I
1.3 Suit Architecture
1.4 PLSS Architecture
1.5 PAS Architecture
1.6 Suit Hardware
1.7 Thermal
1.8 Ventilation
1.9 Oxygen
1.10 PAS Hardware Development
1.11 Suit Interfaces Hardware
1.12 Integrated Testing

2 Advanced EVA Development
2.1 EVA System Development
2.2 Advanced suit technologies
2.3 Advanced PLSS technologies
2.4 Advanced PAS technologies
2.5 Advanced integration hardware

The contractor shall provide engineering products related to the development and demonstration of EVA technologies in accordance with CTSD-ADV-810, EVA Technology Project Task Plan as assigned by Project Directives under the governance of the EC5 Configuration Control Board. The contractor shall track and report technical progress and costs by Project Directive (PD).

Reference Document: EVA Technology (EVAT) Project Task Plan, CTSD-ADV-810.

5.1.1 EVA Technology Development Project
Project Code:

Requirements described above.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CxP 70024	Human Systems Integration Requirements	Current
EA-WI-024	General Operating Procedures Manual for EA Testing Facilities	Baseline
NPR 7120.8	NASA Research and Technology Program and Project Management Requirements	Current

c. **Required DRDs**

5.1.1 EVA Technology Development Project

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	per PD
102	Engineering Drawings and Model Files	per PD
218	Engineering Analysis	per PD

d. **Products**

5.1.1 EVA Technology Development Project

Product(s)	Quantity	Delivery Date

EVA Technology Development Project Products		per PD	per PD

e. **Product Verification**

5.1.1 EVA Technology Development Project	
i. EVA Technology Development Project Products	
- Branch review & acceptance of deliverable	

6.0 Cost Summary

DO 391 Summary					
SLC		CY6	CY7	CY8	**Grand Total**
AS2					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
EN1					
	Sum of Hrs				
	Sum of Dollars				
EN2					
	Sum of Hrs				
	Sum of Dollars				
AS1					
	Sum of Hrs				
	Sum of Dollars				
TN1					
	Sum of Hrs				
	Sum of Dollars				
TN2					
	Sum of Hrs				
	Sum of Dollars				
TN3					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					

64

Total	64	13,842,000

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HE54D DO 392

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2010-01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: Ronald Johnson Date: 09/30/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Thermal Design Branch Engineering					
DO	392					
	Est. Labor Costs				b4	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				b4	
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$809,561

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ10HE54D-DO392

Originator: Christopher Madden (ES3) (281) 483-6463 **TMR:** Rhonda Moore (ES) (281) 483-5282

1. Title of Effort: Thermal Design Branch Engineering

2. Date of Request: 09/14/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

d. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

e. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

f. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Data and Software Development

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall process flight data, maintenance, consultation, and distribution of engineering computer codes, in accordance with the requirements of SOP-001.31. These activities shall be planned and delivered in accordance with SOP-001.32 under the governance of the Structural Engineering Division Configuration Control Board (CCB).

5.1.1 Data and Software Development

Project Code: none

same section 5.1

b. **Applicable Documents**

Document Number	Document Name	Rev.
IEEE/ASTM SI 10-2002	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
JPD 2800.4	JSC Information Technology (IT) Program Management	03-01
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2800.3	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JSC 26648	JSC Automated Information System User?s Security Guide	7-94
NPD 9501.1	NASA Contractor Financial Management Reporting System	Rev G 05-00
NPR 2810.1	Security of Information Technology	08-99
NPR 8715.3	NASA Safety Manual	Change 1 06-02
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
ES-TM-392	Thermal Design Project Schedule	Current
SOP-001.31	Technical Requirements for Structural Engineering	
SOP-001.32	Fiscal Year 2011 Operating Plan for Structural Engineering Division	

c. **Required DRDs**

5.1.1 Data and Software Development

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	beginning of FY
105	Regular Status Report/Summary Review	quarterly

d. **Products**

5.1.1 Data and Software Development

Product(s)	Quantity	Delivery Date
Flight Data Files	3	Landing + 2 weeks
TRASYS Documents	3	per ES-TM-392
SINDA Documents	3	per ES-TM-392
Project Schedule	3	beginning of FY
Technical Status Report/Summaries	9	quarterly

e. **Product Verification**

5.1.1 Data and Software Development

i. Flight Data Files

- approval by TMR's designated representative

ii. TRASYS Documents

- approval by TMR's designated representative

iii. SINDA Documents
- approval by TMR's designated representative
iv. Project Schedule
- approval by TMR's designated representative
v. Technical Status Report/Summaries
- approval by TMR's designated representative

5.2 Thermal Design

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform engineering designs, drawings, and models, in accordance with the requirements of SOP-001.31. These activities shall be planned and delivered in accordance with SOP-001.32 under the governance of the Structural Engineering Division Configuration Control Board (CCB).

5.2.1 Thermal Design
Project Code: none

same as 5.2

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
MIL-STD-973	Configuration Control	Notice 4
NPD 9501.1	NASA Contractor Financial Management Reporting System	Rev G 05-00
ES-TM-392	Thermal Design Project Schedule	Current
SOP-001.31	Technical Requirements for Structural Engineering	
SOP-001.32	Fiscal Year 20011 Operating Plan for Structural Engineering Division	

c. **Required DRDs**

5.2.1 Thermal Design

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	beginning of FY
102	Engineering Drawings and Model Files	per ES-TM-392
105	Regular Status Report/Summary Review	quarterly

d. **Products**

5.2.1 Thermal Design

Product(s)	Quantity	Delivery Date
Engineering Design	26	per project schedule
Project Schedule	3	beginning of FY
Technical Status Report/Summaries	9	quarterly

e. **Product Verification**

5.2.1 Thermal Design

i. Engineering Design
- approval by TMR's designated representative
ii. Project Schedule
- approval by TMR's designated representative
iii. Technical Status Report/Summaries
- approval by TMR's designated representative

5.3 Thermal Analysis

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform thermal analysis, in accordance with the requirements of SOP-001.31. These activities shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Configuration Control Board (CCB).

5.3.1 Thermal Analysis
Project Code: none

same as 5.3

b. **Applicable Documents**

Document Number	Document Name	Rev.
IEEE/ASTM SI 10-2002	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
MIL-STD-973	Configuration Control	Notice 4
NPD 9501.1	NASA Contractor Financial Management Reporting System	Rev G 05-00
NPR 8715.3	NASA Safety Manual	Change 1 06-02
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
ES-TM-392	Thermal Design Project Schedule	Current
SOP-001.31	Technical Requirements for Structural Engineering	
SOP-001.32	Fiscal Year 2011 Operating Plan for Structural Engineering Division	

c. **Required DRDs**

5.3.1 Thermal Analysis

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	beginning of FY
105	Regular Status Report/Summary Review	quarterly

d. **Products**

5.3.1 Thermal Analysis

Product(s)	Quantity	Delivery Date
Thermal Analysis/Test Report	10	per ES-TM-392
Project Schedule	3	beginning of FY
Technical Status Report/Summaries	9	quarterly

e. **Product Verification**

5.3.1 Thermal Analysis

i. Thermal Analysis/Test Report
- approval by TMR's designated representative

ii. Project Schedule
- approval by TMR's designated representative

iii. Technical Status Report/Summaries
- approval by TMR's designated representative

6.0 Cost Summary:

DO 392 Summary					
SLC		CY6	CY7	CY8	**Grand Total**
AS2					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
EN2					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**809,561**

b4

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HE55D DO 393	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 10/01/2010-01/31/2013

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Julie Karr**

Signtature: **Julie Karr** Date: 10/01/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Structural Engineering Division IT Services					
DO	**393**		b4		b4	
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$1,162,997.19

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ10HE55D-DO393

Originator: Joseph Prather (ES) (281) 483-1483 **TMR:** Rhonda Moore (ES) (281) 483-5282

1. Title of Effort: Structural Engineering Division IT Services

2. Date of Request: 09/13/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.4 Website Development**
The contractor shall design, develop, modify, test and install Websites. The contractor shall provide configuration documentation and training on new and modified websites.

c. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

d. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

e. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Structural Engineering Division (SED) Laboratory Upgrades

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide equipment upgrades in SED labs and facilities, as outlined in SOP-001.30, related to Structural Engineering Division laboratories, in accordance with the requirements of SOP-001.31. Products and services shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board(CCB).

It also authorizes the use of SED Project Directives (PD) to define deliverables, due dates, process tailoring, and applicable DRDs. PDs are to be approved by the ES CCB and maintained under configuration control.

Once a product project schedule is delivered and accepted it becomes maintained and controlled under the SED IT Project Plan, ES-TM-393.

5.1.1 Structural Engineering Division (SED) Laboratory Upgrades

Project Code: None

Requirement same as 5.1

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
EA-WI-024	General Operating Procedures Manual for EA Testing	Rev A 07-2008
ES-TM-393	Structural Engineering IT Project Schedule	Current
SOP-001.30	Laboratory Upgrades List	Current
SOP-001.31	Technical Requirements for Structural Engineering	Current
SOP-001.32	Operating Plan for Structural Engineering	Current

c. **Required DRDs**

5.1.1 Structural Engineering Division (SED) Laboratory Upgrades

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Once
105	Regular Status Report/Summary Review	Monthly

d. **Products**

5.1.1 Structural Engineering Division (SED) Laboratory Upgrades

Product(s)	Quantity	Delivery Date
Project Schedule	One per PD	Per ES-TM-393
Facility Upgrades	One per PD	Per ES-TM-393
Technical Status Reports/Summaries	One per PD	Per ES-TM-393

e. **Product Verification**

5.1.1 Structural Engineering Division (SED) Laboratory Upgrades

i. Project Schedule

- - Acceptance /review by the NASA Technical Manager (TM)

ii. Facility Upgrades

- - Acceptance /review by the NASA Technical Manager (TM)
iii. Technical Status Reports/Summaries
- - Acceptance /review by the NASA Technical Manager (TM)

5.2 Application and Database Development for Structural Engineering Division

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall develop applications and databases, related to the Structural Engineering Division, in accordance with the requirements of SOP-001.31. Products and services shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division.

5.2.1 Application and Database Development for Structural Engineering Division

Project Code: None

Requirement same as 5.2

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
ES SOP-001.25	Structural Engineering Application Development Standard Operating Procedure	Current
ES-Application-Development-001	Structural Engineering IT Application Development	Current
SOP-001.31	Technical Requirements for Structural Engineering	Current
SOP-001.32	Operating Plan for Structural Engineering	Current

c. **Required DRDs**

5.2.1 Application and Database Development for Structural Engineering Division

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Per Project Directive (PD)
105	Regular Status Report/Summary Review	Monthly

d. **Products**

5.2.1 Application and Database Development for Structural Engineering Division

Product(s)	Quantity	Delivery Date
Static and Dynamic web page code per application	1 EA	1/31/2013
Application codes along with associated databases per application	1 EA	1/31/2013
Project Schedule	1 per PD	Per Project Directive (PD)
Status Reports/Summaries	1 per PD	Per Project Directive (PD)

e. **Product Verification**

5.2.1 Application and Database Development for Structural Engineering Division

i. Static and Dynamic web page code per application
- Verification and acceptance by the NASA Technical Manager (TM).
ii. Application codes along with associated databases per application
- Verification and acceptance by the NASA TM.
iii. Project Schedule
- Verification and acceptance by the NASA TM.
iv. Status Reports/Summaries
- - Acceptance and review by the NASA (TM)

5.3 Conference Room Modifications

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide conference room modifications, related to the Structural Engineering Division, in accordance with the requirements of SOP-001.31. Products and services shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board(CCB).

5.3.1 Conference Room Modifications
Project Code: None

Requirement same as 5.3

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 8800.1	Asbestos Control Manual	
EA-WI-024	General Operating Procedures Manual for EA Testing	Rev A 07/2008
ES-TM-393	Structural Engineering IT Project Plan	Current
SOP-001.30	Laboratory Upgrades List	Current
SOP-001.31	Technical Requirements for Structural Engineering	Current
SOP-001.32	Operating Plan for Structural Engineering	Current

c. **Required DRDs**

5.3.1 Conference Room Modifications

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Once
105	Regular Status Report/Summary Review	Monthly

d. **Products**

5.3.1 Conference Room Modifications

Product(s)	Quantity	Delivery Date
Equipment and Peripherals associated with NASA approved Conference Room	3	Per PD
Project Schedule	1 per PD	Per ES-TM-393

e. **Product Verification**

5.3.1 Conference Room Modifications

i. Equipment and Peripherals associated with NASA approved Conference Room

- - Acceptance /review by the Technical Manager (TM).

ii. Project Schedule

- - Acceptance /review by the Technical Manager (TM).

5.4 Engineering Analysis of Division IT Infrastructure and Enhancements Implementation

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide IT infrastructure assessments and enhancements, related to the Structural Engineering Division, in accordance with the requirements of SOP-001.31. Products and services shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board(CCB).

5.4.1 Engineering Analysis of Division IT Infrastructure and Enhancements Implementation
Project Code: None

Contractor shall provide assessments and enhancements of the division IT infrastructure. The assessments shall include the cost to procure, implement, manage and maintain the enhancement. The assessments shall also address the return on investment and any impacts to the IT security of the existing system including any changes to the risk assessment and the contingency planning of the system.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPD 2800.4	JSC Information Technology (IT) Program Management	03-01
JPG 2800.3	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
SOP-001.31	Technical Requirements for Structural Engineering	Current
SOP-001.32	Operating Plan for Structural Engineering	Current

c. **Required DRDs**

5.4.1 Engineering Analysis of Division IT Infrastructure and Enhancements Implementation

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Once
105	Regular Status Report/Summary Review	Monthly
218	Engineering Analysis	1

d. **Products**

5.4.1 Engineering Analysis of Division IT Infrastructure and Enhancements Implementation

Product(s)	Quantity	Delivery Date
Engineering Analysis of Division IT Infrastructure and Implementation of Enhancements	One per PD	Per ES-TM-393
Status Report(s)/Summaries	One per Month	Per ES-TM-393
Project Schedule	One per PD	Per ES-TM-393

e. **Product Verification**

5.4.1 Engineering Analysis of Division IT Infrastructure and Enhancements Implementation

i. Engineering Analysis of Division IT Infrastructure and Implementation of Enhancements

- - Acceptance /review by the NASA Technical Manager (TM)

ii. Status Report(s)/Summaries

- - Acceptance /review by the NASA Technical Manager (TM)

iii. Project Schedule

- - Acceptance /review by the NASA Technical Manager (TM)

6.0 Cost Summary

DO 393 Summary					
SLC		**CY6**	**CY7**	**CY8**	**Grand Total**
AS2					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
IT3					
	Sum of Hrs				
	Sum of Dollars				
EN2					
	Sum of Hrs				
	Sum of Dollars				
IT4					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**$1,162,997.19**

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HE56D DO 394	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 10/01/2010-01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: Ronald Johnson Date: 09/30/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ES2 Structures Branch Services					
DO	**394**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$2,687,367

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ10HE56D-DO394 BP1

Originator: Gregory Galbreath (ES2) (281) 483-1270 **TMR:** Rhonda Moore (ES) (281) 483-5282

1. Title of Effort: ES2 Structures Branch Services

2. Date of Request: 09/13/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

e. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

f. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of perfomance starts 10/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Structural Engineering Products and Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering analyses, related to vehicle structures, in accordance with the requirements of SOP-001.31. Products and services shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.1.1 Same as 5.1
Project Code: None

Requirements same as 5.1.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
SSP 30558	Fracture Control Requirements for Space Station	Rev C 11-01
SSP 30559	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01
SSP 50431	Space Station Program Requirements for Payloads	Rev A 06-01
CxP 70135	Structural Design and Verification Requirements Document	4
CxP 70136	Constellation Program Loads Data Book	Baseline
CxP 70137	Constellation Program Loads Control Plan	Revision A
JSC 62550	Strength Design and Verification Criteria for Glass	Baseline
NASA-STD-5017	Design and Development Requirements for Mechanisms	Baseline
NASA-STD-5019	Fracture Control Requirements For Spaceflight Hardware	Baseline
Per ES-TM-394	Structures Project Schedule	Current
SOP-001.31	Technical Requirements for Structural Engineering	Current
SOP-001.32	Operating Plan for Structural Engineering	Current

c. **Required DRDs**

5.1.1 Same as 5.1

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
105	Regular Status Report/Summary Review	9
218	Engineering Analysis	2

d. **Products**

5.1.1 Same as 5.1

Product(s)	Quantity	Delivery Date
Technical Status Reports/Summaries	9	Per ES-TM-394
Engineering Analysis Reports	2	Per ES-TM-394

e. **Product Verification**

5.1.1 Same as 5.1

i. Technical Status Reports/Summaries

- Review of deliverables by the ES2 structures system manager

ii. Engineering Analysis Reports

- Review of deliverables by the ES2 structures system manager

5.2 Structural Engineering Products and Services for Spacecraft

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering designs and analyses related to spacecraft, in accordance with the requirements of SOP-001.31. Products and services shall be planned and delivered in accordance

with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.2.1 Structural Engineering Products and Services for Spacecraft
Project Code: None

Requirements same as 5.2.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
SSP 30558	Fracture Control Requirements for Space Station	Rev C 11-01
SSP 30559	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01
SSP 50431	Space Station Program Requirements for Payloads	Rev A 06-01
CxP 70135	Structural Design and Verification Requirements Document	4
CxP 70136	Constellation Program Loads Data Book	Baseline
CxP 70137	Constellation Program Loads Control Plan	Revision A
ES-TM-394	Structures Project Schedule	Current+
ES2-05-BR-003	Review of GCAR Work Guide	Original
NASA-STD-5017	Design and Development Requirements for Mechanisms	Baseline
NASA-STD-5019	Fracture Control Requirements For Spaceflight Hardware	Baseline
SOP-001.31	Technical Requirements for Structural Engineering	Current
SOP-001.32	Operating Plan for Structural Engineering	Current

c. **Required DRDs**

5.2.1 Structural Engineering Products and Services for Spacecraft		
DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
105	Regular Status Report/Summary Review	18
218	Engineering Analysis	6

d. **Products**

5.2.1 Structural Engineering Products and Services for Spacecraft		
Product(s)	Quantity	Delivery Date
Technical Status Reports/Summaries	18	Per ES-TM-394
Engineering Analysis Reports	6	Per ES-TM-394

e. **Product Verification**

5.2.1 Structural Engineering Products and Services for Spacecraft
i. Technical Status Reports/Summaries
- Review of deliverables by the ES2 structures system manager
ii. Engineering Analysis Reports
- Review of deliverables by the ES2 structures system manager

5.3 Payload Structural Safety Assessments

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide structural safety assessments related to vehicle payloads in accordance with the requirements of SOP-001.31. Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.3.1 Payload Structural Safety Assessments
Project Code: None

Requirements same as 5.1.

b. **Applicable Documents**

Document Number	Document Name	Rev.
NSTS 13830	Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station	Rev C change 4 01-02
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
ES-TM-394	Structures Project Schedule	Current
SOP-001.31	Technical Requirements for Structural Engineering	Current
SOP-001.32	Operating Plan for Structural Engineering	Current

c. **Required DRDs**

5.3.1 Payload Structural Safety Assessments

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	7

d. **Products**

5.3.1 Payload Structural Safety Assessments

Product(s)	Quantity	Delivery Date
Payload Structural Safety Engineering Assessments	7	4 weeks after end of reporting period

e. **Product Verification**

5.3.1 Payload Structural Safety Assessments

i. Payload Structural Safety Engineering Assessments

- ES2 Branch Acceptance of Payload Structural Safety Engineering Assessment and NASA approval in DDMS of Delivery/Acceptance Report

5.4 Inflatable and Expandable Structures Design and Analysis

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall develop design concepts which lead to a final design, and provide design and analysis data, assembly drawings and design analysis reports, in accordance with requirements of SOP-001.31.

The contractor shall provide engineering drawings for inflatable structures resraint layer, structural fabric layer, and structural bladder. Products and services shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.4.1 Inflatable and Expandable Structures Design and Analysis
Project Code: None

Requirements same as 5.4.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ES-TM-394	Structures Project Schedule	Current

NASA SP-8077	Transportation and Handling Loads	Current
SOP-001.31	Technical Requirements for Structural Engineering	Current
SOP-001.32	Operating Plan for Structural Engineering	Current
SOP-010.1	ES Inflatable Module Development Plan	Current

c. **Required DRDs**

5.4.1 Inflatable and Expandable Structures Design and Analysis

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	3
102	Engineering Drawings and Model Files	3
218	Engineering Analysis	3

d. **Products**

5.4.1 Inflatable and Expandable Structures Design and Analysis

Product(s)	Quantity	Delivery Date
Assembly and Detailed Drawing Package	3	Per ES-TM-394
Design/Analysis Report	3	Per ES-TM-394

e. **Product Verification**

5.4.1 Inflatable and Expandable Structures Design and Analysis

i. Assembly and Detailed Drawing Package

- Acceptance review by NASA/ES2 Project Manager

ii. Design/Analysis Report

- Acceptance review by NASA/ES2 Project Manager

6.0 Cost Summary

DO 394 Summary		Contract Year			
SLC		CY6	CY7	CY8	**Grand Total**
AS2					
	Sum of Hrs				
	Sum of Dollars				
EN2					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
EN1					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**2,687,367**

64

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HE57D DO 395 Rev. 1

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2010-09/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: Ronald Johnson Date: 12/16/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Test and Integration Services					
DO	395 R1					
	Est. Labor Costs	64				
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				64	
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$2,998,719

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ10HE57D-DO395 REV. 1

Originator: Sharon Marston (EV) (281) 483-2256 **TMR:** Cordelia Foster (EV) (281) 483-5265

Revision Summary:
Reduce ESTL Scope in DO 395 due to change in priorities.

1. Title of Effort: Test and Integration Services

2. Date of Request: 10/28/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

d. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

e. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 09/30/2011.

5. Product Requirements

5.1 Electronic Systems Test Laboratory Test Projects Updated REV. 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform communication systems test and verification, utilizing the Electronic Systems Test Laboratory (ESTL). Pre-test documentation shall be provided to support Test Readiness Review requirements. Post-test documentation shall consist of a Test Activity Summary or a Test Data Package and Summary, as required. The contractor shall provide the function of Test Conductor, interfacing between the NASA Test Director/Test Manager and all members of the Test Team. The contractor shall also provide the test engineering functions for the test control centers, communications distribution center, space loss simulation areas, and spacecraft systems areas. Testing shall be provided on a single-shift basis; extended hours past the single-shift will be supported on a short term basis only. Testing provided shall be based on 125 test days for FY11 (50% availability of the facility). Updated REV. 1

5.1.1 System and Network Performance Tests Updated REV. 1

Project Code: OV012

The contractor shall determine technical requirements for and conduct system and network performance testing for the Electronic Systems Test Laboratory. Pre- and post-test documentation shall be in accordance with the ESTL General Operating Procedure, ESTL SOP 001 and shall be delivered for the following number of tests:

For FY11:

Short notice tests such as Mission Anomalies: 1+/-1

Routine, often run tests such as Verification/Validation Tests: 5+/-1

Simple but formal tests such as OCA or Goddard Pallet Testing: 2+/-1

Complex formal tests such as ODAR or CEV System Testing: 1

The tests categories listed here are based on historical quantities. The mix and type of tests performed each FY shall be as indicated in the ESTL Quarterly Test Plan, ESTL TP 01, current revision, and shall be based on 125 test days for FY11 (50% availability).

b. **Applicable Documents**

Document Number	Document Name	Rev.
ESTL SOP 001	Electronic Systems Test Laboratory General Operating Procedure	Current
ESTL TP 01	Electronic Systems Test Laboratory Quarterly Test Plan	Current

c. **Required DRDs**

5.1.1 System and Network Performance Tests

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/Month
107	Test Report	1/Test

d. **Products**

5.1.1 System and Network Performance Tests

Product(s)	Quantity	Delivery Date
Performed Tests and Documentation Updated REV. 1	1 set/Test	Per ESTL TP 01, Current Revision
ESTL TP 001 Electronic Systems Test Laboratory Quarterly Test Plan - Revision	1/Quarter	December, March, July, September

e. **Product Verification**

5.1.1 System and Network Performance Tests

i. Performed Tests and Documentation

- Review and approval by Technical Monitor of Performed Tests Memoranda
ii. ESTL TP 001 Electronic Systems Test Laboratory Quarterly Test Plan - Revision
- Review and approval by Technical Monitor of ESTL TP 01

5.2 Electronic Systems Test Laboratory Special Test Equipment and Fixture Development

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall design, develop,test, and deliver special test equipment and test fixtures for the Electronic Systems Test Laboratory, Avionic Systems Division. These developments are for laboratory use only.

5.2.1 Electronic Systems Test Laboratory Special Test Equipment and Fixture Development
Project Code: OV012

The contractor shall design, develop, fabricate, test, document and deliver special test equipment and test fixtures in accordance with ESTL DP 01, Electronic Systems Test Laboratory Special Test Equipment and Fixture Development Plan.

5.2.2 Special Test Equipment and Fixture Development Plan
Project Code: OV012

The contractor shall develop technical requirements for special test equipment and fixtures, and deliver quarterly updates to the ESTL Special Test Equipment and Fixture Development Plan, ESTL DP 01.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ESTL DP 01	Electronic Systems Test Laboratory Special Test Equipment and Fixture Development Plan	Current
ESTL SOP 01	Electronic Systems Test Laboratory General Operating Procedure	Current

c. **Required DRDs**

5.2.1 Electronic Systems Test Laboratory Special Test Equipment and Fixture Development

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	1 Set Each
105	Regular Status Report/Summary Review	1/Month

5.2.2 Special Test Equipment and Fixture Development Plan

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/Month

d. **Products**

5.2.1 Electronic Systems Test Laboratory Special Test Equipment and Fixture Development

Product(s)	Quantity	Delivery Date
Special Test Equipment and Test Fixtures	per ESTL DP 01	per ESTL DP 01 Current Revision
Special Test Equipment and Test Fixture Acceptance Test Data	1 set/Project	per ESTL DP 01 Current Revision
Special Test Equipment and Test Fixture Documentation	1 set/Project	per ESTL DP 01 Current Revision

5.2.2 Special Test Equipment and Fixture Development Plan

Product(s)	Quantity	Delivery Date
ESTL Special Test Equipment and Fixture Development Plan - Revision	1/Quarter	December, March,June, September

e. **Product Verification**

5.2.1 Electronic Systems Test Laboratory Special Test Equipment and Fixture Development
i. Special Test Equipment and Test Fixtures
- Review and Acceptance by Technical Monitor
ii. Special Test Equipment and Test Fixture Acceptance Test Data
- Review and Acceptance by Technical Monitor
iii. Special Test Equipment and Test Fixture Documentation
- Review and Acceptance by Technical Monitor

5.2.2 Special Test Equipment and Fixture Development Plan
i. ESTL Special Test Equipment and Fixture Development Plan - Revision
- Review and Acceptance by Technical Monitor

5.3 Calibrate Shuttle Inertial Measurement Units in the Inertial Systems Laboratory

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall conduct Periodic Calibration Sequences (PCS) and Verification and Calibration Sequences (VACS) on space shuttle High Accuracy Inertial Navigation Systems (HAINS) in the Inertial Systems Laboratory (ISL).

A PCS is required on each spare HAINS unit every six months. A VACS is required on any HAINS unit being returned to spare status after repairs or modification at the vendor (Kearfott). These tests shall verify that internal parameter compensations are valid and that overall performance meets shuttle requirements.

New parameter compensations shall be written to the HAINS internal memory, if required. Test data shall be analyzed, and a test sequence datapack and post test report shall be published. The datapack shall contain all of the test data results and associated test sequence documentation. This report shall summarize the HAINS unit's performance, and assess its viability as a flight spare.

