ATTACHMENT J-1

STATEMENT OF WORK (SOW)

1.0 Introduction

The Upper Stage (US) Element is an integral part of the Ares I launch vehicle and provides the second stage of flight. The US Element is responsible for the roll control during the First Stage burn and separation; and will provide the guidance and navigation, command and data handling, and other avionics functions for the Ares I during all phases of the ascent flight.

The US Element is a new design that emphasizes safety, operability, and minimum life cycle cost. The overall Design, Development, Test and Evaluation (DDT&E), production, and sustaining engineering efforts include activities performed by three organizations; the NASA Design Team (NDT), the Upper Stage Production Contractor (USPC) and the Instrument Unit Production Contractor (IUPC). For clarity, the USPC will be referred to as the Contractor throughout this document. NASA is responsible for the integration of the primary elements of the Ares I Launch Vehicle including: the First Stage, US including Instrument Unit (IU), and US Engine; and will also integrate the Ares I Launch Vehicle at the launch site.

NASA is responsible for the DDT&E, including technical and programmatic integration of the US subsystems and Government-furnished property. NASA will lead the effort to develop the requirements and specifications of the US Element, the development plan and testing requirements, and all design documentation, initial manufacturing and assembly process planning, logistics planning, and operations support planning. Development, qualification, and acceptance testing will be conducted by NASA and the Contractor to satisfy requirements and for risk mitigation. NASA is responsible for the overall Upper Stage Verification and Validation process and will require support from the Contractor.

The Contractor is responsible for the manufacture and assembly of the Upper Stage Test Flight and Operational Upper Stage units including the installation of Upper Stage Instrument Unit, the Government-furnished US Engine, Booster Separation Motors, and other Government-furnished property. A description of the NASA managed and performed efforts is contained in the US Work Packages and will be made available to the Contractor to ensure their understanding of the roles and responsibilities of the NDT, IUPC, and Contractor during the design, development, and operation of the US Element.

The US conceptual design described in the USO-CLV-SE-25704 US Design Definition Document (DDD) is the baseline design for this contract. The Contractor's early role will be to provide producibility engineering support to NASA via the established US Office structure and to provide inputs into the final design configuration, specifications, and standards.

NASA will transition the manufacturing and assembly, logistics support infrastructure, configuration management, and the sustaining engineering functions to the Contractor at the key points during the development and implementation of the program currently planned to occur no later than 90 days after the completion of the following major milestones:

Manufacturing and Assembly	US Preliminary Design Review (PDR)
Logistics Support Infrastructure	US PDR
Configuration Management	US Critical Design Review (CDR)
Sustaining Engineering	US Design Certification Review (DCR)

After the completion of an orderly transition of roles and responsibilities to the Contractor, NASA will assume an insight role into the Contractor's production, sustaining engineering, and operations support of the Ares I US test program and flight hardware. After DCR, the Contractor will be responsible for sustaining engineering per SOW section 4.7, as necessary to maintain and support the US configuration and for production and operations support.

The IUPC will be selected via a separate acquisition and will be responsible for producing the avionics equipment and the installation and checkout of equipment in the US Instrument Ring primary structure as described in SOW section 10.0. The Contractor will be responsible for providing the IU primary structure to the IUPC for installation and checkout of the avionics and supporting hardware. Upon the successful installation and checkout of the avionics hardware, the IUPC will return the IU to the Contractor for final assembly and checkout of the US Element

The paragraphs that include CLIN identification numbers are to identify the type of effort and scope that may be issued via the IDIQ ordering procedures identified in Clause H3, Task Ordering Procedure. The Work Breakdown Structure (WBS) numbers included at the top of each section serve as a reference to the NASA work packages and the current US WBS.

2.0 Documents

The Contractor shall comply with the requirements as defined in the applicable documents listed in Attachment J-6, Applicable Regulations, Procedures and Documents. The Contractor may request the use of alternate applicable documents by providing a meets-or-exceeds assessment to NASA for written approval.

3.0 Project Management (WBS 136905.08.05.01)

The Contractor shall develop, implement, and maintain a set of project management processes, systems, and data deliverables for all contract work.