The NASA Subtask Technical Monitor and contractor Project Manager shall maintain a Master Schedule for these calibrations. Changes to this schedule may be made by their mutual consent. Test reports shall be due 5 weeks after calibration sequences are completed.

5.3.1 Perform three Periodic Calibration Sequences
Project Code:

The contractor shall perform all Periodic Calibrations, to include: HAINS 207-Dec 2010, HAINS 212-Mar 2011, and HAINS 207-May 2011. If spare units are changed with those on shuttle vehicles, the serial numbers and dates may change. Reasonable adjustments to accommodate these changes will be made if necessary.

5.3.2 Perform one Verification and Calibration Sequence
Project Code:

The contractor shall perform a Verification and Calibration Sequences of HAINS 212 in Oct 2010. This date may be changed if necessary to accommodate changes in the scheduled delivery from Kearfott.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ANSI/ESD S20.20-1999	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)	1999 05-99
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
NT-CWI-003	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01
EV3-ISL-EOL-S01	ISL/EOL Master Schedule	Current

c. **Required DRDs**

5.3.1 Perform three Periodic Calibration Sequences

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 updated as required
107	Test Report	1 per calibration

5.3.2 Perform one Verification and Calibration Sequence		
DRD #	**DRD Title**	**Quantity/Frequency**
101	Project Schedule	1 updated as required
107	Test Report	1 per calibration

d. **Products**

5.3.1 Perform three Periodic Calibration Sequences		
Product(s)	**Quantity**	**Delivery Date**
PCS Test Report	3	Per Master Schedule EV3-ISL-EOL-S01
PCS Datapack	3	Per Master Schedule EV3-ISL-EOL-S01
Hangar Calibration A (HCA) Comparison File	3	Per Master Schedule EV3-ISL-EOL-S01

5.3.2 Perform one Verification and Calibration Sequence		
Product(s)	**Quantity**	**Delivery Date**
VACS Test Report	1	Per Master Schedule EV3-ISL-EOL-S01
VACS Datapack	1	Per Master Schedule EV3-ISL-EOL-S01
I-Load Auditpack	1	Per Master Schedule EV3-ISL-EOL-S01
CADS compensation files creation	1	Per Master Schedule EV3-ISL-EOL-S01

e. **Product Verification**

5.3.1 Perform three Periodic Calibration Sequences
i. PCS Test Report
- The NASA Subtask Technical Monitor will review the Test Report.
ii. PCS Datapack
- A transmittal memo will be sent to the NASA Subtask Technical Monitor indicating completion of the product.
iii. Hangar Calibration A (HCA) Comparison File
- A transmittal memo will be sent to the NASA Subtask Technical Monitor indicating completion of the product.

5.3.2 Perform one Verification and Calibration Sequence
i. VACS Test Report
- The NASA Subtask Technical Monitor will review the Test Report.
ii. VACS Datapack
- A transmittal memo will be sent to the NASA Subtask Technical Monitor indicating completion of the product.
iii. I-Load Auditpack
- A transmittal memo will be sent to the NASA Subtask Technical Monitor indicating completion of the product.
iv. CADS compensation files creation
- A transmittal memo will be sent to the NASA Subtask Technical Monitor indicating completion of the product.

5.4 Assess Calibrations of Inertial Measurement Units at the Kennedy Space Center

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall assess ground calibrations of IMU's at KSC. These calibrations are performed every 6 months at the KSC. Calibrations are also performed when spare IMU's are first installed on a vehicle, as a part of the Terminal Countdown Demonstration Test (TCDT), immediately before each launch, and as required for troubleshooting problems. Contractor shall prepare a calibration comparison values report based on previous IMU performance before the calibration, monitor and collect telemetry data from these tests, analyze this data to identify any trends which may indicate problems with the unit, archive the data for future reference, and publish a report summarizing this analysis.

5.4.1 Assess KSC IMU Calibrations
Project Code:

Assess ground calibrations of IMU's at the KSC. This includes creating I-Loads for the Inertial Reference and Alignment Monitoring System (IRAMS) used both at KSC and JSC, creating prediction calibration values, conducting post-calibration analyses, and preparing post-calibration performance analysis reports necessary to ensure that the HAINS are flight worthy and capable of supporting subsequent missions. These tests will be conducted as determined by the KSC operations and launch schedules.

b. **Applicable Documents**

Document Number	Document Name	Rev.
OB-MER-006	MER Handbook	Draft 07-00

c. **Required DRDs**

5.4.1 Assess KSC IMU Calibrations

DRD #	DRD Title	Quantity/Frequency
107	Test Report	due 5 weeks after each calibration

d. **Products**

5.4.1 Assess KSC IMU Calibrations

Product(s)	Quantity	Delivery Date
Test Report	1 per calibration	due 5 weeks after each calibration
IRAMS ILoads	1 set per calibration	due before calibration starts
Prediction calibration values	1 set per calibration	due before calibration starts

e. **Product Verification**

5.4.1 Assess KSC IMU Calibrations

i. Test Report

- NASA Technical Monitor will review the Test Report

ii. IRAMS ILoads

- Satisfactory operation of the IRAMS program will be observed by the NASA Technical Monitor

iii. Prediction calibration values

- NASA Technical Monitor will review the delivery memo

5.5 Shuttle IMU Flight Assessments

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services for space shuttle flights, which shall include preparations made before each flight, and real time operations in the Mission Evaluation Room (MER). A post test report shall be prepared summarizing IMU performance and issues.

5.5.1 Preflight Preparations
Project Code:

The contractor shall prepare a preflight memorandum summarizing the history, technical concerns, predicted calibration values, recommendations for Group B power down candidates, and possible compensation uplinks of the IMU's being flown. The contractor shall conduct a preflight teleconference shall be conducted to review this memorandum with KSC and JSC operators. I-Loads for the IRAMS system shall be prepared.

5.5.2 In flight Performance
Project Code:

The contractor shall operate the IRAMS console in the Mission Evaluation Room (MER) prelaunch, for entry, and whenever needed to provide resolution of IMU problems. During normal orbit operations, status shall be checked daily to insure IMU performance is nominal.

The contractor shall operate the IRAMS system prelaunch, and make recommendations to the IMU Subsystem Manager, IMU NASA Subsystem Engineer, and the MER management on the readiness of the IMU's to support launch. The contractor shall perform engineering analysis on any IMU anomalies occurring during the flight. A post flight report shall be prepared describing the IMU performance, and analyzing any anomalies which occurred.

b. **Applicable Documents**

Document Number	Document Name	Rev.
OB-MER-006	MER Handbook	Draft 07-00

c. **Required DRDs**

5.5.1 Preflight Preparations

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	1/Flight

5.5.2 In flight Performance

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1/Flight

d. **Products**

5.5.1 Preflight Preparations

Product(s)	Quantity	Delivery Date
IRAMS ILOADS	1/Flight	L - 7 days
Pre flight memorandum	1/Flight	L - 7 days

5.5.2 In flight Performance

Product(s)	Quantity	Delivery Date
Real Time verbal and written inputs in the MER	as required	L- 8 hours thru Landing
Post-flight report	1/Flight	within 5 weeks of landing

e. **Product Verification**

5.5.1 Preflight Preparations

i. IRAMS ILOADS

- Satisfactory IRAMS performance will be determined by the NASA technical monitor

ii. Pre flight memorandum

- Review by NASA Technical Monitor

5.5.2 In flight Performance

i. Real Time verbal and written inputs in the MER

- Review by NASA Technical Monitor

ii. Post-flight report

- Review by NASA Technical Monitor

5.6 Provide Star Tracker Assessments for Shuttle Flights

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services for the star tracker during Space Shuttle flights. This shall include regularly assessing star tracker performance, and assisting in investigating any anomalies. Data shall be reviewed after each mission, to identify any performance issues which might have been missed.

5.6.1 Post flight report
Project Code:

The contractor shall prepare a post flight report describing any anomalies or performance issues.

b. **Applicable Documents**

Document Number	Document Name	Rev.
OB-MER-006	MER Handbook	Draft 07-00

c. **Required DRDs**

5.6.1 Post flight report

DRD #	DRD Title	Quantity/Frequency
107	Test Report	1/Flight

d. **Products**

5.6.1 Post flight report

Product(s)	Quantity	Delivery Date
Post Flight Report	1/Flight	5 weeks after landing

e. **Product Verification**

5.6.1 Post flight report

i. Post Flight Report

- NASA Technical Monitor Acceptance

5.7 Perform Star Tracker Performance Evaluations in the Electro Optics Laboratory

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall characterize the performance of star trackers and verify that they meet shuttle requirements for accuracy and sensitivity.

5.7.1 Perform performance evaluations for star tracker serial number 006
Project Code:

Boeing has requested that the EOL evaluate the performance of Image Dissector Tube (IDT) Tracker serial number 6. The contractor shall perform this evaluation when this tracker is delivered for test, which is expected to occur in the last quarter of FY10. The contractor shall evaluate its performance against the expectations expressed in STS 83-0014V2-30 Star Tracker SOP, section 4.66.1.1.1.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ANSI/ESD S20.20-1999	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)	1999 05-99
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
NT-CWI-003	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01

c. **Required DRDs**

5.7.1 Perform performance evaluations for star tracker serial number 006

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
107	Test Report	1

d. **Products**

5.7.1 Perform performance evaluations for star tracker serial number 006

Product(s)	Quantity	Delivery Date
Test Report	1	5 weeks after test

e. **Product Verification**

5.7.1 Perform performance evaluations for star tracker serial number 006
i. Test Report
- The NASA Technical Monitor will review the Test Report

5.8 ESTL Stand Alone Laboratory Network Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide system services to ESTL stand alone Laboratory Networks.

5.8.1 ESTL Stand Alone Laboratory Network Services
Project Code: OV012

The contractor shall provide ESTL stand alone network systems used for special test applications.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ESTL SOP 01	Electronic Systems Test Laboratory General Operating Procedure	Current

c. **Required DRDs**

5.8.1 ESTL Stand Alone Laboratory Network Services		
DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/Month

d. **Products**

5.8.1 ESTL Stand Alone Laboratory Network Services		
Product(s)	Quantity	Delivery Date
Summary of Network Services	1/Month	as part of DRD 105 Regular Status Report

e. **Product Verification**

5.8.1 ESTL Stand Alone Laboratory Network Services
i. Summary of Network Services
- Review and acceptance by Technical Monitor

6.0 Cost Summary and Revision History:

DO 395 R1 Summary				
SLC		CY6	CY7	**Grand Total**
AS1				
	Sum of Hrs			
	Sum of Dollars			
AS2				
	Sum of Hrs			
	Sum of Dollars			
BS1				
	Sum of Hrs			
	Sum of Dollars			
EN1				
	Sum of Hrs			
	Sum of Dollars			
EN2				
	Sum of Hrs			
	Sum of Dollars			
EN3				
	Sum of Hrs			
	Sum of Dollars			
EN4				
	Sum of Hrs			
	Sum of Dollars			
ESS				
	Sum of Hrs			
	Sum of Dollars			
ET3				
	Sum of Hrs			
	Sum of Dollars			
PAM				
	Sum of Hrs			
	Sum of Dollars			
QA1				
	Sum of Hrs			
	Sum of Dollars			
QA2				
	Sum of Hrs			
	Sum of Dollars			
QE1				
	Sum of Hrs			
	Sum of Dollars			

64

QE2	
Sum of Hrs	
Sum of Dollars	
SE	
Sum of Hrs	
Sum of Dollars	
TN1	
Sum of Hrs	
Sum of Dollars	
TN2	
Sum of Hrs	
Sum of Dollars	
TN3	
Sum of Hrs	
Sum of Dollars	
ZP0	
Sum of Hrs	
Sum of Dollars	
IT3	
Sum of Hrs	
Sum of Dollars	
IT4	
Sum of Hrs	
Sum of Dollars	
MGR	
Sum of Hrs	
Sum of Dollars	
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**2,998,719**

64

Revision History:

DO 395 revision history	Total cost	Reason for revision
Original	$3,576,644	New proposal
Rev 1	$2,998,719	Changed the following in Section 5.1: Reduced test days for FY11 from 200 to 125 and facility availability from 80% to 50%. Reduced Short notice tests such as Mission Anomalies: From 3 +/- 2 to 1+/-1 Reduced Routine, often run tests such as Verification/Validation Tests: from 10 +/- 2 to 5+/-1 Reduced Simple but formal tests such as OCA or Goddard Pallet Testing: from 8 +/- 2 to 2+/-1 Reduced complex formal tests such as ODAR or CEV System Testing: from 1 +/- 1 to 1 Reduced test days and lab availability requirements: from 200 test days, 80% availability to 125 test days, 50% availability.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HC88D DO 396	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi J. Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 09/28/2010-01/30/2013

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Ronald Johnson**

Signtature: **Ronald Johnson** Date: 09/29/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ES6 Loads &Structural Dynamics Branch Services					
DO	**396**					
	Est. Labor Costs	b4			b4	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$3,675,427

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

JSC Form 1429 (Rev November 10, 2004) (MSword August 1995)

Engineering and Science Contract

NNJ10HC88D-DO396

Originator: Jeffrey Loechel (ES) (281) 483-0275 **TMR:** Rhonda Moore (ES) (281) 483-5282

1. Title of Effort: ES6 Loads and Structural Dynamics Branch Services

2. Date of Request: 09/09/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

d. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

e. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

f. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

g. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

h. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

i. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

This delivery order period of perfomance starts 09/28/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Structures Working Group Engineering Assessments

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide structural engineering assessments for the loads, dynamics and structural integrity of SSP payloads, in accordance with the requirements of SOP-001.31.

5.1.1 Structures Working Group Engineering Assessments

Project Code: None.

Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

b. **Applicable Documents**

Document Number	Document Name	Rev.
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
NSTS 37329	Structural Integration Analysis Responsibility Definition for Space Shuttle Vehicle and Cargo Element Developers	Rev B Change 2 12-01
NSTS 07700, Vol. II, Book 2	SSP Directive No. 149, SSP Cargo Integration Structures Working Group	
NSTS 08178	Space Shuttle Program Monthly Schedules Document	
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.1.1 Structures Working Group Engineering Assessments

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
105	Regular Status Report/Summary Review	Monthly
218	Engineering Analysis	1 per assessment

d. **Products**

5.1.1 Structures Working Group Engineering Assessments

Product(s)	Quantity	Delivery Date
Project Schedule	1	11/15/2010
Monthly Status Report	9	4 weeks after end of reporting period.
Accurate Structural Engineering Assessments	1 per assessment	7/1/2011

e. **Product Verification**

5.1.1 Structures Working Group Engineering Assessments

i. Project Schedule

- Review of deliverables by NASA technical manager.

ii. Monthly Status Report

- Review of deliverables by NASA technical manager.

iii. Accurate Structural Engineering Assessments

- Review of deliverables by NASA technical manager.

5.2 ISS On-Orbit Loads and Dynamics Engineering

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide vehicle loads and dynamics engineering assessments for the ISS for SSP and/or other visiting vehicles during on-orbit operations, in accordance with the requirements of SOP-001.31.

5.2.1 ISS On-Orbit Loads and Dynamics Engineering
Project Code: None

Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

b. **Applicable Documents**

Document Number	Document Name	Rev.
OB-MER-006	MER Handbook	Draft 07-00
SSP 30559	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01
2-HEC-ES-2CX-109	US Photo Voltaic Array Keep Out Zones and Feathering Angles for the Updated Orbiter VBAR Approach and Separation Jet Firing History Databases	Original / 07-02
ES-TM-396	Loads and Structural Dynamics Project Schedule	current
ICD-A-21546-OOR	Mission ISS-17A Orbiter/ISS Interface Requirements	-0001 / 07-09
JSC-64804	International Space Station (ISS) VAC-17A Orbiter/ISS On-Orbit Loads Report - TDS VM.24.1-53 (17A)	Original / 07-09
NSTS-21000-IDD-ISS	Shuttle Orbiter/International Space Station Interface Definition Document	current
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.2.1 ISS On-Orbit Loads and Dynamics Engineering

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
102	Engineering Drawings and Model Files	One set per mission support
102	Engineering Drawings and Model Files	One set per full or partial VAC analysis
102	Engineering Drawings and Model Files	One set per post-flight analysis
218	Engineering Analysis	One set per mission support
218	Engineering Analysis	One set per full VAC
218	Engineering Analysis	One set per post-flight analysis

d. **Products**

5.2.1 ISS On-Orbit Loads and Dynamics Engineering

Product(s)	Quantity	Delivery Date
Project Schedule	1	10/30/2010
VAC Analysis: Includes interim memos and final report and final set of input model, script, and data files.	1	per ES-TM-396
VAC Analysis (Partial): Includes interim memos and set of input model, script, data files, and output.	2	per ES-TM-396
Mission Support Loads Assessments: Includes memo and set of input model, script, data-files, and output.	3	per ES-TM-396
ICD Inputs	2	per ES-TM-396
Post-Flight Data Delivery: Includes data-files and output files delivered on ECF.	3	per ES-TM-396
Analysis Tools: Includes input/output data and scripts, executables, and verification data files on ECF.	1	per ES-TM-396

e. **Product Verification**

5.2.1 ISS On-Orbit Loads and Dynamics Engineering

i. Project Schedule

- Review of deliverables by NASA technical manager.
ii. VAC Analysis: Includes interim memos and final report and final set of input model, script, and data files.
- Review of deliverables by NASA technical manager.
iii. VAC Analysis (Partial): Includes interim memos and set of input model, script, data files, and output.
- Review of deliverables by NASA technical manager.
iv. Mission Support Loads Assessments: Includes memo and set of input model, script, data-files, and output.
- Review of deliverables by NASA technical manager.
v. ICD Inputs
- Review of deliverables by NASA technical manager.
vi. Post-Flight Data Delivery: Includes data-files and output files delivered on ECF.
- Review of deliverables by NASA technical manager.
vii. Analysis Tools: Includes input/output data and scripts, executables, and verification data files on ECF.
- Review of deliverables by NASA technical manager.

5.3 Shuttle Structural Dynamics and Loads Panel Engineering Assessments

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide vehicle loads and dynamics engineering assessments for the Space Shuttle Structural Dynamics and Loads Panel (Loads Panel), in accordance with the requirements of SOP-001.31.

5.3.1 Shuttle Structural Dynamics and Loads Panel Engineering Assessments
Project Code: None

Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

b. **Applicable Documents**

Document Number	Document Name	Rev.
ES-TM-396	Loads and Structural Dynamics Project Schedule	current
NSTS 07700, Vol. II, Book 2	SSP Directive No. 25D, Space Shuttle Loads and Structural Dynamics Technical Management Area	July 1997
NSTS-08178	Space Shuttle Program Monthly Schedules Document	
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.3.1 Shuttle Structural Dynamics and Loads Panel Engineering Assessments

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
105	Regular Status Report/Summary Review	1
218	Engineering Analysis	Per ES-TM-396

d. **Products**

5.3.1 Shuttle Structural Dynamics and Loads Panel Engineering Assessments

Product(s)	Quantity	Delivery Date
Project Schedule	1	11/15/2011
Loads Panel Proceedings Documentation Package	1	7/1/2011
Structural Dynamics and Loads Panel Meeting Assessments	1 per assessment	Per ES-TM-396

e. **Product Verification**

5.3.1 Shuttle Structural Dynamics and Loads Panel Engineering Assessments

i. Project Schedule

- Review of deliverables by NASA technical manager.
ii. Loads Panel Proceedings Documentation Package
- Review of deliverables by NASA technical manager.
iii. Structural Dynamics and Loads Panel Meeting Assessments
- Review of deliverables by NASA technical manager.

5.4 Structural and Loads Engineering Assessments for Technology Development

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering technical assessments for technology development, in accordance with the requirements of SOP-001.31.

5.4.1 Structural and Loads Engineering Assessments for Technology Development

Project Code: None

Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

Specific tasks shall be assigned by the technical manager through project directives.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
ES-TM-396	Loads and Structural Dynamics Project Schedule	current
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.4.1 Structural and Loads Engineering Assessments for Technology Development

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per GFY
105	Regular Status Report/Summary Review	4 per GFY

d. **Products**

5.4.1 Structural and Loads Engineering Assessments for Technology Development

Product(s)	Quantity	Delivery Date
Project Schedule	3	10/30/2010; 10/30/2011; 10/30/2012
Technical Status Reports/Summaries	9	Per ES-TM-396

e. **Product Verification**

5.4.1 Structural and Loads Engineering Assessments for Technology Development

i. Project Schedule
- Review of deliverables by NASA technical manager.
ii. Technical Status Reports/Summaries
- Review of deliverables by NASA technical manager.

5.5 Structural Systems Engineering and Test Analysis Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering assessments of loads environments, structural performance, and test data analysis for projects in accordance with the requirements of SOP-001.31.

5.5.1 Structural Systems Engineering and Test Analysis Services
Project Code: None

Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

Specific tasks shall be assigned by the technical manager through project directives.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ES-TM-396	Loads and Structural Dynamics Project Schedule	Current
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.5.1 Structural Systems Engineering and Test Analysis Services		
DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
218	Engineering Analysis	1

d. **Products**

5.5.1 Structural Systems Engineering and Test Analysis Services		
Product(s)	Quantity	Delivery Date
Project Schedule	1	11/15/2010
Engineering Analysis Report	1	Per ES-TM-396

e. **Product Verification**

5.5.1 Structural Systems Engineering and Test Analysis Services
i. Project Schedule
- Review of deliverables by NASA technical manager.
ii. Engineering Analysis Report
- Review of deliverables by NASA technical manager.

5.6 Vibro-Acoustic Test Facility Products and Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide VATF dynamic test engineering services and products, in accordance with the requirements of SOP-001.31.

5.6.1 Vibro-Acoustic Test Facility Products and Services
Project Code: None

Activities shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

Specific tasks shall be assigned by the technical manager through project directives.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ES-TM-396	Loads and Structural Dynamics Project Schedule	current
SOP-001.31	Technical Requirements for Structural Engineering	current

SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.6.1 Vibro-Acoustic Test Facility Products and Services

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1 per Project Directive, iaw ES-TM-396

d. **Products**

5.6.1 Vibro-Acoustic Test Facility Products and Services

Product(s)	Quantity	Delivery Date
Project Schedule	1 per Project Directive	3 weeks following Project Directive approval, iaw ES-TM-396.

e. **Product Verification**

5.6.1 Vibro-Acoustic Test Facility Products and Services

i. Project Schedule

- Review of deliverables by NASA technical manager.

5.7 Loads and Dynamics Engineering Services for Spacecraft

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide loads and dynamics engineering for spacecraft projects, in accordance with the requirements of SOP-001.31.

5.7.1 Loads and Dynamics Engineering Services for Spacecraft

Project Code: None.

Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

b. **Applicable Documents**

Document Number	Document Name	Rev.
ES-TM-396	Loads and Structural Dynamics Project Schedule	current
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.7.1 Loads and Dynamics Engineering Services for Spacecraft

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
105	Regular Status Report/Summary Review	9
218	Engineering Analysis	2

d. **Products**

5.7.1 Loads and Dynamics Engineering Services for Spacecraft

Product(s)	Quantity	Delivery Date
Project Schedule	1	11/15/2010
Technical Status Reports/Summaries	9	Per ES-TM-396
Engineering Analysis Reports	2	Per ES-TM-396

e. **Product Verification**

5.7.1 Loads and Dynamics Engineering Services for Spacecraft
i. Project Schedule
- Review of deliverables by NASA technical manager.
ii. Technical Status Reports/Summaries
- Review of deliverables by NASA technical manager.
iii. Engineering Analysis Reports
- Review of deliverables by NASA technical manager.

5.8 Expert Consultant Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide expert consultant services, in accordance with the requirements of SOP-001.31.

5.8.1 Expert Consultant Services

Project Code: None.

Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

b. **Applicable Documents**

Document Number	Document Name	Rev.
ES-TM-396	Loads and Structural Dynamics Project Schedule	current
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.8.1 Expert Consultant Services		
DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
105	Regular Status Report/Summary Review	9

d. **Products**

5.8.1 Expert Consultant Services		
Product(s)	Quantity	Delivery Date
Project Schedule	1	11/15/2010
Technical Status Reports/Summaries	9	Per ES-TM-396

e. **Product Verification**

5.8.1 Expert Consultant Services
i. Project Schedule
- Review of deliverables by NASA technical manager.
ii. Technical Status Reports/Summaries
- Review of deliverables by NASA technical manager.

6.0 Cost Summary

DO 396 Summary		Contract Year			
SLC		CY6	CY7	CY8	**Grand**
AS2					
	Sum of Hrs				
	Sum of Dollars				
EN1					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
PC2					
	Sum of Hrs				
	Sum of Dollars				
IT3					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
BS2					
	Sum of Hrs				
	Sum of Dollars				
BS1					
	Sum of Hrs				
	Sum of Dollars				
TN3					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					3,675,427

b4

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HE58D DO 397

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Miyoshi Thompson
Tel. No.: (281) 244-1683 FAX: (281) 244-5331
E-Mail: miyoshi.thompson-1@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2010-01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall
Signature: _____ Date: _____

10. Name: **Ronald Johnson**
Signtature: Ronald Johnson Date: 09/30/2010
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ES4 Materials and Processes Branch Services					
DO	397					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$3,897,461

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ10HE58D-DO397 BP1

Originator: Bradley Files (ES4) (281) 483-5967 **TMR:** Rhonda Moore (ES) (281) 483-5282

1. Title of Effort: ES4 Materials and Processes Branch Services

2. Date of Request: 09/10/2010

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

d. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

e. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

f. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

g. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

h. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

i. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

j. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Space Shuttle and International Space Station Materials and Fracture Control

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide Material & Process (M&P) and fracture control assessments for the ISS and SSP Programs, in accordance with the requirements of SOP-001.31. These assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.1.1 Space Shuttle and International Space Station Materials and Fracture Control

Project Code: None

Requirements same as 5.1

b. **Applicable Documents**

Document Number	Document Name	Rev.
NASA-STD-5003	Fracture Control Requirements for Payloads Using the Space Shuttle	10-96
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
ES-TM-397	Materials and Processes Project Schedule	Current
JSC 25863	Fracture Control Plan for JSC Spaceflight Hardware	B/April 2009
JSC 27301	Materials Control Plan for JSC Flight Hardware	F/August 2009
NASA-STD-5019	Fracture Control Requirements for Spaceflight Hardware	Baseline/January 2008
NASA-STD-6016	Standard Materials and Processes Requirements for Spacecraft	Baseline/July 2008
SE-R-0006	General Specification: Space shuttle System Requirements for Materials and processes	D/August 1998
SOP 007.5	Materials and Processes Drawing Approval	D/July 2009
SOP 007.6	Materials and Fracture Control Certification	C/July 2009
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current
SSP 30233	Space Station Requirements for Materials and Processes	G/November 2004
SSP 30558	Fracture Control Requirements for Space Station	Rev C 11-01
SSP 52005	ISS Payload Flight Equipment Requirements for Safety Critical Structures	C/December 2002

c. **Required DRDs**

5.1.1 Space Shuttle and International Space Station Materials and Fracture Control		
DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
218	Engineering Analysis	Monthly

d. **Products**

5.1.1 Space Shuttle and International Space Station Materials and Fracture Control		
Product(s)	Quantity	Delivery Date
Project Schedule	1	1 per GFY
Materials and Fracture Control Assessment Reports	28	per ES-TM-397

e. **Product Verification**

5.1.1 Space Shuttle and International Space Station Materials and Fracture Control
i. Project Schedule
- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.
ii. Materials and Fracture Control Assessment Reports
- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

5.2 Orion Materials and Fracture Control

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide Material & Process (M&P) and fracture control assessments for the CEV Program, in accordance with the requirements of SOP-001.31. These assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.2.1 Orion Materials and Fracture Control
Project Code: None

Requirements same as 5.2

b. **Applicable Documents**

Document Number	Document Name	Rev.
ES-TM-397	Materials and Processes Project Schedule	Current
JSC 25863	Fracture Control Plan for JSC Flight Hardware	B, 04/09
JSC 27301	Materials Control Plan for JSC Flight Hardware	E, 11-05
NASA-STD-6016	Standard Materials and processes Requirements for Spacecraft	Baseline
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current
SOP-007.5	Materials and Processes Drawing Approval	C, 07-09
SOP-007.6	Materials and Fracture Control Certification	C, 07-09

c. **Required DRDs**

5.2.1 Orion Materials and Fracture Control

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
218	Engineering Analysis	Monthly

d. **Products**

5.2.1 Orion Materials and Fracture Control

Product(s)	Quantity	Delivery Date
Project Schedule	1	1 per GFY
Materials and Fracture Control Assessment Reports	28	per ES-TM-397

e. **Product Verification**

5.2.1 Orion Materials and Fracture Control

i. Project Schedule

- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

ii. Materials and Fracture Control Assessment Reports

- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

5.3 Materials and Processes Projects

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide Material & Process (M&P) expertise to projects such as probability of detection analysis, and in-situ NDE. The contractor shall also provide M&P expertise to customers such as the U.S. Air Force, and Aircraft Operations at Ellington Field (EFD) in accordance with the requirements of SOP-001.31. Additionally, the contractor shall assess configuration and control plans for pressure vessels/systems (PV/S) in accordance with SOP-009.98. These assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.3.1 Materials and Processes Projects
Project Code: None

Requirements same as 5.3

b. **Applicable Documents**

Document Number	Document Name	Rev.
NASA-STD-5003	Fracture Control Requirements for Payloads Using the Space Shuttle	10-96
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
AOD 33890	WB-57 Users Guide	Baseline/Feb 2002
ES-TM-397	Materials and Processes Project Schedule	Current
JSC 25863	Fracture Control Plan for JSC Spaceflight Hardware	B/April 2009
JSC 27301	Materials Control Plan for JSC Flight Hardware	F/August 2009
MIL-HDBK-6870A	Inspection Program Requirements Nondestructive for Aircraft and Missile Materials and Parts	current
MSFC-HDBK-527/JSC 09604	Materials Selection List for Space Hardware Systems	F, 11-05
NASA-STD-5009	Nondestructive Evaluation Requirements for Fracture Control Programs	current
NASA-STD-5019	Fracture Control Requirements for Spaceflight Hardware	Baseline/January 2008
NASA-STD-6016	Standard Materials and Processes Requirements for Spacecraft	Baseline/July 2008
NASA/SP-2007-6105	NASA Systems Engineering Handbook	1/12-07
SE-R-0006	General Specification: Space Shuttle System Requirements for Materials and Processes	D/July 1998
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current
SOP-007.5	Materials and Processes Drawing Approval	D/July 2009
SOP-007.6	Materials and Fracture Control Certification	C/July 2009
SOP-009.98	Preparation of an Operation & Configuration Control Plan (OCCP) for Category B Pressure Vessels/Systems (PV/S)	Baseline/Jan 2010
SSP 30233	Materials and Processes Requirements for Space Station	G/11-04
SSP 30558	Fracture Control Requirements for Space Station	C, 11-01

c. **Required DRDs**

5.3.1 Materials and Processes Projects

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
218	Engineering Analysis	Monthly

d. **Products**

5.3.1 Materials and Processes Projects

Product(s)	Quantity	Delivery Date
Project Schedule	1	1 per GFY
Materials and Fracture Control Assessment Reports	28	per ES-TM-397

e. **Product Verification**

5.3.1 Materials and Processes Projects

i. Project Schedule

- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

ii. Materials and Fracture Control Assessment Reports

- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

5.4 Payload Safety Review Panel (PSRP) Materials and Fracture Control

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide Material & Process (M&P) and fracture control assessments for the ISS and SSP Program Payload Safety Review Panels (PSRP), in accordance with the requirements of SOP-001.31. These assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.4.1 Payload Safety Review Panel (PSRP) Materials and Fracture Control
Project Code: None

Requirements same as 5.4

b. **Applicable Documents**

Document Number	Document Name	Rev.
NASA-STD-5003	Fracture Control Requirements for Payloads Using the Space Shuttle	10-96
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
SSP 30558	Fracture Control Requirements for Space Station	Rev C 11-01
ES-TM-397	Materials and Processes Project Schedule	Current
JSC 25863	Fracture Control Plan for JSC Spaceflight Hardware	B/April 2009
JSC 27301	Maaterials Control Plan for JSC Flight Hardware	F/August 2009
MSFC-HDBK-527/JSC 09604	Materials Selection List for Space Hardware Systems	F/09-88
NASA-STD-5019	Fracture Control Requirements for Spaceflight Hardware	Baseline/Jan 2008
NASA-STD-6016	Standard Materials and Processes Requirements for Spacecraft	Baseline/July 2008
SE-R-0006	General Specification: Space Shuttle System Requirements for Materials and Processes	D/August 1998
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current
SOP-007.5	Materials and Processes Drawing Approval	D/July 2009
SOP-007.6	Materials and Fracture Control Certification	C/July 2009
SSP 30233	Space Station Requirements for Materials and Processes	G/November 2004
SSP 52005	ISS Payload Flight Equipment Requirements for Safety Critical Structures	C/December 2002

c. **Required DRDs**

5.4.1 Payload Safety Review Panel (PSRP) Materials and Fracture Control

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
218	Engineering Analysis	Monthly

d. **Products**

5.4.1 Payload Safety Review Panel (PSRP) Materials and Fracture Control

Product(s)	Quantity	Delivery Date
Project Schedule	1	1 per GFY
Materials and Fracture Control Assessment Reports	28	per ES-TM-397

e. **Product Verification**

5.4.1 Payload Safety Review Panel (PSRP) Materials and Fracture Control

i. Project Schedule

- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

ii. Materials and Fracture Control Assessment Reports

- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

5.5 EVA Materials and Fracture Control

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide material and process (M&P) assessments, and fracture control for Extravehicular Activity (EVA) hardware, in accordance with the requirements of SOP-001.31. M&P and fracture control activities shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.5.1 EVA Materials and Fracture Control
Project Code: None

Requirements same as 5.5

b. **Applicable Documents**

Document Number	Document Name	Rev.
NASA-STD-5003	Fracture Control Requirements for Payloads Using the Space Shuttle	10-96
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
SSP 30558	Fracture Control Requirements for Space Station	Rev C 11-01
ES-TM-397	Materials and Processes Project Schedule	Current
JSC 25863	Fracture Control Plan for JSC Spaceflight Hardware	B/April 2009
JSC 27301	Materials Control Plan for JSC Flight Hardware	F/August 2009
MSFC-HDBK-527/JSC 09604	Materials Selection List for Space Hardware Systems	F/09-88
NASA-STD-5019	Fracture Control Requirements for Spaceflight Hardware	Baseline/Jan 2008
NASA-STD-6016	Standard Materials and Processes Requirements for Spacecraft	Baseline/July 2008
NSTS 14046	Payload Verification Requirements	Rev E/08-02
SE-R-0006	General Specification: Space Shuttle System Requirements for Materials and Processes	D/July 1998
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current
SOP-007.5	Materials and Processes Drawing Approval	D/July 2009
SOP-007.6	Materials and Fracture Control Certification	C/July 2009
SSP 30233	Space Station Requirements for Materials and Processes	G/November 2004
SSP 52005	ISS Payload Flight Equipment Requirements for Safety Critical Structures	C/December 2002

c. **Required DRDs**

5.5.1 EVA Materials and Fracture Control

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
218	Engineering Analysis	Monthly

d. **Products**

5.5.1 EVA Materials and Fracture Control

Product(s)	Quantity	Delivery Date
Project Schedule	1	1 per GFY
Materials and Fracture Control Assessment Reports	28	per ES-TM-397

e. **Product Verification**

5.5.1 EVA Materials and Fracture Control

i. Project Schedule

- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

ii. Materials and Fracture Control Assessment Reports

- NASA DO Technical Monitor will review and accept completed products. NASA acceptance will be documented using DDMS.

5.6 Fracture Mechanics Software (NASGRO)

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall develop and maintain the fracture mechanics software NASGRO, in accordance with the requirements of SOP-001.31. NASGRO development and maintenance activities shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.6.1 Fracture Mechanics Software (NASGRO)

Project Code: None

Requirements same as 5.6

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
ES-TM-397	Materials and Processes Project Schedule	current
JSC 22267	Fatigue Crack Growth Computer Program NASGRO V 3.0	A
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.6.1 Fracture Mechanics Software (NASGRO)		
DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1
105	Regular Status Report/Summary Review	Quarterly
215	Software Code	1

d. **Products**

5.6.1 Fracture Mechanics Software (NASGRO)		
Product(s)	Quantity	Delivery Date
Project Schedule	1	1 per GFY
NASGRO and Fracture Mechanics Test Summary Report	9	per ES-TM-397
NASGRO Software Release (upgrades of NASBEM, NASFLA, and NASMAT modules)	2	per ES-TM-397

e. **Product Verification**

5.6.1 Fracture Mechanics Software (NASGRO)
i. Project Schedule
- NASA DO Technical Monitor will review and accept completed product. NASA acceptance will be documented using DDMS.
ii. NASGRO and Fracture Mechanics Test Summary Report
- NASA DO Technical Monitor will review and accept completed product. NASA acceptance will be documented using DDMS.
iii. NASGRO Software Release (upgrades of NASBEM, NASFLA, and NASMAT modules)
- NASA DO Technical Monitor will review and accept completed product. NASA acceptance will be documented using DDMS.

6.0 Cost Summary

DO 397 Summary		Contract Year			
SLC		CY6	CY7	CY8	**Grand Total**
AS2					
	Sum of Hrs				
	Sum of Dollars				
EN1					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
MGR					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
SC3					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**3,897,461**

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HE61D DO 398 Rev 2

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2010-01/31/2013

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: 10/05/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	GFE Design & Sustaining Engineering					
DO	**398 Rev 2**					
	Est. Labor Costs	64			64	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$8,778,721.71

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ10HE61D-DO398 REV 2

Originator: Keith Grimm (EV) (281) 483-1532 **TMR:** Cordelia Foster (EV) (281) 483-5265

Revision Summary:
Change DO to close old work, add new work, and revise continuing work for FY12.

1. Title of Effort: GFE Design & Sustaining Engineering

2. Date of Request: 09/22/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

e. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

f. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

g. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

h. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

i. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

j. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Government Furnished Equipment (GFE) Design/Development & Sustaining Engineering Products Updated Rev 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform the sustaining engineering and new development/certification as applicable related to the following subsystems:

5.1.1 SSP Wing Leading Edge Impact Detection System (WLEIDS)Sustaining Engineering
5.1.2 ISS Internal Wireless Instrumentation System (IWIS) & External Wireless Instrumentation System (EWIS)Sustaining Engineering and Spares Certification
5.1.3 SSP Main Engine Ignition Instrumentation (MEII)Sustaining Engineering
5.1.4 Ultrasonic Background Noise Test Development (UBNT) Station Test Objective (SDTO)
5.1.5 SSP Integrated Sensor Inspection System Sensor Package 1 & 2
5.1.6 ISS GFE Sustaining
5.1.7 SSP GFE Sustaining
5.1.8 SSP PGSC and Laptop Sustaining
5.1.9 ISS Advanced Radiation Instrumentation (Intra-Vehicular Tissue Equivalent Proportional Counter (IV-TEPC))
5.1.10 Payload Safety in Avionics
5.1.11 ISS GPS Antenna Spares Fabrication & Test

Note: DRD 105 for all specific product requirements will be met by submission of NASA format "Quad Chart" reporting. Updated Rev 1

5.1.1 SSP Wing Leading Edge Impact Detection System (WLEIDS) Sustaining Engineering Updated REV 2
Project Code: 1S901

The contractor shall provide the sustaining engineering related to the Space Shuttle WLEIDS wireless sensors and associated hardware. This sustaining engineering includes environmental and workmanship acceptance testing of the WLEIDS spare sensors units and preparing them for flight, Shuttle flight mission operations console support, including on-board data retrieval, anomaly resolution and analysis of in-flight data, providing technical representation for hardware assessments, analysis expertise, and administrative expertise to the Wireless Problem Resolution Team (PRT) meetings and executing action requests for hardware assessments and analysis.

Additional tasks include certification life extension of the WLEIDS sensors and sensor-side relays and providing instrumentation for a Shuttle Carrier Aircraft test flight. The Shuttle Carrier Aircraft work will comprise of using existing Development Flight Instrumentation (DFI) to meet instrumentation needs for the Shuttle Carrier Aircraft (SCA) ferry flight with the Boeing Unmanned Aerial Vehicle "Phantom Ray" from St. Louis, MO to NASA Dryden Flight Research Center, CA. Support will require personnel to install the instrumentation (accelerometers, strain gauges, pressure sensors) in strategic locations on the inside of the modified B747 (SCA) as well as the attachment fixtures externally. The goal is to characterize the flight environment of the SCA with the Phantom Ray attached during a test flight first prior to progressing to the long duration flight from MO to CA.

Specific tasks are defined in JSC 64499,Avionic Systems Division Wireless Instrumentation Systems (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

The period of performance for this work is through the end of July 2011.

CLIN number 03 closes as of 7/30/2011.

5.1.2 ISS Internal Wireless Instrumentation System (IWIS) and External Wireless Instrumentation System (EWIS) Sustaining Engineering and Spares Certification Updated REV 2
Project Code: 2S701 & 00109

The contractor shall provide the sustaining engineering related to the ISS Internal Wireless Instrumentation System (IWIS) and ISS Wireless Instrumentation System (EWIS). The general sustaining engineering includes performing the engineering necessary to resolve any on-orbit issues/anomalies, execution of work authorization documentation (TPSs, DRs, and FIARs), processing of flight hardware for flight and shipment for bench review, represent EV IWIS for mission operations and post mission debriefs.

The EWIS sustaining engineering also includes processing of GCAR for transition from Contractor Furnished Equipment (CFE) to Government Furnished Equipment (GFE), configuration management of CFE documentations into GFE system, provide technical assessments of new Change Requests (CRs) for potential hardware or software updates, performing the engineering necessary to resolve any on-orbit issues/anomalies, upload and integrated testing of new EWIS Network Communication Unit (NCU) software on-orbit, installation of EWIS internal antenna, Ops LAN integrated testing in Joint Station LAN (JSL), EWIS Hardware and Software tool development, ISS flight note procedure validation, crew training, and execution of work authorization documentation (TPSs, DRs, and FIARs).

Certification activities for the IWIS Remote Sensor Units (RSUs) and Triaxial Accelerometer Assembly (TAAs) and EWIS Network Control Unit (NCU) includes updates of the PTRS, V&VD, & RAESR, conduct a formal design review (combined SRR/SDR & SAR), provide memos (EEE parts, Thermal, Stress, & Materials), drawings, updated IDD, support Phase III FESRRP, perform acceptance testing of RSUs / NCU (5 flight, 1 ground / 1 flight), update IWIS/EWIS GCAR/CDP, create ADPs, drawing updates for RSU dash number roll. Additionally, provide verification of all acceptance test requirements for EWIS NCU, conformal coating, acceptance test reports and documentation.

Specific tasks are defined in JSC 64499, Avionic Systems Division Wireless Instrumentation Systems (WIS) Engineering Products for International Space Station and Space Shuttle Programs. Transition from CFE to GFE of the EWIS hardware has been completed.

5.1.3 SSP Main Engine Ignition Instrumentation (MEII) Sustaining Engineering Updated REV 2
Project Code: 1S901

The contractor shall provide the sustaining engineering related to the Space Shuttle Main Engine Ignition Instrumentation (MEII) which is installed in the left OMS/RCS stinger for OV-103, OV-104 and OV-105 vehicles. This sustaining engineering effort includes performing the engineering necessary to resolve any anomalies (i.e. sensor unit housing issues, programming/download issues etc.), preparation/delivery of the launch profile programming files to KSC, and processing of the post-flight data to the principle investigators.

Specific tasks are defined in JSC 64499, Avionic Systems Division Wireless Instrumentation Systems (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

The period of performance for this work is through the end of July 2011.

CLIN number 03 closes as of 7/30/2011

5.1.4 Ultrasonic Background Noise Test (UBNT) Station Development Test Objective (SDTO) Updated REV 2
Project Code: 00117

The contractor shall provide the necessary engineering services to complete certification of an Ultrasonic background noise test system to be used as a Station Development Test Objective (DTO). This work includes but is not limited to performing environmental, functional and pre-delivery acceptance/certification testing of the flight hardware as well a designing, fabricating and configuring a flight kit. The objective of the SDTO is to measure the background noise level for each ISS module in support of the development of an ISS leak location instrumentation and as a risk mitigation path for IRMA 4669.
Specific tasks are defined in JSC 64499, Avionic Systems Division Wireless Instrumentation Systems (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

CLIN number 04 closes as of 7/30/2011

5.1.5 SSP Integrated Sensor Inspection System Sensor Package 1 & 2 Updated REV 2
Project Code: 00013

In compliance with the above identified SOW(s) the contractor shall provide the sustaining engineering related to the sensor package 1 (SED39136360), sensor package 2 (SED39137593) and ISIS digital camera. This sustaining engineering includes performing the engineering necessary to resolve any anomalies, preparation/delivery of the top assembly sensor packages to KSC, integrated vehicle testing at KSC, and post-flight testing of the sensor packages.

The contractor shall provide engineering services associated with the Shuttle Program retirement, which includes the identification and archiving of engineering/technical documentation and data and the recommendations on disposition for excessing or transferring of Shuttle hardware.

Specific tasks are defined in JSC 65950, *Integrated Sensor Inspection System Sensor Package 1 and 2 Requirements.*

CLIN number 05 closes as of 7/30/2011

5.1.6 ISS GFE Sustaining Updated REV 2
Project Code: Multiple

The contractor shall provide services and products for tasks listed in JSC 63968 Avionic Systems Division Approved Sustaining Engineering Projects Listing Sections 4, 5, and 6 in accordance with JSC 63950 Avionic Systems Division GFE Sustaining Engineering Requirements.

The contractor shall provide engineering services associated with the Shuttle Program retirement, which includes the identification and archiving of engineering/technical documentation and data and the recommendations on disposition for excessing or transferring of Shuttle hardware.

5.1.7 SSP GFE Sustaining Updated REV 2
Project Code: Multiple

The contractor shall provide services and products for tasks listed in JSC 63968 Avionic Systems Division Approved Sustaining Engineering Projects Listing Sections 4,5, and 6 in accordance with JSC 63950 Avionic Systems Division GFE Sustaining Engineering Requirements.

The contractor shall provide engineering services associated with the Shuttle Program retirement, which includes the identification and archiving of engineering/technical documentation and data and the recommendations on disposition for excessing or transferring of Shuttle hardware.

The period of performance for this work will go through the end of July 2011.

CLIN number 07 closes as of 7/30/2011

5.1.8 SSP PGSC and Laptop Sustaining Updated REV 2
Project Code: Multiple

The contractor shall provide services and products for tasks listed in JSC 63968 Avionic Systems Division Approved Sustaining Engineering Projects Listing Sections 4,5, and 6 in accordance with JSC 63950 Avionic Systems Division GFE Sustaining Engineering Requirements.

The contractor shall provide engineering services associated with the Shuttle Program retirement, which includes the identification and archiving of engineering/technical documentation and data and the recommendations on disposition for excessing or transferring of Shuttle hardware.

CLIN number 08 closes as of 7/30/2011

5.1.9 ISS Advanced Radiation Instrumentation (Intra-Vehicular Tissue Equivalent Proportional Counter (IV-TEPC)) Updated REV 2
Project Code: 00093

The contractor shall complete the detailed design products, and then fabricate, assemble, test, and deliver two class I flight IV-TEPC units (the Qual Unit and Flight Unit #1). All subassembly components for Flight Unit #2 shall also be built and tested, but the top-level assembly does not have to be completed. In addition, the necessary ground support equipment (GSE) and additional subassembly spares shall also be delivered. Specific tasks and deliverables are defined in JSC 64684, Avionic Systems Division Advanced Radiation Instrumentation (ARI) Engineering Products for the International Space Station Program.

Note that all software, with the exception of the hardware complex electronics code, will be provided as GFE by the ER/Software, Robotics and Simulation Division.

5.1.10 ISS Avionic Payload Safety Updated REV 2
Project Code:

In compliance with the above identified SOW(s) the contractor shall perform Engineering assessments of Avionic Payload Safety Packages to verify compliance with design and documentation requirements. In compliance with requirements-NSTS 1700.7B, Safety

Policy and Requirements for Payloads Using the Space Transportation System, TA-92-038, Protection of Payload Electrical Power Circuits, EV-012, Avionics Payload Safety Review Work Instruction and NSTS/ISS 13830C "Payload Safety Review and Data Submittal Requirements", contractor shall complete the Avionics Safety Checklist and a narrative assessment of each Safety Data Package. Contractor shall present assessment results in accordance with NSTS/ISS 13830C "Payload Safety Review and Data Submittal Requirements".

5.1.11 ISS GPS Antenna Spares Fabrication & Test Updated REV 2
Project Code: 2V402

The contractor shall fabricate and assemble three (3) GPS Antenna Assemblies (AA). The Antenna Electronics (AE) shall be supplied to the contractor by NASA. Prior to assembly, the contactor shall prepare for any Technical Interchange Meeting (TIM) or other review required by the project. The contactor shall also perform all certification and acceptance testing required and provide safety products and GSE in accordance with JSC 64742, "Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for the International Space Station Program".

CLIN number11 closes as of 7/30/2011

5.1.12 MPCV Avionics Added REV 2
Project Code:

In compliance with the above identified SOW(s) the contractor shall provide engineering services for MPCV Command and Data handling (C&DH) System Management (SM). The SM function, as specified in CxP-72088, CEV Systems Engineering Management Plan (SEMP), is the single point of contact for oversight and management of the development of a specific system. Included subsystems are defined in the CEV Statement of Work, Attachment J-1. This function covers the entire life cycle including feasibility assessments, project definition, requirements, design, production, certification and operations. The SM also participates in the development of the CEV System Requirements Document, CEV to other element Interface Requirements Documents (IRDs) and Interface Control document (ICDS), the CEV avionic architecture definition, and related trade studies. In addition, this function monitors development, schedules and risk, and participates in programmatic support activities such as Requirements Assessment Cycle (RAC), Design Analysis Cycle (DAC), mode teams and other system integration activities and forums. This function leads an integrated government team of stakeholder disciplines throughout the system development lifecycle involved in the oversight of the contractors' activities. The stakeholder disciplines include flight operations, ground operations, flight crew office, and Safety and Mission Assurance (SMA).

Contractor shall provide engineering analysis of review documents and presentations and present recommended RIDs at the subsystem design reviews {Project Technical Reviews (PTR), PDRs, CDRs} and spacecraft design reviews (PTR, PDRs, CDRs).

Provide engineering services for the MPCV C&DH SM, MPCV flight computer subsystem management, MPCV Power Data Unit Subsystem management, and MPCV instrumentation subsystem management.

1. Provide analysis of system and subsystem requirements as pertaining to the areas above.
2. Provide analysis of the requirement maturation process
3. Assess MPCV documents with consideration to these areas. Generate and work RIDs if required.
4. Perform trade studies.
5. Provide analysis of information provided all meetings, i.e. team technical interface meetings (TIM)

6. Prepare and present briefings.

5.1.13 EVA Sustaining Engineering Added REV 2
Project Code:

The contractor shall provide services and products for tasks listed in EV-100 Avionic Systems Division Approved Sustaining Engineering Projects Listing Sections 4, 5, and 6 in accordance with EV-100 Avionic Systems Division GFE Sustaining Engineering Requirements

5.1.14 IV-TEPC Radiation Monitoring Instrument (ISS) Added REV 2
Project Code: 00093

The contractor shall provide sustaining engineering services for the IV-TEPC hardware, including monitoring the performance and stability of the Qual Unit, Flight Unit, and the class III hardware. When the Flight Unit arrives at ISS and is activated, the contractor shall provide on-orbit assessments of the IV-TEPC instrument's health, status and measurement performance. Engineering services shall be provided to investigate and resolve any FIARs, DRs, IFIs, and anomaly troubleshooting. Technical representation shall also be provided for project reviews, SPRTs, crew training, MOD/BME operations support, and SF/SRAG requests.

Additionally, the assembly of the second Flight Unit shall be completed and acceptance testing performed. The contractor shall also provide IV-TEPC sustaining engineering services to maintain the ARI Lab, including the detector vacuum pump system and the GSE/STE-D support equipment. Project documentation shall be maintained and updated as necessary.

This task assumes the Qual Unit and first Flight Unit have been fully assembled, integrated and tested, as defined in DO398 CLIN 9.

Note that all software, with the exception of the hardware complex electronics, will be sustained by the ER/Software, Robotics and Simulation Division.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ANSI/ESD S20.20-1999	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)	1999 05-99
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 17773	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 28035	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
NASA-STD-8739.1	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	8-99
NASA-STD-8739.3	Soldered Electrical Connection	12-97
NASA-STD-8739.5	Fiber Optic Terminations, Cable Assemblies, and Installation	2-98
NASA-STD-9739.4	Crimping, Interconnecting Cables, Harnesses, and Wiring	2-98
NSTS 13830	Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station	Rev C change 4 01-02
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03

NT-CWI-001	Task Performance Sheet (TPS)	Rev A 03-01
NT-CWI-003	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01
OB-MER-006	MER Handbook	Draft 07-00
SN-C-0005	Contamination Control Requirements	Rev D 07-98
SSP 30243	Space Station Requirements for Electromagnetic Compatibility	Rev G 12-02
SSP 30309	Safety Analysis and Risk Assessment Requirements	Rev E 01-95
SSP 30559	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01
SSP 30599	ISS Safety Review Process	Rev A 06-95
SSP 30695	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287	Hardware/Software Acceptance Process	Rev A 05-01
CEV RFP Added REV 2	Statement of Work, Attachment J-1	CCO 124, July 2010
CxP-72000 Added REV 2	CEV Systems Requirements Document	June 2010 w/errata 008
CxP-72088 Added REV 2	CREW EXPLORATION VEHICLE (CEV) SYSTEMS ENGINEERING MANAGEMENT PLAN (SEMP)	currentRev C, July 22, 2009
DRD CEV-B-003 Added REV 2	CEV Integrated Master Schedule (IMS), included in CEV Cost Performance Report	current
EV-009	Government Furnished Equipment Management Instructions	F
EV-100 Added REV 2	Avionic Systems Division GFE Sustaining Engineering Requirements for EVA	Basic
EV-101 Added REV 2	Avionic Systems Division GFE Sustaining Engineering Requirements for the Intra-Vehicular Tissue Equivalent Proportional Counter (IV-TEPC)	Basic (September, 2011)
EV-12	Avionics Payload Safety Review, Work Instruction	
JSC 49922	ISIS PTRS	Current
JSC 63950 Added REV 2	Avionic Systems Division GFE Sustaining Engineering Requirements for ISS	F
JSC 63968 Added REV 2	Avionic Systems Division Approved Sustaining Engineering Projects Listing	B
JSC 64203	Project Technical Requirements Specification (PTRS) for the ISS Intravehicular ? Tissue Equivalent Proportional Counter (IV- TEPC)	Basic
JSC 64499 Added Rev 1	Wireless Instrumentation Systems (WIS) Engineering Products for International Space Station and Space Shuttle Programs for the Wireless Instrumentation Systems (WIS)	E
JSC 64684 Added Rev 1	Advanced Radiation Instrumentation (ARI) Engineering Products for the International Space Station Program	E
JSC 64742	Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program	B
JSC 65739 Added REV 2	Sustaining Engineering Plan for the ISS IV-TEPC	Baseline, Sept 2011
JSC 65950	Integrated Sensor Inspection System Sensor Package 1 and 2 Requirements	Basic
SSP 41172	Qualification and Acceptance Environmental Test Requirements	Y
SSP 50021	International Space Station Program Safety Requirements Document	Basic
SSP 50835	ISS Pressurized Volume Hardware Common Interface Requirements Document	A
TA-92-038	Protection of Payload Electrical Power Circuits	

c. **Required DRDs**

5.1.1 SSP Wing Leading Edge Impact Detection System (WLEIDS) Sustaining Engineering

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
105	Regular Status Report/Summary Review	1/Monthly

5.1.2 ISS Internal Wireless Instrumentation System (IWIS) and External Wireless Instrumentation System (EWIS) Sustaining Engineering and Spares Certification

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
105	Regular Status Report/Summary Review	1/Monthly

5.1.3 SSP Main Engine Ignition Instrumentation (MEII) Sustaining Engineering

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
105	Regular Status Report/Summary Review	1/Monthly

5.1.4 Ultrasonic Background Noise Test (UBNT) Station Development Test Objective (SDTO)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
102	Engineering Drawings and Model Files	1 set
105	Regular Status Report/Summary Review	1/Monthly
235	Space Station Payload Safety Data Package	1
237	Certification Data Package	1

5.1.5 SSP Integrated Sensor Inspection System Sensor Package 1 & 2

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	1/Monthly
230	Acceptance Data Package	1 per delivered item

5.1.6 ISS GFE Sustaining

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
105	Regular Status Report/Summary Review	1/Monthly

5.1.7 SSP GFE Sustaining

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
105	Regular Status Report/Summary Review	1/Monthly

5.1.8 SSP PGSC and Laptop Sustaining

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
105	Regular Status Report/Summary Review	1/Monthly

5.1.9 ISS Advanced Radiation Instrumentation (Intra-Vehicular Tissue Equivalent Proportional Counter (IV-TEPC))

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
102 Updated Rev 1	Engineering Drawings and Model Files	As required
105	Regular Status Report/Summary Review	1/Monthly
209	Flight Products Verification and Validation Plan	1 per schedule defined in JSC 64684
214	Flight Products Qualification Test Procedures	1 per schedule defined in JSC 64684
216 Deleted Rev 1	Flight Products Qualification Plan	1 per schedule defined in JSC 64684
217 Deleted Rev 1	Flight Product Qualification Report	1 per schedule defined in JSC 64684
218 Updated Rev 1	Engineering Analysis	per schedule defined in JSC 64684
221	Flight Products Acceptance Test Procedures	1 per schedule defined in JSC 64684
222 Deleted Rev 1	Flight Product Verification and Validation Report	1 per schedule defined in JSC 64684
230 Deleted Rev 1	Acceptance Data Package	1 per schedule defined in JSC 64684

231	Limited Life Items List	1 per schedule defined in JSC 64684
237 Deleted Rev 1	Certification Data Package	1 per schedule defined in JSC 64684
241 Deleted Rev 1	Risk Assessment Executive Summary Report (RAESR)	1 per schedule defined in JSC 64684

5.1.10 ISS Avionic Payload Safety

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	1/Analysis

5.1.11 ISS GPS Antenna Spares Fabrication & Test

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	1/Monthly
102	Engineering Drawings and Model Files	15/per GPS Antenna Master Schedule
105	Regular Status Report/Summary Review	1/Monthly
209	Flight Products Verification and Validation Plan	1/per GPS antenna Master schedul
218	Engineering Analysis	3/per GPS Antenna Master schedule
222	Flight Product Verification and Validation Report	1/per GPS Antenna Master schedule

5.1.12 MPCV Avionics

DRD #	DRD Title	Quantity/Frequency
105 Added REV 2	Regular Status Report/Summary Review	1/Month
218 Added REV 2	Engineering Analysis	1/Analysis

5.1.13 EVA Sustaining Engineering

DRD #	DRD Title	Quantity/Frequency
101 Added REV 2	Project Schedule	Monthly
105 Added REV 2	Regular Status Report/Summary Review	Monthly

5.1.14 IV-TEPC Radiation Monitoring Instrument (ISS)

DRD #	DRD Title	Quantity/Frequency
101 Added REV 2	Project Schedule	Monthly
105 Added REV 2	Regular Status Report/Summary Review	Monthly

d. **Products**

5.1.1 SSP Wing Leading Edge Impact Detection System (WLEIDS) Sustaining Engineering

Product(s)	Quantity	Delivery Date
Shuttle flight mission operations console support, including on-board data retrieval, anomaly resolution and analysis of in-flight data. Updated REV 2	1 per Shuttle flight	As defined in JSC 64499, section 4.1.
Provide hardware assessments and analysis to the Problem Resolution Team (PRT) meetings Updated REV 2	As defined in JSC 64499,	As defined in JSC 64499, section 4.1.

5.1.2 ISS Internal Wireless Instrumentation System (IWIS) and External Wireless Instrumentation System (EWIS) Sustaining Engineering and Spares Certification

Product(s)	Quantity	Delivery Date
Anomaly resolution and analysis of in-flight data. Updated REV 2	1 set	As defined in JSC 64499, section

		4.3.
On-Orbit sustaining of IWIS hardware. Updated REV 2	AR	Through September 30th, 2012
On-Orbit sustaining of EWIS hardware. Updated REV 2	AR	Through September 30th, 2012.

5.1.3 SSP Main Engine Ignition Instrumentation (MEII) Sustaining Engineering

Product(s)	Quantity	Delivery Date
Launch Profile CDs for STS-133 and STS-134 Updated REV 2	1 ea	As defined in JSC 64499.

5.1.4 Ultrasonic Background Noise Test (UBNT) Station Development Test Objective (SDTO)

Product(s)	Quantity	Delivery Date
Safety Data Package Updated REV 2	1	As defined in JSC 64499.
Certification Data Package Updated REV 2	1	As defined in JSC 64499.
Delivery of certified UBNT SDTO flight hardware Updated REV 2	1 set	As defined in JSC 64499.

5.1.5 SSP Integrated Sensor Inspection System Sensor Package 1 & 2

Product(s)	Quantity	Delivery Date
Shuttle flight mission operations console support, and in-flight anomaly resolution Updated REV 2	AR during Shuttle flight	As defined in JSC 65950
Provide hardware assessments and analysis to the Problem Resolution Team (PRT) meeting Updated REV 2	As defined in JSC 65950	As defined in JSC 65950

5.1.6 ISS GFE Sustaining

Product(s)	Quantity	Delivery Date
Integrated Microsoft Schedule Updated REV 2	1	Monthly
Regular Status Report/Monthly Review Updated REV 2	1	Monthly

5.1.7 SSP GFE Sustaining

Product(s)	Quantity	Delivery Date
Integrated Microsoft Schedule Updated REV 2	1	Monthly
Regular Status Report/Monthly Review Updated REV 2	1	Monthly

5.1.8 SSP PGSC and Laptop Sustaining

Product(s)	Quantity	Delivery Date
Integrated Microsoft Schedule Updated REV 2	1	Monthly
Regular Status Report/Monthly Review Updated REV 2	1	Monthly

5.1.9 ISS Advanced Radiation Instrumentation (Intra-Vehicular Tissue Equivalent Proportional Counter (IV-TEPC))

Product(s)	Quantity	Delivery Date
Final IV-TEPC detailed design, drawings & documentation Updated REV 2	1	Per schedule defined in JSC-64684.
Engineering services to close out CDR RIDs and Actions Updated REV 2	1	Per schedule defined in JSC-64684.
Refurbished Design Verification Test Unit (DVTU) (Instrument + 2 Detectors) ready to begin testing in JSC Neutron Lab Updated REV 2	1	12/17/2010
Ground Support Equipment (GSE) IV-TEPC Updated REV 2	1	Per schedule defined in JSC-64684.
Spare Class I IV-TEPC circuit boards (assembled & tested) Updated REV 2	1	Per schedule defined in JSC-64684.
Foam Kits for Instrument Deleted REV 2	3	Per schedule defined in JSC-64684.

Foam Kits for Detectors (2 Detectors per kit) Deleted REV 2	4	Per schedule defined in JSC-64684.
Verification & Validation Report Deleted Rev 1	1	Per schedule defined in JSC-64684.
Safety Data Package (Phase III) Deleted Rev 1	1	Per schedule defined in JSC-64684.
Certification Data Package Deleted Rev 1	1	4/30/2011
Acceptance Data Package Deleted Rev 1	2	6/05/2011
Government Certification Approval Request (GCAR) Deleted Rev 1	1	Per schedule defined in JSC-64684.
Engineering services at project reviews Updated REV 2	1	As defined in JSC-64684.
Delivery of certified IV-TEPC External Power/Data cables Deleted REV 2	3	Per schedule defined in JSC-64684.
Delivery of certified IV-TEPC Qualification Unit (Instrument + 2 Detectors) Deleted REV 2	1	Per schedule defined in JSC-64684.
Delivery of certified IV-TEPC Flight Unit #1 (Instrument + 2 Detectors) Deleted REV 2	1	Per schedule defined in JSC-64684.
Delivery of tested subassembly components for IV-TEPC Flight Unit #2 (Instrument + 2 Detectors) Updated REV 2	1	Per schedule defined in JSC-64684.
Technical assessment and problem resolution for FIAR and DR dispositions Updated REV 2	1	As defined in JSC-64684.
Delivery of IV-TEPC External Power/Data cables Added REV 2	3	Per schedule defined in JSC-64684.
Delivery of IV-TEPC Qualification Unit (Instrument + 2 Detectors) Added REV 2	1	Per schedule defined in JSC-64684.
Delivery of IV-TEPC Flight Unit #1 (Instrument + 2 Detectors) Added REV 2	1	Per schedule defined in JSC-64684.

5.1.10 ISS Avionic Payload Safety

Product(s)	Quantity	Delivery Date
Payload Safety Packages/Engineering Assessment Updated REV 2	144	144/year

5.1.11 ISS GPS Antenna Spares Fabrication & Test

Product(s)	Quantity	Delivery Date
Schedule - Certification and manufacturing	1/monthly	Per schedule defined in JSC-64742.
Engineering drawing and model files	15	Per schedule defined in JSC-64742.
Updated Thermal Analysis	1	Per schedule defined in JSC-64742.
Updated Materials and Fracture Control Certification	1	Per schedule defined in JSC-64742.
Updated Stress Analysis	1	Per schedule defined in JSC-64742.
Update and release Verification and Validation Document (V&VD) with documented results	1	Per schedule defined in JSC-64742.
Deliver Acceptance Data Packages (ADPs)	1 for each hardware item	Per schedule defined in JSC-64742.
GCAR	1	Per schedule defined in JSC-64742.
Spare GPS Antenna Assembly	3	Per schedule defined in JSC-64742.
Certification Data Package	1	Per schedule defined in JSC-64742.
Release FESRRP Approved Phase III RAESR and HRs	1	Per schedule defined in JSC-64742.
System Acceptance Review (SAR)	1	Per schedule defined in JSC-64742.
Technical assessment and problem resolution for FIAR and DR dispositions	15	Per schedule defined in JSC-64742.
Thermal Cycle Testing (2 cycles) Added Rev 1	3	Per schedule defined in JSC-64742

5.1.12 MPCV Avionics

Product(s)	Quantity	Delivery Date
Engineering assessment/RID package, with technical review 1 week prior to life cycle reviews Added REV 2	1 set per lifecycle review	CEV Integrated Master Schedule, DRD CEV-B-003
Activity report Added REV 2	1	Monthly
Change Request (CR) evaluation form Added REV 2	1	per CR delivery date

5.1.13 EVA Sustaining Engineering

Product(s)	Quantity	Delivery Date
Integrate Microsoft Schedule Added REV 2	1	Monthly
Regular Status Report/Monthly Review Added REV 2	1	Monthly

5.1.14 IV-TEPC Radiation Monitoring Instrument (ISS)

Product(s)	Quantity	Delivery Date
Completed Pre-Delivery Acceptance (PDA) Test/Inspection TPS for the first IV-TEPC Flight Unit. Added REV 2	1	Per schedule defined in IV-TEPC Sustaining Engr Requirements Document
Second IV-TEPC Flight Unit ready for flight and delivered into Bond. Added REV 2	1	Per schedule defined in IV-TEPC Sustaining Engr Requirements Document
Engineering performance & measurement status reports for the Qual Unit, Flight Units, and FEU. Added REV 2	1	Monthly
Updated log books for the DVTU hardware, detector vacuum pump system, GSE and STE/D support equipment. Added REV 2	1	Monthly
Baselined IV-TEPC User?s Guide document. the IV-TEPC User?s Guide document. Added REV 2	1	Per schedule defined in IV-TEPC Sustaining Engr Requirements Document

e. **Product Verification**

5.1.1 SSP Wing Leading Edge Impact Detection System (WLEIDS) Sustaining Engineering

i. Shuttle flight mission operations console support, including on-board data retrieval, anomaly resolution and analysis of in-flight data.

- Product verification for this product is accomplished by mission console manning during flight with successful handling of data and anomalies as defined in Section 6.0 of JSC 64499, Avionic Systems Division Wireless Instrumentation System (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

ii. Provide hardware assessments and analysis to the Problem Resolution Team (PRT) meetings

- Product verification for this product is defined in Section 6.0 JSC 64499, Avionic Systems Division Wireless Insturmentation System (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

5.1.2 ISS Internal Wireless Instrumentation System (IWIS) and External Wireless Instrumentation System (EWIS) Sustaining Engineering and Spares Certification

i. Anomaly resolution and analysis of in-flight data.

- Product verification for this product is defined in Section 6.0 of JSC 64499, Avionic Systems Division Wireless Instrumentation System (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

ii. On-Orbit sustaining of IWIS hardware.

- On-Orbit operational IWIS system.

iii. On-Orbit sustaining of EWIS hardware.

- On-Orbit operational EWIS system.

5.1.3 SSP Main Engine Ignition Instrumentation (MEII) Sustaining Engineering

i. Launch Profile CDs for STS-133 and STS-134

- Product verification for this product is defined in Section 6.0 of JSC 64499, Avionic Systems Division Wireless Instrumentation System (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

5.1.4 Ultrasonic Background Noise Test (UBNT) Station Development Test Objective (SDTO)

i. Safety Data Package

- Product verification for this product is defined in Section 6.0 of JSC 64499, Avionic Systems Division Wireless Instrumentation System (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

ii. Certification Data Package

- Product verification for this product is defined in Section 6.0 of JSC 64499, Avionic Systems Division Wireless Instrumentation

System (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

iii. Delivery of certified UBNT SDTO flight hardware

- Product verification for this product is defined in Section 6.0 of JSC 64499, Avionic Systems Division Wireless Instrumentation System (WIS) Engineering Products for International Space Station and Space Shuttle Programs.

5.1.5 SSP Integrated Sensor Inspection System Sensor Package 1 & 2

i. Shuttle flight mission operations console support, and in-flight anomaly resolution

- Product verification for this product is defined in JSC 65950.

ii. Provide hardware assessments and analysis to the Problem Resolution Team (PRT) meeting

- Product verification for this product is defined in JSC 65950.

5.1.6 ISS GFE Sustaining

i. Integrated Microsoft Schedule

- Product verification will be obatined via Sustaining Engineering CCB concurrence per JSC 63950.

ii. Regular Status Report/Monthly Review

- Product verification will be obatined via Sustaining Engineering CCB concurrence per JSC 63950.

5.1.7 SSP GFE Sustaining

i. Integrated Microsoft Schedule

- Product verification will be obatined via Sustaining Engineering CCB concurrence per JSC 63950.

ii. Regular Status Report/Monthly Review

- Product verification will be obatined via Sustaining Engineering CCB concurrence per JSC 63950.

5.1.8 SSP PGSC and Laptop Sustaining

i. Integrated Microsoft Schedule

- Product verification will be obatined via Sustaining Engineering CCB concurrence per JSC 63950.

ii. Regular Status Report/Monthly Review

- Product verification will be obatined via Sustaining Engineering CCB concurrence per JSC 63950.

5.1.9 ISS Advanced Radiation Instrumentation (Intra-Vehicular Tissue Equivalent Proportional Counter (IV-TEPC))

i. Final IV-TEPC detailed design, drawings & documentation

- Verification for this product is defined in JSC-64684.

ii. Engineering services to close out CDR RIDs and Actions

- Verification for this product is defined in JSC-64684.

iii. Refurbished Design Verification Test Unit (DVTU) (Instrument + 2 Detectors) ready to begin testing in JSC Neutron Lab

- Verification for this product is defined in JSC-64684.

iv. Ground Support Equipment (GSE) IV-TEPC

- Verification for this product is defined in JSC-64684.

v. Spare Class I IV-TEPC circuit boards (assembled & tested)

- Verification for this product is defined in JSC-64684.

vi. Foam Kits for Instrument Deleted REV 2

- Verification for this product is defined in JSC-64684. Deleted REV 2

vii. Foam Kits for Detectors (2 Detectors per kit) Deleted REV 2

- Verification for this product is defined in JSC-64684. Deleted REV 2

viii. Verification & Validation Report Deleted Rev 1

- Verification for this product is defined in JSC-64684. Deleted Rev 1

ix. Safety Data Package (Phase III) Deleted Rev 1

- Verification for this product is defined in JSC-64684. Deleted Rev 1

x. Certification Data Package Deleted Rev 1

- Verification for this product is defined in JSC-64684. Deleted Rev 1

xi. Acceptance Data Package Deleted Rev 1

- Verification for this product is defined in JSC-64684. Deleted Rev 1

xii. Government Certification Approval Request (GCAR) Deleted Rev 1

- Verification for this product is defined in JSC-64684. Deleted Rev 1

xiii. Engineering services at project reviews

- Verification for this product is defined in JSC-64684.

xiv. Delivery of certified IV-TEPC External Power/Data cables Deleted REV 2

- Verification for this product is defined in JSC-64684. Deleted REV 2

xv. Delivery of certified IV-TEPC Qualification Unit (Instrument + 2 Detectors) Deleted REV 2

- Verification for this product is defined in JSC-64684. Deleted REV 2

xvi. Delivery of certified IV-TEPC Flight Unit #1 (Instrument + 2 Detectors) Deleted REV 2

- Verification for this product is defined in JSC-64684. Deleted REV 2

xvii. Delivery of tested subassembly components for IV-TEPC Flight Unit #2 (Instrument + 2 Detectors)

- Verification for this product is defined in JSC-64684.

xviii. Technical assessment and problem resolution for FIAR and DR dispositions

- Verification for this product is defined in JSC-64684.

xix. Delivery of IV-TEPC External Power/Data cables

- Verification for this product is defined in JSC-64684. Added REV 2

xx. Delivery of IV-TEPC Qualification Unit (Instrument + 2 Detectors)

- Verification for this product is defined in JSC-64684. Added REV 2

xxi. Delivery of IV-TEPC Flight Unit #1 (Instrument + 2 Detectors)

- Verification for this product is defined in JSC-64684. Added REV 2

5.1.10 ISS Avionic Payload Safety

i. Payload Safety Packages/Engineering Assessment

- Avionics Safety Checklist and a narrative assessment of each Safety Data Package acceptance at the PSRP by NASA Program Manager.

5.1.11 ISS GPS Antenna Spares Fabrication & Test

i. Schedule - Certification and manufacturing

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

ii. Engineering drawing and model files

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

iii. Updated Thermal Analysis

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

iv. Updated Materials and Fracture Control Certification

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

v. Updated Stress Analysis

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

vi. Update and release Verification and Validation Document (V&VD) with documented results

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

vii. Deliver Acceptance Data Packages (ADPs)

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

viii. GCAR

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

ix. Spare GPS Antenna Assembly

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

x. Certification Data Package

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

xi. Release FESRRP Approved Phase III RAESR and HRs

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

xii. System Acceptance Review (SAR)

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

xiii. Technical assessment and problem resolution for FIAR and DR dispositions

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program.

xiv. Thermal Cycle Testing (2 cycles)

- Product verification for this product is defined in Section 6.0 of JSC 64742, Spare Global Positioning System (GPS) Antenna Assembly Engineering Products for International Space Station Program. Added Rev 1

5.1.12 MPCV Avionics

i. Engineering assessment/RID package, with technical review 1 week prior to life cycle reviews

- - Branch review and acceptance Added REV 2

ii. Activity report

- - Branch review and acceptance Added REV 2

iii. Change Request (CR) evaluation form

- - Branch review and acceptance Added REV 2

5.1.13 EVA Sustaining Engineering

i. Integrate Microsoft Schedule

- Product verification will be obatined via Sustaining Engineering CCB concurrence per EV-100 Added REV 2

ii. Regular Status Report/Monthly Review

- Product verification will be obatined via Sustaining Engineering CCB concurrence per EV-100 Added REV 2

5.1.14 IV-TEPC Radiation Monitoring Instrument (ISS)

i. Completed Pre-Delivery Acceptance (PDA) Test/Inspection TPS for the first IV-TEPC Flight Unit.

- Product verification is defined in the IV-TEPC Sustaining Engineering Requirements Document Added REV 2

ii. Second IV-TEPC Flight Unit ready for flight and delivered into Bond.

- Product verification is defined in the IV-TEPC Sustaining Engineering Requirements Document Added REV 2

iii. Engineering performance & measurement status reports for the Qual Unit, Flight Units, and FEU.

- Product verification is defined in the IV-TEPC Sustaining Engineering Requirements Document Added REV 2

iv. Updated log books for the DVTU hardware, detector vacuum pump system, GSE and STE/D support equipment.

- Product verification is defined in the IV-TEPC Sustaining Engineering Requirements Document Added REV 2

v. Baselined IV-TEPC User?s Guide document. the IV-TEPC User?s Guide document.

- Product verification is defined in the IV-TEPC Sustaining Engineering Requirements Document Added REV 2

6.0 Cost Summary and Revision History

SLC	Type	CY6	CY7	CY8	G Total
AS2	Sum of Hours				
	Sum of Dollars				
AS3	Sum of Hours				
	Sum of Dollars				
BS1	Sum of Hours				
	Sum of Dollars				
CM1	Sum of Hours				
	Sum of Dollars				
CM2	Sum of Hours				
	Sum of Dollars				
EN1	Sum of Hours				
	Sum of Dollars				
EN2	Sum of Hours				
	Sum of Dollars				
EN3	Sum of Hours				
	Sum of Dollars				
EN4	Sum of Hours				
	Sum of Dollars				
ESS	Sum of Hours				

	Sum of Dollars
ET1	Sum of Hours
	Sum of Dollars
ET3	Sum of Hours
	Sum of Dollars
IT2	Sum of Hours
	Sum of Dollars
IT3	Sum of Hours
	Sum of Dollars
MGR	Sum of Hours
	Sum of Dollars
PC1	Sum of Hours
	Sum of Dollars
PC2	Sum of Hours
	Sum of Dollars
QA1	Sum of Hours
	Sum of Dollars
QA2	Sum of Hours
	Sum of Dollars
QE1	Sum of Hours
	Sum of Dollars
QE2	Sum of Hours
	Sum of Dollars
QE3	Sum of Hours
	Sum of Dollars
QE4	Sum of Hours
	Sum of Dollars
SE	Sum of Hours
	Sum of Dollars
SM	Sum of Hours
	Sum of Dollars
SV	Sum of Hours
	Sum of Dollars
TN1	Sum of Hours
	Sum of Dollars
TN2	Sum of Hours
	Sum of Dollars
TN3	Sum of Hours
	Sum of Dollars
Total Direct Labor Hours	
Total Direct Labor Costs	
Travel Costs	
Subcontract	
NLR Misc	
Materials	
Burden on Non-Labor	
Total Non Labor	
Total Costs	
Fee	
Total	$8,778,721.71

DO 398 revision history	Total cost	Reason for revision
Original	$7,016,722	N/A
Rev 1	$7,675,712	Added Engineering Product Documents JSC 64499 Rev. E and JSC 64684 Rev. E to the supporting document section. Updated the period of performance for sections 5.1.1, 5.1.3 & 5.1.7. Updated the Products Requirements sections 5.1.9 and 5.1.11
Rev 2	$8,778,722	Closed old work, added WBS 5.12 MPCV Avionics, 5.13 EVA Sustaining engineering, and 5.14 IV-TEPC radiation Monitoring Instrument; changed period of performance to 01-30-2013.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No. **NNJ10HC87D DO 399 Rev 2**

2. Date Of Order See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 09/24/2010-09/30/2011

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: 7/08/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ER3 Flight Robotic Systems-Robotic Analysis and Engineering Services					
DO	**399 Rev 2**					
	Est. Labor Costs	b4				
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden				b4	
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$2,964,299.70

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ10HC87D-DO399 REV 2

Originator: Gary Gutkowski (ER) (281) 483-0801 **TMR:** Jared Woodfill (ER) (281) 483-6331

Revision Summary:

JSC-61834 Rev A, Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011, is being revised to include the following changes:
- In section II, one EBIT presentation was removed.
- In section III, some of the SRMS analyses were replaced by other SRMS analyses, one element of the ER SRMS simulation validation task was removed, new tasks were added to provide a matrix of permissible SRMS maneuvers and to review SRMS flight software test results, and the total number of DN reviews was decreased.
- In section V, hardware development engineering services were increased to include several additional flight hardware components/payloads.

1. Title of Effort: ER3 Flight Robotic Systems

2. Date of Request: 06/08/2011

3. Statement of Work Task Description

a. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

b. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

c. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

d. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

e. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

f. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

g. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 09/30/2011.

5. Product Requirements

5.1 Flight Robotic Systems Updated Rev 1

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall 1) Perform robotic analyses for capture and release of the JAXA H-II vehicle, the Space X Dragon vehicle and the Orbital Cygnus vehicle using the SSRMS on the International Space Station.
2) Perform analyses for robotic berthing operations for the ISS.
3) Provide SRMS hardware and software sustaining engineering. Provide real-time mission support for the SRMS console in the MER for each Shuttle mission. Perform and document flight specific analysis for SRMS operations associated with Shuttle missions planned during the duration of the delivery order. Provide simulation software development and analyses for the Shuttle Remote Manipulator System (SRMS) Math Model Working Group (MMWG).
4) Provided sustaining engineering for the SSP OBSS hardware, and engineering services for the development of the Enhanced Inspection Boom Assembly (EIBA) for the ISS
5) Provide system management and subsystem management engineering services for the Mobile Servicing System (MSS),
6) Provide engineering services for ISS Mobile Servicing System (MSS) software integration and Graphical User Interface and Overlay requirements definition and verification support.
7)Provide sustaining engineering for the Centerline Berthing Camera System; and systems engineering for the External Berthing Camera System. Updated Rev 1

5.1.1 Visiting Vehicle Capture Analysis Updated Rev 1
Project Code:

Perform robotic analyses for capture and release of the JAXA H-II vehicle, the Space X Dragon vehicle and the Orbital Cygnus vehicle using the SSRMS on the International Space Station. The contractor shall perform capture and release analyses, validate simulation tools, and provide analysis reports

5.1.2 EBIT Berthing Analysis Updated Rev 1
Project Code:

The contractor shall utilize real-time and non-real-time simulations with integrated mechanism and manipulator models to perform analyses of integrated manipulator/mechanism berthing operations for ISS. Analyses shall be documented in EBIT presentations and JSC documents.

5.1.3 SRMS Engineering Updated Rev 1
Project Code:

The contractor shall provide subsystem management for the Shuttle Remote Manipulator System (SRMS)and Grapple Fixtures. Engineering services shall be provided to assess development of SRMS refurbishments, upgrades and associated hardware and software for the Shuttle support of the International Space Station (ISS), generation of historical records of SRMS mission logs for each shuttle mission, and provision of grapple fixtures to payload customers in a timely manner. For each Shuttle mission the contractor shall provide verification of the RMS Level C Data requirements and flight software products, and maintenance of the SRMS software suite of applications in the Mission Evaluation Room (MER) and the mini-MER in the Intelligent Systems Laboratory (ISL). Contingency SAIL testing of SRMS flight software will be required to investigate any on-orbit anomalies. In addition the contractor shall provide assessments of mission operations products including procedures and flight techniques for each Shuttle mission affecting SRMS. The contractor shall conduct simulations and analyses for SRMS payloads whose parameters fall outside nominal payload parameters and prescribed flight planning load limits and report results for each shuttle mission during the period of performance. The contractor shall provide engineering services, and documenation in presentation or report format, for SRMS math model updates required by the JSC SRMS math model working group and the End-to-End Berthing Integration Team. Provide SRMS Mission Evaluation Room (MER) console engineering services.

5.1.4 Orbiter Boom Sensor System Updated Rev 1
Project Code:

The contractor shall provided sustaining engineering for the SSP OBSS hardware, and engineering services for the development of the Enhanced Inspection Boom Assembly (EIBA) for the ISS. The contractor shall review and provide input on all hardware related non-conformances and shall participate in Materiel Review Boards (MRBs) and Integrated Program Reviews.

5.1.5 MSS System Management and Subsystem Management (SSM) Updated Rev 1
Project Code:

The contractor shall provide system management and subsystem management engineering services for the Mobile Servicing System. Provide assessment and recommended resolution for on-orbit operational anomalies, PRACA, In-flight Investigations (IFIs), Failure

Investigation Teams (FITs), Anomaly Resolution Team (ART),Review Item Dispositions (RIDs), Verification Closure Notices (VCNs), and Flight Rules for Extravehicular Robotic Systems on the International Space Station. Provide engineering services to assess system performance and gather operational data from on-orbit telemetry, crew questions/comments, and MOD comments for EVR systems. Provide Engineering Services for MER EVR console support for flight and stage robotic operations on the ISS. Provide assessment of the effect of software changes on system functionality for each software change. Assess EVR system documentation including MSS, SPDM, payloads, and carriers for compliance with end-to-end system integration requirements. This includes design specifications, interface documents, performance documentation, and operational documentation. Provide system engineering services for Robotics and HTV/VVI integration with ISS

5.1.6 ISS Robotics Integration Updated Rev 1
Project Code:

The contractor shall provide engineering services for the development and maintenance of the MSS GUI software requirements including development and maintenance of the SSRMS/MBS/SPDM GUI displays and overlays of the RWS. The contractor shall provide updates to the following documents: - SRS for MSS GUI Volume 1: SSRMS (SSP-50337-01) - SRS for MSS GUI Volume 2: MBS (SSP-50337-02) - SRS for MSS GUI Volume 3: SPDM (SSP-50337-03) - Robotic Workstation CCTV Screen Overlay Requirements (SSP-50350) - S/W ICD MSS PCS/GUI Configuration Files (SSP-50351) - RWS Configuration File Requirements (SSP 50837) The contractor shall conduct weekly MSS GUI integrated product team meetings with CSA and provide minutes including meeting agenda, issues discussed, and action item status to team members and NASA task lead. The contractor shall assess issues related to the robotic workstation (RWS) Overlays and MSS PSC displays for the ISS flights, and recommend changes to flight MSS PCS displays, and analyze and evaluate the functionality of the RWS overlays The contractor shall provide engineering services for requirements specification development, documentation and testing of MSS HTV and Visiting Vehicle flight overlays and GUIs, and provide recommendations and updates. The contractor shall provide engineering services for MSS software integration to ensure concept design, functionality, and compliance with program requirements. This includes assessment of MSS software products and documentation for accuracy and compliance with ISS requirements, including writing and coordination of PIRNs, PCRs, and associated IP&CL documentation. Also the contractor shall provide assessment, recommended resolution and disposition of MSS software problem reports and changes to MSS software documentation. Engineering services shall be provided for each MSS software related program meeting associated with pre- and post- test and end-to-end meetings to provide essential technical contributions to MSS software problem resolutions and requirements changes.

5.1.7 Robotic Berthing Target System Updated Rev 1
Project Code:

The contractor shall provide the engineering services for project management and sustaining engineering necessary to continue the operation of the CBCS and sustaining engineering services for the EBCS flight systems.

b. Applicable Documents

Document Number	Document Name	Rev.
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
NPD 9501.1	NASA Contractor Financial Management Reporting System	Rev G 05-00
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
JSC 61834 Added REV 2	Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011	Rev B.

c. Required DRDs

5.1.1 Visiting Vehicle Capture Analysis

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly 15th of the month
105	Regular Status Report/Summary Review	Monthly 15th of the month
218 Deleted Rev 1	Engineering Analysis	As required in JSC 61834
218 Deleted REV 2	Engineering Analysis	As Required in JSC 61834 Rev A
218 Added REV 2	Engineering Analysis	As Required in JSC 61834 Rev B

5.1.2 EBIT Berthing Analysis

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly 15th of the month
105	Regular Status Report/Summary Review	Monthly 15th of the month
218 Deleted Rev 1	Engineering Analysis	As required in JSC 61834
218 Deleted REV 2	Engineering Analysis	As Required in JSC 61834 Rev A
218 Added REV 2	Engineering Analysis	As Required in JSC 61834 Rev b

5.1.3 SRMS Engineering

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly 15th of the month
105	Regular Status Report/Summary Review	Monthly 15th of the month
218 Deleted Rev 1	Engineering Analysis	As required in JSC 61834
218 Deleted REV 2	Engineering Analysis	As Required in JSC 61834 Rev A
218 Added REV 2	Engineering Analysis	As Required in JSC 61834 Rev B

5.1.4 Orbiter Boom Sensor System

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly 15th of the month
105	Regular Status Report/Summary Review	Monthly 15th of the month
218 Deleted Rev 1	Engineering Analysis	As required in JSC 61834
218 Deleted REV 2	Engineering Analysis	As Required in JSC 61834 Rev A
218 Added REV 2	Engineering Analysis	As Required in JSC 61834 Rev B

5.1.5 MSS System Management and Subsystem Management (SSM)

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly 15th of the month
105	Regular Status Report/Summary Review	Monthly 15th of the month
218 Deleted Rev 1	Engineering Analysis	As required in JSC 61834
218 Deleted REV 2	Engineering Analysis	As Required in JSC 61834 Rev A
218 Added REV 2	Engineering Analysis	As Required in JSC 61834 Rev B

5.1.6 ISS Robotics Integration

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly 15th of the month
105	Regular Status Report/Summary Review	Monthly 15th of the month
218 Deleted Rev 1	Engineering Analysis	As required in JSC 61834
218 Deleted REV 2	Engineering Analysis	As Required in JSC 61834 Rev A

5.1.7 Robotic Berthing Target System

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly 15th of the month

105	Regular Status Report/Summary Review	Monthly 15th of the month
218 Deleted Rev 1	Engineering Analysis	As required in JSC 61834
218 Deleted REV 2	Engineering Analysis	As Required in JSC 61834 Rev A
218 Added REV 2	Engineering Analysis	As Required in JSC 61834 Rev B

d. **Products**

5.1.1 Visiting Vehicle Capture Analysis

Product(s)	Quantity	Delivery Date
Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1	1	9/30/2011
Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2	1	9/30/2011
Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Added REV 2	1	9/30/2011

5.1.2 EBIT Berthing Analysis

Product(s)	Quantity	Delivery Date
Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1	1	9/30/2011
Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2	1	9/30/2011
Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Added REV 2	1	9/30/2011

5.1.3 SRMS Engineering

Product(s)	Quantity	Delivery Date
Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1	1	9/30/2011
Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2	1	9/30/2011
Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Added REV 2	1	9/30/2011

5.1.4 Orbiter Boom Sensor System

Product(s)	Quantity	Delivery Date
Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1	1	9/30/2011
Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2	1	9/30/2011
Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Added REV 2	1	9/30/2011

5.1.5 MSS System Management and Subsystem Management (SSM)

Product(s)	Quantity	Delivery Date
Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1	1	9/30/2011
Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2	1	9/30/2011
Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Added REV 2	1	9/30/2011

5.1.6 ISS Robotics Integration

Product(s)	Quantity	Delivery Date
Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and	1	9/30/2011

Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1		
Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2	1	9/30/2011
Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Added REV 2	1	9/30/2011

5.1.7 Robotic Berthing Target System

Product(s)	Quantity	Delivery Date
Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1	1	9/30/2011
Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2	1	9/30/2011
Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Added REV 2	1	9/30/2011

e. **Product Verification**

5.1.1 Visiting Vehicle Capture Analysis

i. Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834. Deleted Rev 1

ii. Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev A. Deleted REV 2

iii. Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev B Added REV 2

5.1.2 EBIT Berthing Analysis

i. Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834. Deleted Rev 1

ii. Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev A. Deleted REV 2

iii. Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev B Added REV 2

5.1.3 SRMS Engineering

i. Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834. Deleted Rev 1

ii. Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev A. Deleted REV 2

iii. Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev B Added REV 2

5.1.4 Orbiter Boom Sensor System

i. Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834. Deleted Rev 1

ii. Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev A. Deleted REV 2

iii. Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev B Added REV 2

5.1.5 MSS System Management and Subsystem Management (SSM)

i. Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834. Deleted Rev 1

ii. Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev A. Deleted REV 2

iii. Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev B Added REV 2

5.1.6 ISS Robotics Integration

i. Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834. Deleted Rev 1

ii. Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev A. Deleted REV 2

iii. Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev B Added REV 2

5.1.7 Robotic Berthing Target System

i. Implementation of JSC-61834 Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted Rev 1

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834. Deleted Rev 1

ii. Implementation of JSC-61834 Rev A. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011 Deleted REV 2

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev A. Deleted REV 2

iii. Implementation of JSC-61834 Rev B. Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011

- -Flight Systems Branch (ER3) monthly review of status report/project schedule for implementation of JSC 61834 Rev B Added REV 2

6.0 Cost Summary and Revision History

DO 399 R2 Summary				
SLC		CY6	CY7	Grand Total
AS2				
	Sum of Hrs			
	Sum of Dollars			
EN1				
	Sum of Hrs			
	Sum of Dollars			
EN2				
	Sum of Hrs			
	Sum of Dollars			
EN3				
	Sum of Hrs			
	Sum of Dollars			
IT3				
	Sum of Hrs			
	Sum of Dollars			
IT4				
	Sum of Hrs			
	Sum of Dollars			
SC4				
	Sum of Hrs			
	Sum of Dollars			
EN4				
	Sum of Hrs			
	Sum of Dollars			
IT2				
	Sum of Hrs			
	Sum of Dollars			
PC1				
	Sum of Hrs			
	Sum of Dollars			
Total Direct Labor Hrs				
Total Direct Labor Cost				
Subcontract				
Material				
Travel				
NLR Misc				
Burden on Non-Labor				
Total Non-Labor				
Total Costs				
Fee (100% of Pool)				
Total				$2,964,299.70

DO 399 revision history	Total cost	Reason for revision
Original	2,737,899	
Revision 1	2,882,502	Revision A to JSC 61834, Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011, requires additional resources for visiting vehicle robotics analysis and integration services, Mission Evaluation Room (MER) robotics console services, and Mobile Servicing System (MSS) software related assessments and testing.
Revision 2	2,964,300	Revision B to JSC 61834, Engineering Requirements and Products for International Space Station and Shuttle Program Robotic Systems for FY 2011,

		requires additional resources for SRMS engineering services and MSS System Management and Subsystem Management engineering services. A slight reduction of resources is required for EBIT analysis.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HC86D DO 400 Rev 3

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2010-09/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian C. Clayton**

Signature: **Adrian C. Clayton** Date: 09/13/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	**Dynamic Systems Test Branch (ER5) Services**					
DO	**400 Rev 3**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$1,096,786.02

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ10HC86D-DO400 REV 3

Originator: ASHER LIEBERMAN (ER5) (575) .52-5150 **TMR:** Jared Woodfill (ER) (281) 483-6331

Revision Summary:

ER5-TM 400 Revision 3 is incorporated and supersedes ER5-TM400-Revision 2:
1. Increase Engineering Services Pool (ER5) scope.
2. Rescope SDTS to resolve more working system failures and less material than planned.
3. Rescope ARGOS to remove the originally planned amount of Stress Analysis work and increase materials for system development requirements.

1. Title of Effort: Dynamic Systems Test Branch (ER5) Services

2. Date of Request: 08/05/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.1.4 Website Development**
The contractor shall design, develop, modify, test and install Websites. The contractor shall provide configuration documentation and training on new and modified websites.

e. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

f. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

g. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

h. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

i. **2.1.3 Facility Modifications**
The contractor shall perform facility systems performance evaluations and facility systems modernization and upgrades for EA and KA facilities. The contractor shall transition facility operational readiness conditions for EA and KA facilities.

j. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance Updated REV 3

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 08/15/2011 and ends 09/30/2011.

5. Product Requirements

5.1 Dynamic Systems Branch Engineering Services Updated REV 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services as described in ER5-TM400, and under the technical authority of the Dynamic Systems Test Branch of the Software, Robotics, and Simulation Division (SR&SD). All maintenance and operations, mechanical design and design analysis, electrical engineering, services for the design, testing and evaluation of hardware in SR&SD projects as well as training/test operations for several of the Building 9 robotic laboratories and training/test facilities will be done as described in ER5-TM400. Additionally, the contractor shall provide engineering services associated with the systems engineering, design, analysis, general manufacturing, test and sustaining engineering to the USA Simplified Aid For EVA Rescue (SAFER).

The regular status report/summary (DRD 105) is required. A single integrated regular status report/summary encompassing all of the 5.1 tasks will be delivered monthly.

Changes to the Dynamic Systems Test Branch (ER5) Services Master Plan and Schedule (ER5-TM400) will be mutually agreed upon by NASA and contractor and will be documented in the Regular Status Report/Summary Review (DRD 105). Changes which impact cost or product delivery and period of performance will require a revision to this DO.

Product Verification will go through Software, Robotics & Simulation Division, Dynamic Systems Test Branch review, witness and acceptance.

Effective DO Rev. 3: ER5 TM-400-Rev 3 supercedes ER5-TM 400-Rev 2. Updated REV 3

5.1.1 USA SAFER Flight Unit Processing and Sustaining Engineering Updated Rev 1

Project Code:

The Contractor shall provide the engineering services necessary to continue the operation of the USA SAFER flight system in accordance with ER5-TM400, Section I.

5.1.2 Engineering Service Pool Tasks Updated Rev 1

Project Code:

The Contractor shall provide engineering services necessary to continue the operation of the Engineering Services Pool Tasks in accordance with ER5-TM400, Section II.

5.1.3 SDTS Facilities Maintenance and Operations/Test Operations Updated Rev 1

Project Code:

The Contractor shall provide the technical engineering services necessary to continue facility maintenance and test operations in accordance with ER5-TM400, Section III.

5.1.4 Quality/Safety Services Updated Rev 1

Project Code:

The Contractor shall provide technical services for the approved Safety and Quality Systems, including audit preparation and corrective action resolution for each of the laboratories in accordance with ER5-TM400, Section IV.

5.1.5 ARGOS Engineering Services Updated Rev 1

Project Code:

The Contractor shall provide engineering services necessary to continue development and test operations in accordance with ER5-TM400, Section V.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001	JSC Lessons Learned Process	10-02

EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
IEEE/ASTM SI 10-2002	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
IPC 2221	Generic Standard on Printed Board Design	Rev A 05-03
IPC-6011	Generic Performance Specification for Printed Boards	07-96
IPC-6012	Qualification and Performance Specification for Rigid Printed Boards	Rev A 07-00
JPD 2800.4	JSC Information Technology (IT) Program Management	03-01
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2800.3	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 17481	Safety Requirements Document for JSC Space Shuttle Flight Equipment	Rev B 09-02
JSC 17773	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 28035	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 49879 Draft	Johnson Space Center (JSC) Wire and Cable Integrity Compliance Program	Draft
MIL-STD-882	Standard Practice for System Safety	Rev D 02-02
MIL-STD-973	Configuration Control	Notice 4
NASA-STD-2101-91	NASA Software Documentation Standard	7-91
NASA-STD-2201.93	Software Assurance Standard	11/92
NASA-STD-8739.2	Surface Mount Technology	8-99
NASA-STD-8739.3	Soldered Electrical Connection	12-97
NASA-STD-8739.5	Fiber Optic Terminations, Cable Assemblies, and Installation	2-98
NASA-STD-9739.4	Crimping, Interconnecting Cables, Harnesses, and Wiring	2-98
NPD 9501.1	NASA Contractor Financial Management Reporting System	Rev G 05-00
NPD 9501.3	Earned Value Management	Rev A 08-02
NPR 2810.1	Security of Information Technology	08-99
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
NPR 9501.2	NASA Contractor Financial Management Reporting	Rev D 05-01
NSTS 13830	Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station	Rev C change 4 01-02
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
NSTS 22206	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	Rev D 12-93
NSTS 5300.4 (1D-2)	Safety, Reliability, Maintainability and Quality Provisions for the Space Shuttle Program	9-97
NT-CWI-001	Task Performance Sheet (TPS)	Rev A 03-01
NT-CWI-003	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01
SSP 30309	Safety Analysis and Risk Assessment Requirements	Rev E 01-95
SSP 30524	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
SSP 30599	ISS Safety Review Process	Rev A 06-95
SSP 50287	Hardware/Software Acceptance Process	Rev A 05-01
SSP 50431	Space Station Program Requirements for Payloads	Rev A 06-01
SW-E-0002	GSE General Design Requirements Space Shuttle	Rev E 02-92
ER5-TM400-Rev3 Added REV 3	Dynamic Systems Test Branch (ER5) Services Master Plan and Schedule Implementation Plan	3
SD&SD-00-016	RMP Drawing Control Procedure	C
SR&SD-00-010	RMP Standard Operating Procedure	J
SR&SD-00-011	RMP Training/Certification Plan Work Instruction	F
SR&SD-01-026	Configuration Management Plan Work Instruction for DMT	B
SR&SD-08-005	Configuration Management Plan for ARGOS	Original
SR&SD-96-020	RMP Configuration Management Work Instruction	C
SR&SD-97-015	SDTS Document Listing	H

c. **Required DRDs**

5.1.1 USA SAFER Flight Unit Processing and Sustaining Engineering

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each Month

5.1.2 Engineering Service Pool Tasks

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each Month

5.1.3 SDTS Facilities Maintenance and Operations/Test Operations

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each Month

5.1.4 Quality/Safety Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each Month

5.1.5 ARGOS Engineering Services

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each Month

d. **Products**

5.1.1 USA SAFER Flight Unit Processing and Sustaining Engineering

Product(s)	Quantity	Delivery Date
Regular Status Report/Summary Review Updated REV 3	1	As per ER5-TM400-Rev3
USA SAFER Flight Unit Processing and Sustaining Engineering Updated REV 3	As per ER5-TM400-Original	As per ER5-TM400-Rev3

5.1.2 Engineering Service Pool Tasks

Product(s)	Quantity	Delivery Date
Regular Status Report/Summary Review Updated REV 3	1	As per ER5-TM400-Rev3
Engineering Service Pool Tasks Updated REV 3	As per ER5-TM400-Rev 1	As per ER5-TM400-Rev3

5.1.3 SDTS Facilities Maintenance and Operations/Test Operations

Product(s)	Quantity	Delivery Date
Regular Status Report/Summary Review Updated REV 3	1	As per ER5-TM400-Rev3
SDTS Facilities Maintenance and Test Operations Updated REV 3	As per ER5-TM400-Rev 1	As per ER5-TM400-Rev3

5.1.4 Quality/Safety Services

Product(s)	Quantity	Delivery Date
Regular Status Report/Summary Review Updated REV 3	1	As per ER5-TM400-Rev3
Quality/Safety Updated REV 3	As per ER5-TM400-Rev 1	As per ER5-TM400-Rev3

5.1.5 ARGOS Engineering Services

Product(s)	Quantity	Delivery Date
Regular Status Report/Summary Review Updated REV 3	1	As per ER5-TM400-Rev3
ARGOS Engineering, Maintenance, Operations, and Test Updated REV 3	As per ER5-TM400-Rev 1	As per ER5-TM400-Rev3

e. **Product Verification**

5.1.1 USA SAFER Flight Unit Processing and Sustaining Engineering

i. Regular Status Report/Summary Review

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section I. Updated REV 3

ii. USA SAFER Flight Unit Processing and Sustaining Engineering

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section I. Updated REV 3

5.1.2 Engineering Service Pool Tasks

i. Regular Status Report/Summary Review

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section II. Updated REV 3

ii. Engineering Service Pool Tasks

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section II. Updated REV 3

5.1.3 SDTS Facilities Maintenance and Operations/Test Operations

i. Regular Status Report/Summary Review

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section III. Updated REV 3

ii. SDTS Facilities Maintenance and Test Operations

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section III. Updated REV 3

5.1.4 Quality/Safety Services

i. Regular Status Report/Summary Review

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section IV. Updated REV 3

ii. Quality/Safety

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section IV. Updated REV 3

5.1.5 ARGOS Engineering Services

i. Regular Status Report/Summary Review

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section V. Updated REV 3

ii. ARGOS Engineering, Maintenance, Operations, and Test

- SR&D Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM400-Rev3, Section V. Updated REV 3

6.0 Cost Summary and Revision History

DO 400 R3 Summary				
SLC		CY6	CY7	**Grand Total**
EN1				
	Sum of Hrs			
	Sum of Dollars			
EN2				
	Sum of Hrs			
	Sum of Dollars			
EN3				
	Sum of Hrs			
	Sum of Dollars			
EN4				
	Sum of Hrs			
	Sum of Dollars			
ESS				
	Sum of Hrs			
	Sum of Dollars			
ET2				
	Sum of Hrs			
	Sum of Dollars			
IT3				
	Sum of Hrs			
	Sum of Dollars			
PC1				
	Sum of Hrs			
	Sum of Dollars			
SV				
	Sum of Hrs			
	Sum of Dollars			
TN2				
	Sum of Hrs			
	Sum of Dollars			
TN3				
	Sum of Hrs			
	Sum of Dollars			
QA1				
	Sum of Hrs			
	Sum of Dollars			
QE1				
	Sum of Hrs			
	Sum of Dollars			
SE				
	Sum of Hrs			
	Sum of Dollars			
Total Direct Labor Hrs				
Total Direct Labor Cost				
Subcontract				
Material				
Travel				
NLR Misc				
Burden on Non-Labor				
Total Non-Labor				
Total Costs				
Fee (100% of Pool)				
Total				**$1,096,786.02**

DO 400 revision history	Total cost	Reason for revision
Original	$1,217,813	N/A
Revision 1	$954,545	This revision to the DO incorporates a descope of the work for the B9 HiBay, ARGOS, and SDTS subtasks of the DO. The descope of the Engineering Service Pool is due to a reduction of the customer's available budget and shift of resources to new SAFER work in the ER5 branch resulting in a reduction of approximately 3 FTE on this DO. The SDTS subtask material allocation is also reduced to bring the scope in line with customer's available funds. The ARGOS subtask is deleted in this revision per customer request.
Revision 2	$1,061,638	This DO revision adds scope to the SAFER Sustaining task to provide engineering services to assist NASA in certifying the USA SAFERs to fly on alternate launch vehicles post shuttle retirement. This revision also adds scope to perform stress analysis for the ARGOS project.
Revision 3	$1,096,786	This DO revision adds scope to procure hardware for ARGOS and also decreases the stress analysis work by $10k. This revision also adds additional scope for material purchases for Engineering Service Pool and redistributes SDTS costs between labor and non-labor.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HE49D DO 401 Rev 1	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 10/01/2010-09/30/2011

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order.
Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: 07/18/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ER7 FY11 Systems Engineering Simulator (SES) Engineering Services					
DO	**401 R1**					
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:

☐COMP ☐PART

Requisition No.: PPC: BC

Reissue To:

13. Total

$2,730,081.29

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ10HE49D-DO401 REV 1

Originator: Michael Red (ER7) (281) 483-1546 **TMR:** Jared Woodfill (ER) (281) 483-6331

Revision Summary:
Changes required for expanded scope of task.

1. Title of Effort: ER7 FY11 Systems Engineering Simulator (SES) Engineering Services

2. Date of Request: 06/14/2011

3. Statement of Work Task Description

a. **2.3.1-Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 09/30/2011.

5. Product Requirements

5.1 FY11 Systems Engineering Simulator (SES) Engineering Services

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering services associated with the Systems Engineering Simulator (SES) in accordance with ER7-TM401 (SES FY11) and under the technical authority of the Simulation and Graphics Branch of the Automation, Robotics and Simulation Division (ARSD). All design, development, integration and validation of hardware and software will be done in accordance with SES WI 1005 (SES Project Life Cycle Process).

5.1.1 SES Engineering Services Development Updated REV 1

Project Code:

The contractor shall provide the engineering services necessary to conduct simulation development in accordance with ER7-TM401 (SES FY11).

b. **Applicable Documents**

Document Number	Document Name	Rev.
ER7-TM401 (SES FY11)	SES Project Requirements	Current
SES WI 1005	SES Project Life Cycle Process	Current

c. **Required DRDs**

5.1.1 SES Engineering Services Development

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Monthly, 17th day of the month

d. **Products**

5.1.1 SES Engineering Services Development

Product(s)	Quantity	Delivery Date
Implementation of ER7-TM401 (SES FY11)	1	9/30/2011

e. **Product Verification**

5.1.1 SES Engineering Services Development

i. Implementation of ER7-TM401 (SES FY11)

- SRSD Simulation and Graphics Branch review, witness and acceptance of simulation engineering data

6.0 Cost Summary and Revision History

SLC		CY6	CY7	CY8	Grand Total
AS2					
	Sum of Hrs				
	Sum of Dollars				
BS1					
	Sum of Hrs				
	Sum of Dollars				
EN1					
	Sum of Hrs				
	Sum of Dollars				
EN2					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
EN4					

	Sum of Hrs
	Sum of Dollars
ESS	
	Sum of Hrs
	Sum of Dollars
IT2	
	Sum of Hrs
	Sum of Dollars
IT3	
	Sum of Hrs
	Sum of Dollars
IT4	
	Sum of Hrs
	Sum of Dollars
PC1	
	Sum of Hrs
	Sum of Dollars
SV	
	Sum of Hrs
	Sum of Dollars
TN3	
	Sum of Hrs
	Sum of Dollars
Total Direct Labor Hrs	
Total Direct Labor Cost	
Subcontract	
Material	
Travel	
NLR Misc	
Burden on Non-Labor	
Total Non-Labor	
Total Costs	
Fee (100% of Pool)	
Total	**$2,730,081.29**

64

DO 401 revision history	Total cost	Reason for revision
Original	$2,695,444	Beginning of FY11
Revision 1	$2,730,081	Add labor funding for design and installation of Beta Dome hardware to place the MMSEV cockpit at mid-sphere, and integration of computers into SES Mini-Dome facility.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HC90D DO 402 Rev 1

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2010-09/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: 6/3/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ER7 FY11 Simulation Robot Work Station (SRWS) Engineering Services					
DO	**402 Rev 1**					
	Est. Labor Costs	b4				
	Materials/Subcontracts					
	Travel				b4	
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$455,766.01

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

Proposal-DO402 REV 1

Originator: Jared Woodfill (ER) (281) 483-6331 **TMR:** Jared Woodfill () (281) 483-6331

Revision Summary:

DO-402 Rev Summary: The subject revision provides Enigma Graphics Scene generator and TRICK Simulation Host hardware, software, and documentation upgrades as well as MSS software integration services. The revision effort is detailed in the supporting document ER7-TM402 by changing item 1, removing item 2, and reducing the cost to complete DO-402 subtask 3 to approximately half of its previous value.

1. Title of Effort: ER7 FY11 Simulation Robot Work Station (SRWS) Engineering Services

2. Date of Request: 04/21/2011

3. Statement of Work Task Description

a. **2.1-Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 09/30/2011.

5. Product Requirements

5.1 SRWS Facilities Maintenance and Operations/Test Operations

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide the engineering services necessary to continue training and test operations in accordance with ER7-TM402, per the ESCG-8300-ER-08-ER-DOC-0009 SRWS Engineering Services Project Management Plan.

5.1.1 Advanced Robotics Lab Development and Testing Services

Project Code:

Revisions to ER7-TM402, ER7 SRWS Engineering Services Requirements, must be approved by NASA Simulation and Graphics Branch (ER7) and accepted by the contractor Delivery Order Branch Technical Manager and Division Technical Manager. Changes which impact cost or product delivery or period of performance will require a revision to this DO.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ER7-TM402	ER7 SRWS Engineering Services Requirements	Current

c. **Required DRDs**

5.1.1 Advanced Robotics Lab Development and Testing Services

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	As required

d. **Products**

5.1.1 Advanced Robotics Lab Development and Testing Services

Product(s)	Quantity	Delivery Date
Informal Status Reports	50	Weekly
Implementation of ER7-TM402	1	09/30/2011

e. **Product Verification**

5.1.1 Advanced Robotics Lab Development and Testing Services

i. Informal Status Reports

- Completion of regular status report/summary review.

ii. Implementation of ER7-TM402

- NASA DO Technical Monitor will review/accept completed product. Acceptance by TM will be documented through TMR/Alternate.

6.0 Cost Summary and Revision History

DO 402 R1 Summary				
SLC		CY6	CY7	**Total**
EN4				
	Sum of Hrs			
	Sum of Dollars			
IT4				
	Sum of Hrs			
	Sum of Dollars			
PC1				
	Sum of Hrs			
	Sum of Dollars			
AS2				
	Sum of Hrs			
	Sum of Dollars			
ESS				
	Sum of Hrs			
	Sum of Dollars			
QA2				
	Sum of Hrs			
	Sum of Dollars			
SV				
	Sum of Hrs			
	Sum of Dollars			
Total Direct Labor Hrs				
Total Direct Labor Cost				
Subcontract				
Material				
Travel				
NLR Misc				
Burden on Non-Labor				
Total Non-Labor				
Total Costs				
Fee (100% of Pool)				
Total				**$455,766.01**

DO 402 revision history	Total cost	Reason for revision
Original	$508,665	Simulated Robotics Work Station (SRWS) Services
Revision 1	$455,766	Clarified and refined tasks for WBS-30 Simulated Robotics Work Station (SRWS) Operational Control Software Development per coordination with customer. Primary refinement was the inclusion of an SRWS Maintenance Plan. Remove dollars from WBS-03 Simulated Robotics Work Station (SRWS) Operational Control Software Development lining up the budget with the tasks to be be completed.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HE59D DO 403 Rev 1	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 09/30/2010-01/31/2013

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: **Adrian D. Clayton** Date: 05/26/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Energy Systems Division Services					
DO	**403 Rev 1**					
	Est. Labor Costs	b4			b4	
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$7,441,231.63

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ10HE59D-DO403 REV 1

Originator: Roberto Garcia (EP) (281) 483-2076 **TMR:** Roberto Garcia (EP) (281) 483-2076

Revision Summary:
Revision will change period of performance for Shuttle program requirements to specified date in the corresponding revised Project Directives.

1. Title of Effort: Energy Systems Division Services

2. Date of Request: 02/25/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

c. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 09/30/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Energy Systems Division Services

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide technical services, analysis, and hardware and software design and development for the Energy Systems Division on projects specified by the Energy Systems Division (ESD) Services Project Plan, EP-TRD-101. Depending on project life cycle, requirements include conceptual design, feasibility studies, analysis, development, manufacturing, qualification testing, flight certification, safety and risk analysis, operations, and sustaining engineering. ESD functional areas include:

Propulsion
Batteries and Chargers
Hydraulic and Electromechanical Actuation
Chemical Processing
Power Generation
Fluids Distribution, Storage and On-orbit Transfer
In-Situ Resource Utilization (ISRU)
Energy Conversion & Storage
Power Distribution & Control
Pyrotechnics

For the purposes of these requirements, the term "project" is used to refer to a discrete task, including technical services, with schedule and measured products. Requirements for all projects shall be documented on Project Directives as part of the project management process defined in EP-TRD-101. Project Directives will identify any other contract DRD's depending on the engineering life cycle of the project tasks that will be delivered in addition to those specified in this Delivery Order.

The contractor shall provide the specific products by function, program, or special project as detailed in the following sections. The project technical status, schedule, and supplemental cost reporting product requirements specified in 5.1.1, Institutional Services, shall cover all products delivered for 5.1.1 through 5.1.8.

Requirements changes within the ESD Services Project Plan and Project Directives that affect the overall contract scope of this delivery order shall require revision. The link for the Project Plan is:

\\jsc-ifs-02\data\Ea\EP_Shr\SC\EP-TRD-101.doc

5.1.1 Institutional Services Updated REV 1

Project Code:

The products for Institutional Services are associated with specific services of project management, technical graphics production, information systems planning development and management. An initial project schedule, the Master Planning Schedule (MPS), shall be provided, followed by updates as required for changes to project/service requirements or external dependencies. The MPS shall be accepted and controlled by NASA at an EP CCB, with ESCG engagement.

The Master Planning Schedule file link for EP projects is \\Jsc-ifs02\EA\EP_SHR\SC\MPS.xlsm

Project status shall be provided monthly to provide technical details on completed milestones and supplemental cost information at the project level as specified in EP-TRD-101. Product quantities are weighted, based on a typical flight battery refurbishment task.

5.1.2 SSP Technical Services Updated REV 1

Project Code:

The products for Space Shuttle Program technical services include subsystem mission operations summaries, failure analysis, subsystem and component analysis data, analysis software code and user guides, feasibility studies, and safety and risk analysis for ESD functional areas. SSP technical services are required for Shuttle missions through the end of the Program. Product quantities are weighted, based on a typical flight battery refurbishment task.

5.1.3 ISS Technical Services Updated REV 1

Project Code:

The products for International Space Station Program technical services include failure analyses and risk assessments, subsystem and component analysis data, analysis software code and user guides, feasibility studies, and safety and risk analysis for ESD functional areas. Product quantities are weighted, based on a typical flight battery refurbishment task.

5.1.4 EVA Technical Services Updated REV 1
Project Code:

The products for EVA technical services include flight hardware design, development, test specification, and operational assements, component analysis data, analysis software code and user guides, feasibility studies, H/W and S/W specification development, manufacturing, and safety and risk analysis for ESD functional areas. Product quantities are weighted, based on a typical flight battery refurbishment task.

5.1.5 CxP Engineering Services Updated REV 1
Project Code:

The products for Constellation technical services include design, development, test specification, and operational assements, component analysis data, analysis software code and user guides, feasibility studies, H/W and S/W specification development, and safety and risk analysis for ESD functional areas. Product quantities are weighted, based on a typical flight battery refurbishment task.

5.1.6 Advanced Program Technical Services Updated REV 1
Project Code:

The products for Advanced Program technical services include conceptual design, feasibility studies, H/W and S/W specification development, analysis, development, manufacturing, qualification testing, flight certification, safety and risk analysis, operations, and sustaining engineeringfor ESD functional areas. Product quantities are weighted, based on a typical flight battery refurbishment task.

5.1.7 PSRP Technical Services Updated REV 1
Project Code:

The products for Payload Safety Review Panel technical services include safety analyses for payloads transported to ISS by the Shuttle and other cargo carrier spacecraft for ESD functional areas. Product quantities are weighted based on a typical flight battery charger payload safety review. The PSRP Calendar is maintained and controlled by the PRSP.

The Link to the PSRP Calendar is on the S&MA webpage http://sma.jsc.nasa.gov/pce/

5.1.8 Special Division Projects Technical Services Updated REV 1
Project Code:

The products for special Division projects technical services include conceptual design, feasibility studies, H/W and S/W specification development, analysis, development, manufacturing, qualification testing, flight certification, safety and risk analysis, operations, and sustaining engineering for ESD functional areas. Product quantities are weighted, based on a typical flight battery refurbishment task.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
EP-TRD-101	Energy Systems Division Services Project Plan	Basic
mps.xlsm	The Master Planning Schedule file link for EP projects on \\Jsc-ifs02\EA\EP_SHR\SC\MPS.xlsm	Current
PSRP_Calendar.doc	PSRP Calendar on S&MA webpage http://sma.jsc.nasa.gov/pce/	Current

c. **Required DRDs**

5.1.1 Institutional Services

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	initial and per approved changes
102	Engineering Drawings and Model Files	(see d. Products)
105	Regular Status Report/Summary Review	Monthly

5.1.2 SSP Technical Services

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	(see d. Products)

5.1.3 ISS Technical Services

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	(see d. Products)
218	Engineering Analysis	(see d. Products)

5.1.4 EVA Technical Services

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	(see d. Products)
218	Engineering Analysis	(see d. Products)

5.1.5 CxP Engineering Services

DRD #	DRD Title	Quantity/Frequency
334	GFE Project Drawings	(see d. Products)
336	Engineering Models and Simulations	(see d. Products)

5.1.6 Advanced Program Technical Services

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	(see d. Products)
218	Engineering Analysis	(see d. Products)

5.1.7 PSRP Technical Services

DRD #	DRD Title	Quantity/Frequency
218	Engineering Analysis	per PSRP Schedule

5.1.8 Special Division Projects Technical Services

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	(see d. Products)
218	Engineering Analysis	(see d. Products)

d. **Products**

5.1.1 Institutional Services

Product(s)	Quantity	Delivery Date
Monthly Status Report and Supplemental Cost Data Updated REV 1	28	15th of following month
MasterPlanning Schedule Updated REV 1	1	15 days after initiation or change approval
Technical Graphics Products Updated REV 1	9	per MPS, i.a.w. mps.xlsm

5.1.2 SSP Technical Services

Product(s)	Quantity	Delivery Date
Engineering Analysis	7	per MPS, i.a.w. mps.xlsm

5.1.3 ISS Technical Services

Product(s)	Quantity	Delivery Date
Engineering Drawings and Model Files Updated REV 1	30	per MPS, i.a.w. mps.xlsm

Engineering Analysis	30	per MPS, i.a.w. mps.xlsm

5.1.4 EVA Technical Services

Product(s)	Quantity	Delivery Date
Engineering Drawings and Model Files Updated REV 1	13	per MPS, i.a.w. mps.xlsm
Engineering Analysis	13	per MPS, i.a.w. mps.xlsm

5.1.5 CxP Engineering Services

Product(s)	Quantity	Delivery Date
Engineering Drawings and Model Files Updated REV 1	28	per MPS, i.a.w. mps.xlsm
Engineering Analysis	28	per MPS, i.a.w. mps.xlsm

5.1.6 Advanced Program Technical Services

Product(s)	Quantity	Delivery Date
Engineering Drawings and Model Files Updated REV 1	12	per MPS, i.a.w. mps.xlsm
Engineering Analysis	12	per MPS, i.a.w. mps.xlsm

5.1.7 PSRP Technical Services

Product(s)	Quantity	Delivery Date
Payload Safety Comments for PSRP Updated REV 1	672	per PSRP Schedule, i.a.w. PRPS_Calendar.doc

5.1.8 Special Division Projects Technical Services

Product(s)	Quantity	Delivery Date
Engineering Drawings and Model Files Updated REV 1	5	per MPS, i.a.w. mps.xlsm
Engineering Analysis	5	per MPS, i.a.w. mps.xlsm

e. **Product Verification**

5.1.1 Institutional Services

i. Monthly Status Report and Supplemental Cost Data

- NASA Division, Branch and Technical Monitor review and acceptance of report and data.

ii. MasterPlanning Schedule

- NASA Division, Branch and Technical Monitor review and acceptance of schedule.

iii. Technical Graphics Products

- NASA Technical Monitor review and acceptance of technical graphics products.

5.1.2 SSP Technical Services

i. Engineering Analysis

- NASA Technical Monitor review and acceptance of analysis.

5.1.3 ISS Technical Services

i. Engineering Drawings and Model Files

- NASA Technical Monitor review and acceptance of drawings.

ii. Engineering Analysis

- NASA Technical Monitor review and acceptance of analysis.

5.1.4 EVA Technical Services

i. Engineering Drawings and Model Files

- NASA Technical Monitor review and acceptance of drawings.

ii. Engineering Analysis

- NASA Technical Monitor review and acceptance of analysis.

5.1.5 CxP Engineering Services

i. Engineering Drawings and Model Files

- NASA Technical Monitor review and acceptance of drawings.

ii. Engineering Analysis

- NASA Technical Monitor review and acceptance of analysis.

5.1.6 Advanced Program Technical Services

i. Engineering Drawings and Model Files

- NASA Technical Monitor review and acceptance of drawings.

ii. Engineering Analysis

- NASA Technical Monitor review and acceptance of analysis.

5.1.7 PSRP Technical Services

i. Payload Safety Comments for PSRP

- NASA EP Technical Monitor and PSRP review and acceptance of analysis.

5.1.8 Special Division Projects Technical Services

i. Engineering Drawings and Model Files

- NASA Technical Monitor review and acceptance of drawings.

ii. Engineering Analysis

- NASA Technical Monitor review and acceptance of analysis.

6.0 Cost Summary and Revision History

ROM C403%R1

SLC	Type	CY6	CY7	CY8	G Total
AS2	Sum of Hours				
	Sum of Dollars				
BS1	Sum of Hours				
	Sum of Dollars				
EN1	Sum of Hours				
	Sum of Dollars				
EN2	Sum of Hours				
	Sum of Dollars				
EN3	Sum of Hours				
	Sum of Dollars				
EN4	Sum of Hours				
	Sum of Dollars				
ESS	Sum of Hours				
	Sum of Dollars				
ET3	Sum of Hours				
	Sum of Dollars				
ETS	Sum of Hours				
	Sum of Dollars				
IT3	Sum of Hours				
	Sum of Dollars				
PC2	Sum of Hours				
	Sum of Dollars				
QE3	Sum of Hours				
	Sum of Dollars				
SC1	Sum of Hours				
	Sum of Dollars				
SC3	Sum of Hours				
	Sum of Dollars				
TN2	Sum of Hours				
	Sum of Dollars				
TN3	Sum of Hours				
	Sum of Dollars				
Total Direct Labor Hours					
Total Direct Labor Costs					
Travel Costs					
Subcontract					
NLR Misc					
Materials					
Burden on Non-Labor					
Total Non Labor					
Total Costs					
Fee					
Total					$7,441,231.63

DO 403 Revision History	Total cost	Reason for revision
Original	$6,730,012	New DO with work proposed from FY10.
R1	$7,441,232	Section 2: Change PM Section 3: Increase the number of Project Directive of the DO from 18 to 20, increasing scope of DO. Section 5.2: Change SSP Shuttle Technical Services provided from ending in March to end at the end of Shuttle Program.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HE51D DO 404 Rev 1

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 09/29/2010-09/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall
Signature: _____ Date: _____

10. Name: **Miyoshi J. Thompson**
Signtature: Miyoshi J. Thompson Date: 05/16/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Mission Evaluation Room (MEER) Services					
DO	404 Rev 1					
	Est. Labor Costs		b4			
	Materials/Subcontracts					
	Travel				b4	
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$1,863,106.91

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.
Authorized U.S. Government Representative Date

Engineering and Science Contract

NNJ10HE51D-DO404 RBP1

Originator: Malise Fletcher (MV6) (281) 483-1952 **TMR:** Malise Fletcher (MV) (281) 483-1952

Revision Summary:
To reflect the addition of STS-135 to the manifast

1. Title of Effort: Mission Evaluation Room (MER) Services

2. Date of Request: 04/25/2011

3. Statement of Work Task Description

a. **2.1.4 Website Development**
The contractor shall design, develop, modify, test and install Websites. The contractor shall provide configuration documentation and training on new and modified websites.

b. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

c. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

d. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 09/29/2010 and ends 09/30/2011.

5. Product Requirements

5.1 MER Products and Services

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide products and services per the MER FY11 Master Plan and Schedule (MER-ESC-010) to facilitate mission operations and maintain the operational readiness of the Space Shuttle and International Space Station Mission Evaluation Rooms.

Due to the use of the SSP and ISS MER facilities and data systems for ISS continuous operations, Shuttle tests, ground operations, and simulations, the operational capability of the MER data systems shall be maintained regardless of Shuttle manifest changes. The operational capability and configuration of each MER data system shall have the capacity to conduct two simultaneous activities, in any combination of Shuttle mission, Shuttle ground operation, Shuttle system tests, ISS continuous operations, and simulations.

Unless otherwise specified, the baseline for operating procedures shall be the current version as-of October 1, 2010.

5.1.1 MER Products and Services Updated RBP1

Project Code:

The contractor shall provide operational services for the SSP and ISS MER facilities. Services shall include managing technical data, coordinating logistics for investigative teams, coordinating facility resources, maintaining and executing facility procedures, planning and scheduling training, validating required certifications and training, and providing console staffing for operations shifts.

The contractor shall configure and update MER data systems to provide for the operational readiness of the Shuttle and ISS MER to conduct Shuttle mission operations, ISS continuous operations, tests, and simulations. Data systems configuration shall include the readiness of MER Information Technology (I/T) systems and procedures. The contractor shall serve as the Group Administrator (GA) for the MER data systems and primary interface to Mission Control Center (MCC) facility working groups. The contractor shall coordinate and track open facilities issues and operate SSP MER video teleconferencing equipment for missions and Mission Management Team simulations.

The contractor shall configure and update the MER Web System to provide for the operational readiness of the Shuttle and ISS MER to conduct mission operations, simulations, and tests. This includes mission and test specific configuration, development of new web system tools, and system upgrades to provide new capability. This service shall also include the management and updating of procedures, MER specific IT procurement plans, and IT security plans.

The contractor shall design, develop, test, and release MER software development projects. Development projects may be either new software, new requirements for existing software, or maintenance changes to existing software. The developed software shall be in compliance with the Software Management Plan for Mission Control Center Applications, JSC-27029.

The contractor shall provide the capability/environment to conduct MER software development and maintenance activities. Software development systems shall be maintained to ensure compatibility with MCC Workstation hardware/software platforms. The contractor shall update I/T Security Plans in accordance with the JSC I/T Handbook and perform quarterly security scans as scheduled by the JSC Computer Security Office. The contractor shall perform property custodian duties for controlled software development environment property.

The contractor shall develop and conduct training classes for MER software tools to train SSP and ISS MER operators in the use of MER data systems. The contractor shall maintain ISS MER software tools training material and SSP MER console operations training material. The contractor shall update and maintain a database system to track MER training and certification.

The contactor shall provide documentation services for the Shuttle MER. Services shall include editing and publication of Shuttle Mission Reports and incorporation of mission updates to the Shuttle Flight Data and In-Flight Anomaly List database (Greenbook).

The contractor shall provide archival services for SSP MER technical documentation and electronic data in accordance with Shuttle end-of-program historical data capture requirements.

The contractor shall provide the necessary services to support the transition of the MER IT task form the ESC contract to the ISS Program Integration & Control (PI&C) contract which is planned for no earlier than FY12.

The contractor shall protect for SSP MER STS-135 operations, as specificed in MER-ESC-010, MER FY11 master Plan and Schedule.

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPR 2810.1	JSC Information Technology Security Handbook	
JSC 27029	Software Management Plan for Mission Control Center Applications	B
MER-ESC-001	MER Project Management Plan	A
MER-ESC-003	MER Software Development Plan	
MER-ESC-010 Added RBP1	MER FY11 Master Plan and Schedule	B

c. **Required DRDs**

5.1.1 MER Products and Services		
DRD #	**DRD Title**	**Quantity/Frequency**
105	Regular Status Report/Summary Review	Monthly - 15th of each

d. **Products**

5.1.1 MER Products and Services		
Product(s)	**Quantity**	**Delivery Date**
Implementation of MER-ESC-010 MER FY11 Master Plan and Schedule	1	09/30/2011

e. **Product Verification**

5.1.1 MER Products and Services
i. Implementation of MER-ESC-010 MER FY11 Master Plan and Schedule
- - Monthly TMR review of status report against MER-ESC-010 MER FY11 Master Plan and Schedule

6.0 Cost Summary and Revision History

DO 404 R1 Summary		ContractYear			
SLC		CY6	CY7	CY8	**Total**
AS2					
	Sum of Hrs				
	Sum of Dollars				
BS2					
	Sum of Hrs				
	Sum of Dollars				
BS3					
	Sum of Hrs				
	Sum of Dollars				
EN2					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
IT2					
	Sum of Hrs				
	Sum of Dollars				
IT3					
	Sum of Hrs				
	Sum of Dollars				
IT4					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**$1,863,106.91**

DO 404 revision history	Total cost	Reason for revision
Original	$1,654,504	Original version
Revision 1	$1,863,107	Adds protecting for SSP MER STS-135, as specified in MER-ESC-010, MER FY11 Master Plan and Schedule.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.	2. Date Of Order	NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER
NNJ10HE52D DO 405 Rev 1	See Block 10	Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office

NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421

NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor

Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447

Phone: (281) 461-5013 FAX: (281) 280-8729

TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:

Period of Performance: 09/29/2010-01/31/2013

7. BILLING ADDRESS:

NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:

☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:

☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: Adrian D. Clayton

Signtature: Adrian D. Clayton Date: 09/30/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ES5 Mechanical Design & Analysis Branch Services					
DO	**405 Rev 1**	b4			b4	
	Est. Labor Costs					
	Materials/Subcontracts					
	Travel					
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:

Requisition No.: PPC: BC ☐COMP ☐PART

Reissue To:

13. Total

$1,127,760.21

14. Quantities In "Quantity Accepted" Column Have Been:

☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:

TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

_____ Authorized U.S. Government Representative

_____ Date

Engineering and Science Contract

NNJ10HE52D-DO405 REV 1

Originator: Adam Gilmore (ES5) (281) 483-8436 **TMR:** Rhonda Moore (ES) (281) 483-5282

Revision Summary:

This revision increases the total value of the DO. It increases the engineering services required for subtask 1, Mechanical System Safety Assessments, subtask 3, Mechanical System Design & Analysis Assessments and sub-task 4, Mechanical System Projects. This DO revision deletes sub task 2, Orbiter Tire Engineering Assessments.

1. Title of Effort: ES5 Mechanical Design & Analysis Branch Services

2. Date of Request: 09/09/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

e. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

f. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration; electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

g. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight

hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

h. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 09/29/2010 and ends 01/31/2013.

5. Product Requirements

5.1 Mechanical System Safety Assessments

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide mechanical system safety assessments related to spacecraft and spacecraft payloads in accordance with the requirements of SOP-001.31. Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.1.1 Mechanical System Safety Assessments Updated REV 1
Project Code: None

Requirements same as 5.1

b. **Applicable Documents**

Document Number	Document Name	Rev.
NSTS 13830	Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station	Rev C change 4 01-02
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System	Change 13 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
MA2-00-057	Mechanical System Safety	September 2000
NASA-STD-5017	Design and Development Requirements for Mechanisms	baseline
NSTS/ISS 18798	Interpretations of NSTS/ISS payload Safety requirements	Rev B
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current
SSP 50021	ISS Safety Requirements Document	current

c. **Required DRDs**

5.1.1 Mechanical System Safety Assessments

DRD #	DRD Title	Quantity/Frequency
101 Updated REV 1	Project Schedule	3 / 1 per GFY
105 Updated REV 1	Regular Status Report/Summary Review	28 / 1 per Month

d. **Products**

5.1.1 Mechanical System Safety Assessments

Product(s)	Quantity	Delivery Date
Payload Mechanical Safety Engineering Assessment Summary Updated REV 1	28	Per SOP 001.32
Project schedule Updated REV 1	3	Per SOP 001.32

e. **Product Verification**

5.1.1 Mechanical System Safety Assessments

i. Payload Mechanical Safety Engineering Assessment Summary
- ES5 Mechanical Systems Working Group review and acceptance Updated REV 1

ii. Project schedule
- ES5 Mechanical Systems Working Group review and acceptance Updated REV 1

5.2 Orbiter Tire Engineering Assessments

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering technical assessments of the Space Shuttle Orbiter tires in accordance with the requirements of SOP-001.31. Assessments shall be planned and delivered in

accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.2.1 Orbiter Tire Engineering Assessments Updated REV 1
Project Code: none

requirements same as 5.2

b. **Applicable Documents**

Document Number	Document Name	Rev.
Per ES-TM-405	Mechanical Design and Analysis Project Schedule	current
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.2.1 Orbiter Tire Engineering Assessments		
DRD #	DRD Title	Quantity/Frequency
101 Deleted REV 1	Project Schedule	1
105 Deleted REV 1	Regular Status Report/Summary Review	2

d. **Products**

5.2.1 Orbiter Tire Engineering Assessments		
Product(s)	Quantity	Delivery Date
Technical Status Reports/Summaries Deleted REV 1	2	Per ES-TM-405
Project schedule Deleted REV 1	1	Per ES-TM-405

e. **Product Verification**

5.2.1 Orbiter Tire Engineering Assessments
i. Technical Status Reports/Summaries Deleted REV 1
- review by the NASA Subsystem Engineer Deleted REV 1
ii. Project schedule Deleted REV 1
- review by the NASA Subsystem Engineer Deleted REV 1

5.3 Mechanical System Design & Analysis Assessments

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall perform design and analyses of aerospace structures and mechanisms in accordance with the requirements of SOP-001.31. Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.3.1 Mechanical System Design & Analysis Updated REV 1
Project Code: none

requirements same as 5.3

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
SSP 30559	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01

SSP 50431	Space Station Program Requirements for Payloads	Rev A 06-01
SW-E-0002	GSE General Design Requirements Space Shuttle	Rev E 02-92
CxP 70135	Structural Design and Verification Requirements Document	4
NASA-STD-5017	Design and Development Requirements for Mechanisms	baseline
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.3.1 Mechanical System Design & Analysis

DRD #	DRD Title	Quantity/Frequency
101 Updated REV 1	Project Schedule	3 / 1 per GFY
102 Updated REV 1	Engineering Drawings and Model Files	3 / 1 per GFY
105 Updated REV 1	Regular Status Report/Summary Review	5 / 1 per half year
218 Updated REV 1	Engineering Analysis	0 N/A
336 Updated REV 1	Engineering Models and Simulations	3 / 1 per GFY

d. **Products**

5.3.1 Mechanical System Design & Analysis

Product(s)	Quantity	Delivery Date
Technical Status Reports / Summaries Updated REV 1	5	Per SOP 001.32
models and simulation package Updated REV 1	3	Per SOP 001.32
drawings and CAD model file package Updated REV 1	3	Per SOP 001.32
Analysis reports Updated REV 1	0	Per SOP 001.32
Project schedule Updated REV 1	3	Per SOP 001.32

e. **Product Verification**

5.3.1 Mechanical System Design & Analysis

i. Technical Status Reports / Summaries

- review of deliverable by ES5 NASA system manager

ii. models and simulation package

- review of deliverable by ES5 NASA system manager

iii. drawings and CAD model file package

- review of deliverable by ES5 NASA system manager

iv. Analysis reports

- review of deliverable by ES5 NASA system manager

v. Project schedule

- review of deliverable by ES5 NASA system manager

5.4 Mechanical System Projects

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide mechanical design, analysis, components, prototypes, testing, and training for the completion of mechanical system projects in accordance with the requirements of SOP-001.31. Assessments shall be planned and delivered in accordance with SOP-001.32, under the governance of the Structural Engineering Division Change Control Board (CCB).

5.4.1 Mechanical System Projects Updated REV 1
Project Code: none

requirements same as 5.4

b. **Applicable Documents**

Document Number	Document Name	Rev.
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
SSP 30559	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01
SSP 50431	Space Station Program Requirements for Payloads	Rev A 06-01
SW-E-0002	GSE General Design Requirements Space Shuttle	Rev E 02-92
CxP 70135	Structural Design and Verification Requirements	4
NASA-STD-5017	Design and Development Requirements for Mechanisms	baseline
SOP-001.31	Technical Requirements for Structural Engineering	current
SOP-001.32	Operating Plan for Structural Engineering	current

c. **Required DRDs**

5.4.1 Mechanical System Projects

DRD #	DRD Title	Quantity/Frequency
101 Updated REV 1	Project Schedule	3 / 1 per GFY
102 Updated REV 1	Engineering Drawings and Model Files	2 / 1 per GFY
105 Updated REV 1	Regular Status Report/Summary Review	2 / 1 per GFY
218 Updated REV 1	Engineering Analysis	0 N/A
336 Updated REV 1	Engineering Models and Simulations	2 / 1 per GFY

d. **Products**

5.4.1 Mechanical System Projects

Product(s)	Quantity	Delivery Date
Design / Analysis Report Updated REV 1	0	Per SOP 001.32
CAD Models and Drawing package Updated REV 1	2	Per SOP 001.32
Status Report / Summary Updated REV 1	2	Per SOP 001.32
Project schedule Updated REV 1	3	Per SOP 001.32
Engineering Models and Simulations Updated REV 1	2	Per SOP 001.32

e. **Product Verification**

5.4.1 Mechanical System Projects

i. Design / Analysis Report

- acceptance review by the NASA ES5 project manager

ii. CAD Models and Drawing package

- acceptance review by the NASA ES5 project manager

iii. Status Report / Summary

- acceptance review by the NASA ES5 project manager

iv. Project schedule

- acceptance review by the NASA ES5 project manager

v. Engineering Models and Simulations

- acceptance review by the NASA ES5 project manager

6.0 Cost Summary and Revision History

DO 405 R1 Summary					
SLC		CY6	CY7	CY8	Grand Total
AS2					
	Sum of Hrs				
	Sum of Dollars				
BS2					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					$1,127,760.21

64

DO 405 revision history	Total cost	Reason for revision
Original	930,265	N/A
Revision 1	1,127,760	This revision increases the total value of the DO by approximately $197K. It increases the engineering services required for subtask 1, Mechanical System Safety Assessments, subtask 3, Mechanical System Design & Analysis Assessments and sub-task 4, Mechanical System Projects. This DO revision deletes sub task 2, Orbiter Tire Engineering Assessments.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ10HE50D DO 406 Rev 6

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 10/01/2010-09/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Adrian D. Clayton**

Signtature: Adrian D. Clayton Date: 09/06/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	Spacecraft Software Engineering					
DO	406 Rev 6					
	Est. Labor Costs		b4			
	Materials/Subcontracts					
	Travel				b4	
	Est. M&T Burden					
	Subtotal					
	Fee					

The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$3,460,800.31

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date

Engineering and Science Contract

NNJ10HE50D-DO406 REV 6

Originator: Pedro Martinez (ER6) (281) 483-9792 **TMR:** Jared Woodfill (ER) (281) 483-6331

Revision Summary:

a. Increase the scope of sub task 2 to provide final delivery of the TVIS checkout utility. This is an MPS change only.
b. Reduce the scope of sub task 2 to not include generation of input to the preliminary versions of software life cycle deliverable items associated with ISS CR 012879. (Note: This change does not include a change to the MPS.)
c. Increase the scope of sub task 5 to provide an RTEMS training class. This is an MPS change only.
d. Reduce the scope of sub task 7 to eliminate a SAFER test report. This is an MPS change only.

1. Title of Effort: Spacecraft Software Engineering

2. Date of Request: 08/22/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.1.4 Website Development**
The contractor shall design, develop, modify, test and install Websites. The contractor shall provide configuration documentation and training on new and modified websites.

e. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

f. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

g. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 10/01/2010 and ends 09/30/2011.

5. Product Requirements

5.1 ISS Advanced Radiation Instrumentation (ARI) Software Engineering Updated Rev 4

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide software engineering services for development of the ARI software, and integration of the verified software with the hardware subsystems. NASA will manage the project, participate in the development of the software, and will develop some of the software code as specified in Section 5.4 of the SDP.

Provide software sustaining engineering for the ARI project, consisting of maintenance of the IV-TEPC flight software, SSC User Application, Ground Processing application, and associated documentation.

Provide software quality services for review and approval of design documentation and test procedures for the IV-TEPC flight software, SSC User Application, and Ground Processing application. Updated Rev 4

5.1.1 ISS Advanced Radiation Instrumentation (ARI) Software Engineering Updated Rev 3

Project Code:

Provide ISS Advanced Radiation Instrumentation software engineering services for development of the software, and integration of the verified software with the hardware subsystems.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
JSC 28035	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
NASA-STD-2101-91	NASA Software Documentation Standard	7-91
NASA-STD-2202-93	Software Formal Inspections	3/01
NASA-STD-8719.13	NASA Software Safety Standard	Rev A 09-97
NASA-STD-8739-8	Software Assurance	Draft
SSP 30234	Failure Modes and Effects Analysis and Critical Items Requirements List for Space Station	Rev F 10-02
SSP 30309	Safety Analysis and Risk Assessment Requirements	Rev E 01-95
SSP 30524	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
SSP 30599	ISS Safety Review Process	Rev A 06-95
SSP 30695	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287	Hardware/Software Acceptance Process	Rev A 05-01
EA-WI-025	GFE Flight Project Software and Firmware Development	Current
ER6-TM406	ER6 DO-406 Master Plan and Schedule	Current
JSC 64203	Project Technical Requirements Specification for the ISS IV-TEPC	Current
JSC 64204	Project Technical Requirements Specification for the ISS EV-TEPC	Current
JSC 64205	Project Technical Requirements Specification for the ISS RAD	Current
JSC 64429	Software Development Plan for the ISS Advanced Radiaton Instrumentation Project	Current
NASA-STD-8719.13	Software Assurance Standard	Current
NASA-STD-8739.8	Software Assurance Standard	Current

c. **Required DRDs**

5.1.1 ISS Advanced Radiation Instrumentation (ARI) Software Engineering

DRD #	DRD Title	Quantity/Frequency
101 Deleted Rev 3	Project Schedule	One/month
102 Deleted Rev 3	Engineering Drawings and Model Files	One
105	Regular Status Report/Summary Review	One/month

209 Deleted Rev 3	Flight Products Verification and Validation Plan	One
210 Deleted Rev 3	Flight Products Software Requirements Specification	Four
212 Deleted Rev 3	Flight Products Software Design Document	Four
215 Deleted Rev 3	Software Code	One
218 Added Rev 4	Engineering Analysis	One per analysis
218 Deleted Rev 3	Engineering Analysis	One per analysis
317 Deleted Rev 3	Version Description Document (Software and / or Formware, See EA-WI-025 for details)	One

d. **Products**

5.1.1 ISS Advanced Radiation Instrumentation (ARI) Software Engineering

Product(s)	Quantity	Delivery Date
Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6 DO-406 Master Plan and Schedule, Current	Per ER6 DO-406 Master Plan and Schedule, Current

e. **Product Verification**

5.1.1 ISS Advanced Radiation Instrumentation (ARI) Software Engineering

i. Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

- Products verification methods are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

5.2 ISS Countermeasures System (CMS) Software Updated REV 6

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall develop and sustain the International Space Station (ISS) Crew HealthCare System (CHeCS) Countermeasures System (CMS) and Environmental Health Services (EHS) software for on-orbit operations and ground operations as defined in the subsequent paragraphs. The Contractor shall provide software subsystem products and services for:

a) Maintenance software engineering for the Medical Equipment Computer (MEC) load through February 2011.

b) Maintenance software engineering for the Counter Measure System (CMS) Software applications from February 2011 until September 2011.

c) Software engineering for the TVIS Data Recovery Ground Utility, and the TVIS PCMCIA Card Checkout Utility. This shall include certification of the TVIS PCMCIA Card Ground Recovery Utility and Checkout Utility.

d) Software engineering for the Advanced Resistive Exercise Device (ARED) software upgrades associated with ISS CR 012879. This activity will not include generation of input to preliminary versions of software life cycle deliverable items.

ER6 will develop design documentation.

ER6 will supply the tools necessary for the contractor to perform product management, evaluations, test and verification, and develop software prototypes and accomplish training. ER6 will supply laboratory space, and development systems required by the contractor to accomplish the tasks defined in this DO. Updated REV 6

5.2.1 ISS Countermeasures System (CMS) Software Updated Rev 3
Project Code:

Develop and sustain the International Space Station (ISS) Crew HealthCare System (CHeCS) Countermeasures System (CMS) and Environmental Health Services (EHS) software for on-orbit operations and ground operations

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01

JSC 28035	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
NASA-STD-2101-91	NASA Software Documentation Standard	7-91
NASA-STD-2202-93	Software Formal Inspections	3/01
NASA-STD-8719.13	NASA Software Safety Standard	Rev A 09-97
NASA-STD-8739-8	Software Assurance	Draft
SSP 30234	Failure Modes and Effects Analysis and Critical Items Requirements List for Space Station	Rev F 10-02
SSP 30309	Safety Analysis and Risk Assessment Requirements	Rev E 01-95
SSP 30524	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
SSP 30599	ISS Safety Review Process	Rev A 06-95
SSP 30695	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287	Hardware/Software Acceptance Process	Rev A 05-01
EA-WI-025	GFE Flight Project Software and Firmware Development	Current
ER6-TM406	ER6 DO-406 Master Plan and Schedule	Current
JSC 62816	Project Management of GFE Flight Projects	Basic
JSC 62817	Crew Health Care System (CHeCS) GFE Specification	Rev. A
NASA-STD-8719.13	Software Safety Standard	Current
NASA-STD-8739.8	Software Assurance Standard	Current

c. **Required DRDs**

5.2.1 ISS Countermeasures System (CMS) Software

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	Monthly, per the Master Plan and Schedule
105	Regular Status Report/Summary Review	Monthly, per the Master Plan and Schedule
218	Engineering Analysis	One per analysis

d. **Products**

5.2.1 ISS Countermeasures System (CMS) Software

Product(s)	Quantity	Delivery Date
Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6 DO-406 Master Plan and Schedule, Current	Per ER6 DO-406 Master Plan and Schedule, Current

e. **Product Verification**

5.2.1 ISS Countermeasures System (CMS) Software

i. Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

- Products verification methods are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

5.3 International Low Impact Docking System (ILIDS) Software Development Updated Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide engineering services associated with ILIDS Software Development.
This work shall include requirements document maintenance, design, implementation, and testing of ILIDS hardware-in-the-loop (HITL) real-time (RT) simulation software.
This work shall also include the development of test objectives, test plans and test procedures, to be used during EDU-58 testing. The test plans/procedures should be based on the ILIDS software V&V document (CDR version) and requirements documents and should form the basis of the test plans/procedures to be used for formal V&V. This work shall also include HSI2 testing and development of testing tools.
Contractor shall perform SE&I engineering services. Contractor shall develop engineering assessments of SW FDIR requirements. Contractor shall also perform engineering analyses of SW interfaces and requirements (command, data/TLM (MSID), hw-software, LE

interface). Contractor shall provide engineering assessment of maintenance of SW requirements / traceability in software documentation. Contractor shall provide engineering assessment to operations concept development.Contractor shall perform engineering analyses, assessments, and provide aid as requested.
ER6 will supply the tools necessary for the contractor to perform product management, evaluations, test and verification, and develop software prototypes and accomplish training. ER6 will supply laboratory space, and development systems required by the contractor to accomplish the tasks defined in this DO. Updated Rev 3

5.3.1 International Low Impact Docking System (ILIDS) Software Development Updated Rev 3
Project Code:

Provide engineering services associated with ILIDS Software Development.
This work shall include requirements document maintenance, design, implementation, and testing of ILIDS hardware-in-the-loop (HITL) real-time (RT) simulation software.

b. Applicable Documents

Document Number	Document Name	Rev.
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
NASA-STD-2101-91	NASA Software Documentation Standard	7-91
NASA-STD-2202-93	Software Formal Inspections	3/01
NASA-STD-8719.13	NASA Software Safety Standard	Rev A 09-97
NASA-STD-8739-8	Software Assurance	Draft
CxP 70038	CxP Hazard Analysis Methodology	Revision B, 03/19/2008
CxP 70065	CxP Computing System Requirements	Baseline, Change 001, 12-20-07
EA-WI-025	GFE Flight Project Software and Firmaware Development	Current
ER6-TM406	ER6 DO-406 Master Plan and Schedule	Current
NASA-STD-8719.13	Softeare Safety Standard	Current
NASA-STD-8739.8	Software Assurance Standard	Current
SSP 30223	Problem Reporting and Corrective Action for the Space Station Program	Current, Supercedes SSP 30524, effective Rev. 1
SSP 30234	Failure Modes and Effects Analysus and Ciritical Items Requirements List for Space Station	Current
SSP 30309	Safety Analysis and Risk Assessment Requirements	Current
SSP 30599	ISS Safety Review Process	Current
SSP 30695	Accpetance Data Package Requirements Specification	Current

c. Required DRDs

5.3.1 International Low Impact Docking System (ILIDS) Software Development

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Twelve snapshots delivered once per month
209	Flight Products Verification and Validation Plan	Updates if necessary
210	Flight Products Software Requirements Specification	Updates if necessary
215	Software Code	Three
218	Engineering Analysis	One per analysis
320	Software Test Plan	Three
322	Software Test Description	Three, one per software test procedure

d. Products

5.3.1 International Low Impact Docking System (ILIDS) Software Development

Product(s)	Quantity	Delivery Date
Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6 DO-406 Master Plan and Schedule, Current	Per ER6 DO-406 Master Plan and Schedule, Current

e. Product Verification

5.3.1 International Low Impact Docking System (ILIDS) Software Development

i. Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

- Products verification methods are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

5.4 Orion Software Engineering Updated Rev 3

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide software subsystem engineering services for the Orion Crew Exploration Vehicle (CEV) Flight Software and Flight Support Software. ESCG will evaluate requirements, architecture, processes, designs, and configuration management, for various areas on the Orion Flight and Flight Support software. Additionally, the work will include fostering a collaborative environment with the Level 3 Orion prime contractor, and other Level 3 team members to create an open forum that allows for the exchange of information that will allow the NASA Orion team to assess the prime contractor?s software development activities for the entire software life cycle.
ESCG will perform the following:
1.Evaluate Orion avionics and software reference architectures and external interfaces, and participate as a member of the Orion Software SE&I team.
2.Evaluate Orion Flight and Flight Support Software plans, metrics, concepts, requirements, design, integration, verification, validation, , certification and acceptance, implementation, operations, maintenance, decommissioning and overall life cycle for the following Orion software functional areas:
a)Communications and Tracking
4.Evaluate Type 1 and Type 2 documents and provide approval recommendations. Review Type 3-5 documents for impact on Orion Software.
5.Assess Orion Software Change Requests (CRs) and Discrepancy Reports (DRs) and provide closure recommendations.
6.Perform conceptual design trades consistent with subsystem requirements. Perform testability analysis of subsystem instrumentation design using system modeling tools.
7.Provide technical reporting to the Software System Manager and Orion Software System Manager in programmatic level reviews, technical meetings, and control boards.
8.Perform development, integration and operations of the Kedalion Software Engineering Environment.
a)ESCG will assist in equipment selection, procurements, hardware and software integration, test coordination, planning, set up and overall development of the environment.
b)ESCG will maintain and track environment hardware inventory and configuration, maintaining and tracking versions and configuration of software tools, development environment, software deliveries, maintain CM documentation within the environment CM system and perform property custodian duties.
c)ESCG will develop, maintain and operate the facility through the CEV lifecycle.
d) ESCG will integrate and maintain Orion Data Services (ODS) databases.
9.Perform development, integration, and operation tasks associated with the Orion Software Tool Chain and the JSC instance of the Orion Software Collaborative Environment (SCE-lite).
a)ESCG will assist in equipment selection, procurements, hardware and software integration, test coordination, planning, set up, and overall development of the Orion Software Tool Chain.
b)ESCG will develop the JSC SCE-lite environment including integration of required SCE-lite software packages, development of capabilities to accept, distribute, and exchange Orion software product deliveries, and support of the environment.
c)ESCG will track, maintain, and ensure correct configuration of required software capabilities such as Synergy, Change, DOORS, Oracle, and LDRA in the JSC SCE-lite node.
d)ESCG will perform property custodian duties to develop, maintain, and operate the JSC SCE-lite node through the CEV lifecycle.

11.Provide technical reporting to the Flight Systems Branch (ER6) in the JSC and Engineering Directorate Software Engineering Process Groups (SEPGs).
12.Provide engineering services for NASA branch and division CMMI activities.
13. Development and integration of Orion Data Services databases, including development of GUIs.

ESCG will use ER6 products necessary for ESCG to perform product management, evaluations, test and verification, and develop software prototypes and accomplish training. ESCG will use ER6 laboratory space, and development systems required by ESCG to accomplish tasks under DO368. Updated Rev 3

5.4.1 Orion Software Engineering Updated Rev 3
Project Code:

Provide software subsystem engineering services for the Orion Crew Exploration Vehicle (CEV) Flight Software and Flight Support Software. ESCG will evaluate requirements, architecture, processes, designs, and configuration management, for various areas on the Orion Flight and Flight Support software. Additionally, the work will include fostering a collaborative environment with the Level 3 Orion prime contractor, and other Level 3 team members to create an open forum that allows for the exchange of information that will allow the NASA Orion team to assess the prime contractor's software development activities for the entire software life cycle.

b. **Applicable Documents**

Document Number	Document Name	Rev.
CxP 72099	Crew Exploration Vehicle (CEV) Software Management Plan	Current
ER6-TM406	ER6 DO-406 Master Plan and Schedule	Current
NPR 7123.1	NASA Systems Engineering Processes and Requirements	Current

c. **Required DRDs**

5.4.1 Orion Software Engineering

DRD #	DRD Title	Quantity/Frequency
102	Engineering Drawings and Model Files	Per ER6 DO-406 Master Plan and Schedule
215	Software Code	One per analysis
218	Engineering Analysis	One per analysis

d. **Products**

5.4.1 Orion Software Engineering

Product(s)	Quantity	Delivery Date
Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

e. **Product Verification**

5.4.1 Orion Software Engineering

i. Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

- Products verification methods are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

5.5 Advanced Intelligent System Capability Development and Analysis Products Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide research, technology development and analyses engineering services associated with the Intelligent Systems (IS) projects.

This activity includes prototyping components, intelligent system requirements generation, developing specifications, design, software programming, unit testing, verification testing, and integrated system validation testing. This activity also includes research and development of methods and tools for analyzing complex systems; research and development of methods for helping engineers make integrated use of disparate modeling approaches for quick look analysis; research and development of concepts and methods for collaborative intelligent systems for operations; development of content for proposals for new projects; and development of content for planning and scheduling products for new projects.

This activity includes requirements management services that shall assist the Orion Flight Software team with the identification of traceability issues and risks and provide engineering services for life cycle review of the Subsystems Specifications and Software Requirements Specifications (SRS). As a major life cycle review approaches and new releases and/or snapshots of the requirements documents become available, software requirements and requirements-related information shall be parsed and imported into the database. Continued and expanded engineering services are needed as requests for requirements reports increase. These services shall be performed in a supportive infrastructure of servers, with configuration management for the requirements database.

This activity includes sustaining engineering services for control software; sustaining engineering and engineering services for the integration of control software into prototype RTOS and other system interfaces for Habitat Systems. This also includes integration of systems developed for Habitat Systems into a Habitat Demonstration Unit (HDU).

This activity includes dry run services at JSC and on-site services for these systems during Desert Research and Technology Studies (RATS) testing, including services for multiple shifts.

This activity includes provision of lab equipment. Updated Rev 5

5.5.1 Advanced Intelligent System Capability Development and Analysis Products Updated Rev 2
Project Code:

Provide research, technology development and analyses engineering services associated with the Intelligent Systems (IS) projects.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ER6-TM406	ER6 DO-406 Master Plan and Schedule	Current

c. **Required DRDs**

5.5.1 Advanced Intelligent System Capability Development and Analysis Products

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	Monthly
218	Engineering Analysis	One per analysis

d. **Products**

5.5.1 Advanced Intelligent System Capability Development and Analysis Products

Product(s)	Quantity	Delivery Date
Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

e. **Product Verification**

5.5.1 Advanced Intelligent System Capability Development and Analysis Products

i. Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

- Products verification methods are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

5.6 JSC SEPG Engineering Services Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide continuation of the JSC Software Engineering & Process Group (SEPG) website requirements document maintenance, website development, and maintenance of the current site, provide recommendations as related to software engineering, quality, and design through implementation of NPR 7150.2, and provide recommendations/input on developing a JPR document that covers ground and flight software at JSC. This activity includes developing specifications, website development, unit testing, providing user manuals, and providing website maintenance of the new website. This activity also includes performing the research required to provide recommendations on developing the JPR document.
Contractor shall perform engineering assessments for development, maintenance, and implementation of JSC and EA SEPG Process Improvement Plans. Contractor shall also provide engineering assessments to maintenance and update of software work instructions and processes, including training and consultation to projects implementing these work instructions and processes. Contractor shall perform engineering assessments and maintenance of Process Assets Libraries. Contractor shall perform engineering assessments of the NASA software engineering policies (i.e., NPR, standards).

The contractor shall obtain specialized equipment for testing website changes. Updated Rev 5

5.6.1 JSC SEPG Engineering Services Updated Rev 5
Project Code:

Provide continuation of the JSC Software Engineering & Process Group (SEPG) website requirements document maintenance, website development, and maintenance of the current site, provide recommendations as related to software engineering, quality, and design through implementation of NPR 7150.2, and provide recommendations/input on developing a JPR document that covers ground and flight software at JSC.

b. **Applicable Documents**

Document Number	Document Name	Rev.
ER6-TM406	ER6 DO-406 Master Plan and Schedule	Current
JSC-SEPG-TBD	JSC SEPG Integrated Project Schedule	Current
JSE-SEPG-TBD	JSC SEPG Website Development Requirements	Current
NPR 7150.2	NASA Software Engineering Requirements	Current

c. **Required DRDs**

5.6.1 JSC SEPG Engineering Services

DRD #	DRD Title	Quantity/Frequency
101	Project Schedule	12/monthly
105	Regular Status Report/Summary Review	12/monthly

215	Software Code	One per analysis
218	Engineering Analysis	One per analysis

d. **Products**

5.6.1 JSC SEPG Engineering Services		
Product(s)	**Quantity**	**Delivery Date**
Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current	Per ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

e. **Product Verification**

5.6.1 JSC SEPG Engineering Services
i. Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current
- Products verification methods are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

5.7 ISS Simplified Aid for EVA Rescue (SAFER) Software Engineering Products and Services Updated Rev 5

a. **Requirement -** In compliance with the above identified SOW(s) the contractor shall provide ISS Simplified Aid for EVA Rescue (SAFER) GFE products and services for project management, software engineering, development of the software.

The contractor shall obtain specialized equipment for testing website changes.

ER6 will supply the tools necessary for the contractor to perform product management, evaluations, test and verification, and develop software prototypes and accomplish training. ER6 will supply laboratory space, and development systems required by the contractor to accomplish the tasks defined in this DO. Updated Rev 5

5.7.1 ISS Simplified Aid for EVA Rescue (SAFER) Software Engineering Products and Services Added Rev 3
Project Code:

Provide ISS Simplified Aid for EVA Rescue (SAFER) Software products and services for project management, software engineering, development of the software, and integration of the verified software with the hardware subsystems.

b. **Applicable Documents**

Document Number	Document Name	Rev.
EA-WI-025 Added Rev 3	GFE Flight Project Software and Firmware Development	Rev A 11-01
JSC 28035 Added Rev 3	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
NASA-STD-2101-91 Added Rev 3	NASA Software Documentation Standard	7-91
NASA-STD-8719.13 Added Rev 3	NASA Software Safety Standard	Rev A 09-97
NASA-STD-8739-8 Added Rev 3	Software Assurance	Draft
SSP 30234 Added Rev 3	Failure Modes and Effects Analysis and Critical Items Requirements List for Space Station	Rev F 10-02
SSP 30309 Added Rev 3	Safety Analysis and Risk Assessment Requirements	Rev E 01-95
SSP 30524 Added Rev 3	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
SSP 30599 Added Rev 3	ISS Safety Review Process	Rev A 06-95
SSP 30695 Added Rev 3	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287 Added Rev 3	Hardware/Software Acceptance Process	Rev A 05-01

ER6-TM406 Added Rev 3	ER6 DO-406 Master Plan and Schedule	Current
JSC 62816 Added Rev 3	Project Management of GFE Flight Projects	Basic

c. **Required DRDs**

5.7.1 ISS Simplified Aid for EVA Rescue (SAFER) Software Engineering Products and Services

DRD #	DRD Title	Quantity/Frequency
101 Added Rev 3	Project Schedule	Monthly, per the Master Plan and Schedule
105 Added Rev 3	Regular Status Report/Summary Review	Monthly, per the Master Plan and Schedule
210 Added Rev 3	Flight Products Software Requirements Specification	One
211 Added Rev 3	Flight Products Software Development Plan	One
212 Added Rev 3	Flight Products Software Design Document	One
215 Added Rev 3	Software Code	One
218 Added Rev 3	Engineering Analysis	One per analysis

d. **Products**

5.7.1 ISS Simplified Aid for EVA Rescue (SAFER) Software Engineering Products and Services

Product(s)	Quantity	Delivery Date
Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current Added Rev 3	Per ER6 DO-406 Master Plan and Schedule, Current	Per ER6 DO-406 Master Plan and Schedule, Current

e. **Product Verification**

5.7.1 ISS Simplified Aid for EVA Rescue (SAFER) Software Engineering Products and Services

i. Products, associated DRDs, quantities and delivery dates are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current

- Products verification methods are specified in ER6-TM406, ER6 DO-406 Master Plan and Schedule, Current Added Rev 3

6.0 Cost Summary and Revision History

DO 406 R6 Summary		ContractYear			
SLC		CY6	CY7	CY8	**Grand Total**
AS3					
	Sum of Hrs				
	Sum of Dollars				
EN4					
	Sum of Hrs				
	Sum of Dollars				
ESS					
	Sum of Hrs				
	Sum of Dollars				
IT3					
	Sum of Hrs				
	Sum of Dollars				
PC1					
	Sum of Hrs				
	Sum of Dollars				
QE2					
	Sum of Hrs				
	Sum of Dollars				
SQ4					
	Sum of Hrs				
	Sum of Dollars				
EN3					
	Sum of Hrs				
	Sum of Dollars				
IT4					
	Sum of Hrs				
	Sum of Dollars				
SE					
	Sum of Hrs				
	Sum of Dollars				
EN1					
	Sum of Hrs				
	Sum of Dollars				
BS2					
	Sum of Hrs				
	Sum of Dollars				
IT2					
	Sum of Hrs				
	Sum of Dollars				
Total Direct Labor Hrs					
Total Direct Labor Cost					
Subcontract					
Material					
Travel					
NLR Misc					
Burden on Non-Labor					
Total Non-Labor					
Total Costs					
Fee (100% of Pool)					
Total					**$3,460,800.31**

DO406 Revision Change History	Total Cost	Reason for Revision
Original	$3,091,337	Software Engineering Services.
Mod 1	$3,051,289	De-scope of software development tasking for WBS-20 CMS. Decreased scope resulted in decrease in cost by $40,047.
Mod 2	$3,019,664	• Addition of lab equipment materials purchase of $5,000 for WBS-50. • Reduction of work to WBS-20 CMS by removing design document development, reducing cost by $1,600. • Reduction of work to WBS-50 Advanced Intelligent System Capability Development and Analysis Products by removing development of a prototype Real Time Operating System (RTOS), reducing cost by $35,000. • Total cost estimate change DO406 resulting from Revision 2: -$31,626.
Mod 3	$3,401,578	• Decrease scope of 5.1 ISS Advanced Radiation Instrumentation Software Products and Services project management and integration. Remove software quality and safety tasking. Reduce cost by $101,596. • Increase scope of 5.2 ISS Countermeasures System (CMS) Software to include certification of the TVIS PCMCIA Card Checkout Utility. Increase cost by $62,819. • Increase scope of 5.3 International Low Impact Docking System (ILIDS) Software Development testing and verification. Increase cost by $24,623. • Increase scope of 5.4 Orion Software to include database development, integration, and GUI development. Increase cost by $168,385. • Add 5.7 SAFER Software tasking at a cost of $227,683. • Total cost estimate change DO406 resulting from Revision 3: $381,915.
Mod 4	$3,426,367	• Increase scope of 5.1 ISS Advanced Radiation Instrumentation Software Products and Services. Add sustaining engineering and software quality services. Increase cost by $24,788.
Mod 5	$ 3,472,007	Revision 5 of this DO consists of the following change: • Change scope of 5.2 CMS Software to include ARED software development and update TVIS Checkout and Ground Recovery Utility deliverables. Increase cost by $35,647. • Increase scope of 5.5 ISTD to include additional labor for Desert RATS software engineering services and engineering services for project proposal and planning development. Increase cost by $9,995. • Change scope of 5.6 SEPG to reduce website development tasking and add test equipment materials purchase. No net cost change. • Change scope of 5.7 to reduce tasking and add test equipment materials purchase. No net cost change. • Total cost estimate change DO406 resulting from Revision 5 is $45,640. Resulting total cost for DO406 is $ 3,472,007.
Mod 6	$3,460,800	Revision 6 of this DO consists of the following changes: • Adjust scope of 5.2. Add final delivery of the TVIS Checkout Utility (MPS change only – no cost change). Remove $8,004 for elimination of input to life cycle products.

		• Increase scope of 5.6 SEPG by $22,820 (burdened) to include provision of RTEMS real-time operating system training course (see Master Plan and Schedule, Revision F). • Reduce scope of 5.7 by $26,022 for elimination of test report product (see Master Plan and Schedule, Revision F). • Total cost estimate change DO406 resulting from Revision 6 is -$11,207. Resulting total cost for DO406 is $3,460,800.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

ORDER FOR SUPPLIES OR SERVICES

1. Order No.
NNJ11HC21D DO 413 Rev 1

2. Date Of Order
See Block 10

NOTE: MARK ALL PACKAGES AND PAPERS WITH ORDER

Certified for National Defense under DPAS (15 CFR 700) DO-C9

3. Issuing Office
NASA Johnson Space Center, Houston, TX 77058-3696
Org./Buyer: BH2 / Chris Gaspard
Tel. No.: (281) 483-0034 FAX: (281) 244-5331
E-Mail: christian.c.gaspard@nasa.gov

4. Ship To: Transportation Officer, Building 421
NASA Johnson Space Center
Houston, TX 77058
Mark For: Accountable Property
Order No.: **See Block #1**

5. Contractor
Jacobs Technology, Inc.
PO Box 58447
Houston, TX 77258-8447
Phone: (281) 461-5013 FAX: (281) 280-8729
TIN: 62-0510412 CAGE CODE: 348M3

6. Deliver On Or Before:
Period of Performance: 04/19/2011- 09/30/2011

7. BILLING ADDRESS:
NSSC - FMD Accounts Payable
Bldg. 1111, C. Road
Stennis Space Center, MS 39529
Order No.: **See Block #1**

8. Type Of Order:
☐ PURCHASE: Please furnish the following in accordance with the conditions specified on this order. Reference:
☒ DELIVERY: Except for the Terms and Conditions of Purchase Order listed on the following page, this delivery order is subject to instructions contained on this form and is issued subject to terms and conditions of contract number: **NNJ05HI05C**

9. Written acceptance of this order by contractor [X] is, [ ] is not required. Sign below if required and return to contracting officer.
Name: Ray DeVall

Signature: _____ Date: _____

10. Name: **Herbert H. Baker**

Signature: **Herbert H. Baker** Date: 09/22/2011
CONTRACTING OFFICER

11. SCHEDULE

ITEM NO.	DESCRIPTION	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY ACCEPTED
001	ISS Safer					
DO	**413 Rev 1**					
	Est. Labor Costs	b4				
	Materials/Subcontracts					
	Travel				b4	
	Est. M&T Burden					
	Subtotal					
	Fee					
	The contractor's proposal for this order is incorporated herein by reference. However the order's requirements take precedence over the contractor's proposal.					

12. For Jsc Internal Use Only:
Requisition No.: PPC: BC ☐COMP ☐PART
Reissue To:

13. Total
$2,346,475.18

14. Quantities In "Quantity Accepted" Column Have Been:
☐ INSPECTED ☐ ACCEPTED ☐ RECEIVED BY:
TO CONFORM TO THE CONTRACT, ACCEPTANCE BE AT JSC UNLESS OTHERWISE NOTED.

Authorized U.S. Government Representative _____ Date _____

Engineering and Science Contract

NNJ11HC21D-DO413 REV 1

Originator: John Chladek (ER5) (281) 483-1528 **TMR:** Jared Woodfill (ER) (281) 483-6331

Revision Summary:

This revision rescopes DO with the following changes: Project removes a main element from ESCG: SAFER Electrical System. Project pushes back SRR date and defers some documents. Deletes TRR and Phased Safety services (moved to next FY). Delays PIDS (name change to EIS) from pre-SRR to pre-PRD. Expands stress analysis to include FEA to assess IP launch vehicles. Deletes project ICDs. Deletes generation of schematics. Removes essentially all SAFER Electrical (moved to EV). Deletes FSE and MSE. Deletes GSE Transportation and Shipping containers. Deletes SAFER/Test Module Integration and SR&QA services (move to next FY).

1. Title of Effort: ISS SAFER

2. Date of Request: 07/22/2011

3. Statement of Work Task Description

a. **2.1 Technical Services**
The contractor shall provide technical services and products per Delivery Orders for NASA programs and special projects.

b. **2.1.1 Testing and Training**
The contractor shall execute testing and training requirements which include: the execution of plans, the achievement of objectives; design, development, fabrication and integration of hardware, software and instrumentation; conduct of readiness reviews; generation of procedures; scheduling of facilities; collection, reduction and reporting of data and resolution of issues.

c. **2.1.2 Engineering Assessments**
The contractor shall provide assessments which include: space flight materials usage; metallographic; fracture control; structural integrity, structural loads; loads model verification; avionics systems integrity; electrical systems integrity; hardware and software integration; hardware and software requirements, change requests, specifications, and test plans; test procedures and results, analyses; crew procedures, flight rules, and flight techniques; critical technologies; software independent verification and validation; and safety products for Government owned and Payload Customer hardware and software. The contractor shall provide documentation packages as required in Delivery Orders for each type of assessment.

d. **2.1.5 Database Development**
The contractor shall design, develop, test, implement, acquire, and document databases required to support data requirements on this contract. Technical databases include: real-time data acquisition; data archival; data analysis; requirements development; design criteria data; flight parameters data; and hardware lists. Management databases include: property records; logistics databases; flight and GSE records; and maintenance databases.

e. **2.2 Analysis**
The contractor shall perform engineering and science analysis and tool development for NASA programs, and special projects.

f. **2.2.1 Analytical Capability**
The contractor shall develop and implement new analytical tools and math models and shall modify existing analytical tools and math models to support evolving engineering and science analysis requirements. The contractor shall validate the math model implementations and tool configurations using data from bench tests, ground tests, flight tests, and/or crosschecks with other equivalent independently configured tools. The contractor shall develop new computational capabilities and modify existing computational capabilities necessary to support the generation of the engineering and science analysis products. The contractor shall deliver documentation on the definition, configuration, and verification of the analytical math models. The contractor shall also deliver documentation on the configuration and verification of the NASA unique and COTS software tools. The contractor shall provide training on how to use the NASA unique software tools to perform the associated engineering and science analyses.

g. **2.2.2 Analytical Products**
The contractor shall provide analytical products associated with engineering and science requirements including: aerodynamics and aerothermodynamics; communications and tracking; environmental control and life support; fracture mechanics and fracture analysis; guidance, navigation, and control; imagery; meteoroid and orbital debris; space environments and contamination; structural loads and stress; autonomous flight management; contact dynamics; electronics; fluid dynamics; intelligent systems; kinematics including robotics; mass properties; power management; propellant management; rendezvous, proximity operations, and capture; structural dynamics and vibration;

electromagnetic effects; thermal management; and spacecraft shielding designs.

The contractor shall perform flight systems analyses, which include: systems compatibility, software algorithm design, performance, flight reconstruction, and failure modes. Products shall include analytical math models, and results including data, algorithms and interpretation of results.

h. **2.3 Hardware and Software Products**
The contractor shall provide flight certified hardware and software products and development products for NASA programs.

i. **2.3.1 Product Development**
The contractor shall provide hardware and software products for NASA Programs. Deliverable end items may include: certified flight hardware and software, flight payloads, flight and non-flight ground support equipment (GSE), prototypes, electronic and computer and camera systems, mockups, test articles, training hardware, laboratory test equipment, and research instruments.

The contractor shall perform tasks associated with product development including: logistics; maintenance; repair; hardware and software integration; inter/intra-center integration; pre and post flight processing; training; procedure development; and procedures for operational use for system and subsystem components for NASA program products.

The contractor shall provide formal documentation including: engineering drawings, analysis reports; technical specifications and reports, test procedures and reports, and operations manuals as appropriate for hardware or software type.

j. **2.3.2 Flight Hardware and Software Certification**
The contractor shall certify flight hardware and software. The contractor shall perform tasks including: analyses; certification test plan development; certification, verification, and acceptance testing of hardware and software components, subsystems and systems.

k. **2.4 Safety and Mission Assurance**
The contractor shall perform safety and mission assurance activities for flight hardware and software including: system safety planning; reliability and maintainability predictions; safety and hazard analysis; Failure Modes and Effects Analysis (FMEA) and development of Critical Item Lists (CIL); life-cycle (wear-out) estimates for orbit maintainable items; Limited Life Items identification; qualitative maintainability assessment; certification of hardware and software; and Acceptance Data Packages for each hardware and software deliverable.

l. **2.6 Payload and Research Integration Services**
The contractor shall provide payload and research integration products and services associated with the International Space Station (ISS) which include: strategic-level research planning; tactical-level planning and payload manifesting; and execution-level planning and implementation through console operations and documentation of ISS payload mission accomplishments. The contractor shall produce promotional and educational products related to ISS payloads and research.

m. All contract management, facility maintenance and operation, data and software systems, safety and mission assurance and logistics requirements specified within the Baseline ESC SOW 1.0 are applicable and considered within scope to the ESC and shall not be priced as an element of this Delivery Order. Test facility and associated test equipment operational requirements shall be in accordance with ESC Attachment J14, EA / KA Facility Matrix. Training and certification of all personnel required to maintain the laboratories in a state of readiness are also considered within scope to ESC baseline efforts per matrix J14, EA / KA Facility Matrix.

4. Period of Performance

The period of performance does not commence until the CO has granted authorization to proceed.

This delivery order period of performance starts 03/28/2011 and ends 09/30/2011.

5. Product Requirements

5.1 ISS SAFER Development

a. **Requirement** - In compliance with the above identified SOW(s) the contractor shall provide engineering services as described in ER5-TM413-Current and under the technical authority of the Dynamic Systems Test Branch of the Software, Robotics and Simulation Division (SR&SD). The contractor shall provide engineering services associated with systems engineering, specfications, design, analysis, general manufacturing, test and sustaining engineering to the ISS Simplified Aid For EVA Rescue (SAFER), including research and development, as described in ER5-TM413-current.

Deliverables provided under this DO include regular status report/summary (DRD 105) and products described in EA-WI-023E, Project Management of Government Furnished Equipment (GFE) Flight Projects Work Instruction. A single integrated regular status report/summary encompassing all of the 5.1 tasks will be delivered monthly.

Changes to the Dynamic Systems Test Branch (ER5) Support Master Plan and Schedule (ER5-TM413) will be mutually agrees upon by NASA and contractor and will be documented in the Regular Status Report/Summary Review (DRD 105). Changes which impact cost or product delivery and period of performance will require a revision to this DO.

Product verification will be through Software, Robotics and Simulation Division, Dynamic Systems Test Branch review, witness and acceptance.

5.1.1 ISS SAFER Project Management
Project Code:

The contractor will provide engineering services necessary to manage the ISS SAFER flight system project in accordance with ER5-TM413, Section 1.1.

5.1.2 ISS SAFER Systems Engineering and Integration
Project Code:

The contractor will provide engineering services necessary to perform systems engineering and integration of the ISS SAFER flight system project in accordance with ER5-TM413, Section 1.2.

5.1.3 ISS SAFER Free Flyer
Project Code:

The contractor will provide engineering services necessary to design,develop, test and evaluate the ISS SAFER flight article (the free flyer) in accordance with ER5-TM413, Section 1.3.

5.1.4 ISS SAFER Test Module
Project Code:

The contractor will provide engineering services necessary to design,develop, test and evaluate the ISS SAFER Test Module in accordance with ER5-TM413, Section 1.4.

5.1.5 ISS SAFER/Test Module Integration
Project Code:

The contractor will provide engineering services necessary to integrate and test the ISS SAFER (free flyer) and the Test Module in accordance with ER5-TM413, Section 1.5.

5.1.6 Safety, Reliability and Quality Assurance
Project Code:

The contractor will provide engineering services necessary to support the transfer of design and analysis data to the SR&QA organization in accordance with ER5-TM413, Section 1.6.

b. **Applicable Documents**

Document Number	Document Name	Rev.
AG-CWI-001	JSC Lessons Learned Process	10-02
ANSI/ESD S20.20-1999	Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)	1999 05-99
Clinger-Cohen Act of 1996 (as revised)	IT Management Reform Act of 1996 (the "Clinger-Cohen Bill")	1996
EA-WI-023	Project Management of GFE Flight Projects	Rev D 02-04
EA-WI-025	GFE Flight Project Software and Firmware Development	Rev A 11-01
IEEE/ASTM SI 10-2002	American National Standard for Use of the International System of Units (SI): The Modern Metric System	2002
IPC 2221	Generic Standard on Printed Board Design	Rev A 05-03
IPC 2222	Sectional Design Standard for Rigid Organic Printed Boards	02-98
IPC-6011	Generic Performance Specification for Printed Boards	07-96
IPC-6012	Qualification and Performance Specification for Rigid Printed Boards	Rev A 07-00
ISO 10012	Quality Assurance Requirements for Measuring Equipment	2003 04-03
JHB 1710.13	Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems	Rev B 03-94
JPD 2800.4	JSC Information Technology (IT) Program Management	03-01
JPG 1700.1	JSC Safety & Health Handbook	Rev I 07-02
JPG 2800.3	JSC Information Technology Product Implementation Guidelines, Requirements, and Standards	
JPG 2810.1	JSC Information Technology Security Handbook	Rev B 10-01
JPG 8500.4	Engineering Drawing System Manual	Rev H 11-01
JSC 14686	Criteria/Guidelines for Payload Thermal Math Models for Integration Analysis	01-79
JSC 17481	Safety Requirements Document for JSC Space Shuttle Flight Equipment	Rev B 09-02
JSC 17773	Instruction for Preparation of Hazard Analysis for JSC Ground Operations	Rev C 04-99
JSC 23642	JSC Fastener Integrity Testing Program	Rev E 10-01
JSC 26549	Manual for the Control of Program Stock (Receiving, Handing, Storage, Packaging, Preservation, and Delivery of Controlled Flight, Non-Flight, and Ground Support Equipment	Rev B 02-04
JSC 26648	JSC Automated Information System User?s Security Guide	7-94
JSC 27260	Decal Design and Production Facility- Decal Process Document and Catalog	Rev D 05-02
JSC 28035	Program Problem Reporting and Corrective Action (PRACA) Requirements for Johnson Space Center (JSC) Government Furnished Equipment (GFE)	Rev A 05-01
JSC 28484	Program Requirements Document for Johnson Space Center Non-Critical Government Furnished Equipment	Chg 4 07-03
JSC 49879 Draft	Johnson Space Center (JSC) Wire and Cable Integrity Compliance Program	Draft
JSC 61360	Engineering Directorate Certified Parts Approval Process	Revi A
MIL-STD-882	Standard Practice for System Safety	Rev D 02-02
MIL-STD-973	Configuration Control	Notice 4
NASA-STD-2101-91	NASA Software Documentation Standard	7-91
NASA-STD-2201.93	Software Assurance Standard	11/92
NASA-STD-2202-93	Software Formal Inspections	3/01
NASA-STD-5003	Fracture Control Requirements for Payloads Using the Space Shuttle	10-96
NASA-STD-8719.13	NASA Software Safety Standard	Rev A 09-97
NASA-STD-8739-8	Software Assurance	Draft
NASA-STD-8739.1	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	8-99
NASA-STD-8739.2	Surface Mount Technology	8-99
NASA-STD-8739.3	Soldered Electrical Connection	12-97
NASA-STD-8739.5	Fiber Optic Terminations, Cable Assemblies, and Installation	2-98
NASA-STD-9739.4	Crimping, Interconnecting Cables, Harnesses, and Wiring	2-98
NPD 9501.1	NASA Contractor Financial Management Reporting System	Rev G 05-00

AR&SD-98-004	USA SAFER Project Avionics Software Design Specification	C
AR&SD-98-004	USA SAFER Project Avionics Software Design Specification	C
AR&SD-99-030	USA SAFER Project Interconnecting Cable and Harness Acceptance Test	
ARSD-00-009	Sustaining Engineering of SAFER Software Work Instruction	C
JSC-33351	SAFER Project Flight Article Prime Item Development Specification	C
JSC-33352	USA SAFER Mission Support Equipment Prime Item Development Specification	
JSC-33353	USA SAFER Project Design Loads Specification	A
JSC-33354	USA SAFER Ground Project Support Equipment Prime Item Development Specification	
JSC-37966	Project Requirements Document for the SAFER Production Project	
JSC-37967	Project Management Plan for SAFER Production Project	A
JSC-38026	Thermal Analysis Document on Simplified Aid for EVA Rescue (SAFER) CTSD-SH-787	
JSC-38381	USA SAFER Pre-Delivery Acceptance Procedure	
JSC-38382	USA SAFER Project Functional Test Procedure	D
JSC-38388	USA SAFER Project System Level Test Plan Certification Unit	C
JSC-38407	USA SAFER Project System Level Test Plan Flight Unit	A
JSC-39033	USA SAFER Post Delta CDR System Level Test Plan Certification Unit	
JSC-61618	USA SAFER Project Post Life Extension Refurbishment Test Plan Certification and Flight Units	A
JSC-61660	USA SAFER Shipping and Handling Requirements Document	
SRSD-10-006	Software, Robotics, and Simulation Division Test Readiness Review Process	Basic

c. **Required DRDs**

5.1.1 ISS SAFER Project Management

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each month

5.1.2 ISS SAFER Systems Engineering and Integration

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each month

5.1.3 ISS SAFER Free Flyer

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each month

5.1.4 ISS SAFER Test Module

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each month

5.1.5 ISS SAFER/Test Module Integration

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each month

5.1.6 Safety, Reliability and Quality Assurance

DRD #	DRD Title	Quantity/Frequency
105	Regular Status Report/Summary Review	15th of each month

d. **Products**

5.1.1 ISS SAFER Project Management

NPD 9501.3	Earned Value Management	Rev A 08-02
NPR 2810.1	Security of Information Technology	08-99
NPR 7150.2	NASA Software Engineering Requirements	Basic 09-04
NPR 8621.1	NASA Procedural Requirements for Mishap Reporting, Investigating, and Record keeping	Rev A 02-04
NPR 8715.3	NASA Safety Manual	Change 1 06-02
NPR 8735.1	Procedures for Exchanging Parts, Materials, and Safety Data Utilizing the Government-Industry Data Exchange Program and NASA Advisories	Rev A 08-02
NPR 9501.2	NASA Contractor Financial Management Reporting	Rev D 05-01
NSTS 13830	Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station	Rev C change 4 01-02
NSTS 14046	Payload Verification Requirements	Rev E Change 3 08-02
NSTS 1700.7B ISS Addendum	Safety Policy and Requirements for Payloads Using the International Space Station	Rev S 01-03
NSTS 21288	Required Data/Guidelines for Payload/Shuttle Electromagnetic Compatibility (EMC) Analysis	Basic 01-94
NSTS 22206	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)	Rev D 12-93
NSTS 37329	Structural Integration Analysis Responsibility Definition for Space Shuttle Vehicle and Cargo Element Developers	Rev B Change 2 12-01
NSTS 5300.4 (1D-2)	Safety, Reliability, Maintainability and Quality Provisions for the Space Shuttle Program	9-97
NT-CWI-001	Task Performance Sheet (TPS)	Rev A 03-01
NT-CWI-003	Quality Assurance Record Center Discrepancy Reporting and Tracking	Rev B 03-01
SN-C-0005	Contamination Control Requirements	Rev D 07-98
SSP 30234	Failure Modes and Effects Analysis and Critical Items Requirements List for Space Station	Rev F 10-02
SSP 30237	SS Electromagnetic Emissions and Susceptibility	Rev E 10-99, DCN 010 03-00, DCN011 08-00, DCN013 03-01, DCN014 03-01
SSP 30240	Space Station Grounding Requirements	Rev D 12-02
SSP 30243	Space Station Requirements for Electromagnetic Compatibility	Rev G 12-02
SSP 30256	Extravehicular Activity (EVA) Standard Interface Control Document	Rev G 09-99, Part 2 06-99, Part 3 06-99, Part 4 06-99, Part 5 06-99, IRN0001 12-99, IRN0002 10-00
SSP 30309	Safety Analysis and Risk Assessment Requirements	Rev E 01-95
SSP 30312	Electrical, Electronic and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program	Rev F 11-95
SSP 30420	Space Station Electromagnetic, Ionizing Radiation, and Plasma Environment Definition and Design Requirements.	Rev B 06-93
SSP 30423	Space Stations Approved Electrical, Electronic, and Electromechanical Parts List	Rev F 11-95
SSP 30425	Space Station Natural Environment Definition for Design	Rev B 05-94
SSP 30426	Space Station External Contamination Control Requirements	Rev D 05-94, DCN001 10-99
SSP 30524	Problem Reporting and Corrective Action (PRACA) Data System Requirements Document	Rev E 10-98
SSP 30558	Fracture Control Requirements for Space Station	Rev C 11-01
SSP 30559	Structural Design and Verification Requirements	Rev C 04-01, DCN012 09-01
SSP 30599	ISS Safety Review Process	Rev A 06-95
SSP 30695	Acceptance Data Package Requirements Specification	Rev A 01-95
SSP 50287	Hardware/Software Acceptance Process	Rev A 05-01
SSP 50431	Space Station Program Requirements for Payloads	Rev A 06-01
SSP 50492	General International Space Station On-Orbit Requirements for Nonpressurized Support Equipment	Baseline 05-00, DCN001 07-01, DCN002 07-01
UWI-AI-001	Office of the CIO Process for Document and Data Control	Rev B 03-01
AR&SD-00-009	Sustaining Engineering of SAFER Software Work Instruction	C
AR&SD-00-031	USA SAFER Project Production Verification and Validation and Installation of SAFER Avionics Software USA009	
AR&SD-96-013	SAFER Ground Test Processor Software User Guide	
AR&SD-96-015	USA SAFER Project System Test Plan	
AR&SD-96-028	USA SAFER Virtual Reality Laboratory Avionics Interface Control	

Product(s)	Quantity	Delivery Date
Implementation of ER5-TM413, Section 1.1	1	9/30/11

5.1.2 ISS SAFER Systems Engineering and Integration

Product(s)	Quantity	Delivery Date
Implementation of ER5-TM413, Section 1.2	1	9/30/11

5.1.3 ISS SAFER Free Flyer

Product(s)	Quantity	Delivery Date
Implementation of ER5-TM413, Section 1.3	1	9/30/11

5.1.4 ISS SAFER Test Module

Product(s)	Quantity	Delivery Date
Implementation of ER5-TM413, Section 1.4	1	9/30/11

5.1.5 ISS SAFER/Test Module Integration

Product(s)	Quantity	Delivery Date
Implementation of ER5-TM413, Section 1.5	1	9/30/11

5.1.6 Safety, Reliability and Quality Assurance

Product(s)	Quantity	Delivery Date
Implementation of ER5-TM413, Section 1.6	1	9/30/11

e. **Product Verification**

5.1.1 ISS SAFER Project Management

i. Implementation of ER5-TM413, Section 1.1

- SR&SD Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM413, Secton 1.1

5.1.2 ISS SAFER Systems Engineering and Integration

i. Implementation of ER5-TM413, Section 1.2

- SR&SD Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM413, Secton 1.2

5.1.3 ISS SAFER Free Flyer

i. Implementation of ER5-TM413, Section 1.3

- SR&SD Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM413, Secton 1.3

5.1.4 ISS SAFER Test Module

i. Implementation of ER5-TM413, Section 1.4

- SR&SD Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM413, Secton 1.4

5.1.5 ISS SAFER/Test Module Integration

i. Implementation of ER5-TM413, Section 1.5

- SR&SD Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM413, Secton 1.5

5.1.6 Safety, Reliability and Quality Assurance

i. Implementation of ER5-TM413, Section 1.6

- SR&SD Dynamic Systems Test Branch review, witness and acceptance of products identified in ER5-TM413, Secton 1.6

6.0 Cost Summary and Revision History

DO 413 R1 Summary			
SLC		CY7	**Grand Total**
EN1			
	Sum of Hrs		
	Sum of Dollars		
EN2			
	Sum of Hrs		
	Sum of Dollars		
EN3			
	Sum of Hrs		
	Sum of Dollars		
PC2			
	Sum of Hrs		
	Sum of Dollars		
SV			
	Sum of Hrs		
	Sum of Dollars		
EN4			
	Sum of Hrs		
	Sum of Dollars		
ESS			
	Sum of Hrs		
	Sum of Dollars		
ET3			
	Sum of Hrs		
	Sum of Dollars		
QA2			
	Sum of Hrs		
	Sum of Dollars		
QE3			
	Sum of Hrs		
	Sum of Dollars		
TN3			
	Sum of Hrs		
	Sum of Dollars		
TN2			
	Sum of Hrs		
	Sum of Dollars		
Total Direct Labor Hrs			
Total Direct Labor Cost			
Subcontract			
Material			
Travel			
NLR Misc			
Burden on Non-Labor			
Total Non-Labor			
Total Costs			
Fee (100% of Pool)			
Total			**$2,346,475.18**

DO 413 revision history	Total cost	Reason for revision
Original	$3,749,379	N/A
Revision 1	$2,346,475	This DO revision removes manufacturing scope and funding from WBS 03 along with design and analysis scope and funding from WBS 03 and 04. The revision also includes an increase in scope to WBS 02 to include additional stress analysis and a reduction of effort on WBS 05 and 06. Funding reduced by $1,402,904