3.1 Project Management and Administration

a. The Contractor shall utilize the NASA developed US design to develop, produce, and certify the US Element flight units and element level test articles.

b. The Contractor shall provide producibility engineering to support the NDT led efforts to ensure safe operations and meet the requirements while minimizing life cycle costs.

c. To support MSFC Protective Services, the Contractor shall develop and deliver Badged Employee and remote IT user listings data in accordance with DRD1145MA-009.

d. To support MSFC Protective Services, the Contractor shall develop and deliver Contractor employee clearance documents in accordance with DRD1145MA-010.

e. To support MSFC Protective Services, in the assessment of employee risk determination, the Contractor shall develop and deliver Position Risk Description for Non-NASA employee forms in accordance with DRD1145MA-012.

f. To support MSFC Protective Services, the Contractor shall comply with NPR 1600.1 and NPR 1620.3 regarding NASA MAF areas identified as Mission Essential Infrastructure.

3.1.1 Contract Management

a. The Contractor shall develop and implement contract and subcontract management practices, procedures, and metrics for management of US requirements, schedules, contract cost, and life cycle cost estimates.

b. The Contractor shall perform continual evaluation of subcontractor performance toward meeting technical, business, and management provisions of the contract. The Contractor shall provide insight on subcontracts to the Government and submit consent packages as required by contract provisions. The Contractor shall implement effective change control procedures from prime to subcontractor to lower tier subcontractor for processing of proposed changes.

3.1.2 Project Management Systems, Planning and Reporting

The Contractor shall develop and implement a Project Management Plan that covers all aspects of project management for the contractor performed tasks in accordance with DRD1145MA-001.

3.1.3 Performance Management Reviews and Performance Metrics

The Contractor shall conduct quarterly Performance Management Reviews (PMRs) with the Government.

3.1.4 Data Management Systems, Planning, and Reporting

The Contractor shall collect, record, and report US information using systems that are compatible with the NASA Integrated Collaborative Environment (ICE), defined in Attachment J-9, ICE Operating Environment, and are compatible with the MSFC Design and Data Management System (DDMS) as described in the Upper Stage Element Data Management Process White Paper (USO-CLV-MA-25005).

3.1.5 Integrated Contractor Schedule (ICS)

The Contractor shall develop and maintain an Integrated Contractor Schedule (ICS) in accordance with DRD1145MA-004, for day-to-day management of the contract tasks required to meet the milestones as defined in Attachment J-8, Ares I / Upper Stage Milestones.

3.1.6 Contractor Work Breakdown Structure

The Contractor shall develop and maintain a Contractor WBS and supporting dictionary in accordance with DRD1145MA-005 that integrates with the NDT WBS as provided in Attachment J-7, Work Breakdown Structure.

3.2 Business Management

3.2.1 Financial Management

a. The Contractor shall develop, deliver, and implement monthly financial management reporting in accordance with DRD1145MA-008.

b. The Contractor shall support the development of the US annual Operating Plan (OP) for the upcoming fiscal year as requested by the Government. The Contractor shall provide program planning and budget execution data for the OP in accordance with DRD1145MA-003.

c. The Contractor shall support the development of US Element budget data in accordance with DRD1145MA-002, upon request from the Government.

d. The Contractor shall provide property financial reports in accordance with DRD1145LS-005.

e. The Contractor shall develop and deliver cost performance reporting (CPR) data submittals in accordance with DRD1145MA-011.

3.2.2 Integrated Baseline Review (IBR)

The Contractor shall perform a preliminary IBR with the Government to establish the contract baseline within 90 calendar days after the authority to proceed and will perform a delta IBR upon completion of the US CDR process. The Contractor shall perform subsequent updates as necessary for major requirement changes and as required to update the performance measurement baseline.

3.2.3 Workforce Reporting

The Contractor shall develop and deliver workforce reporting in accordance with DRD1145MA-014.

3.2.4 Life Cycle Cost Analysis

The Contractor shall provide inputs to the NDT performed life cycle cost analysis of the US, utilizing the existing Upper Stage models and tools to include all phases of the US life cycle.

3.3 Information Technology (IT) Management

a. For IT applications, other than mission-specific flight and non-flight software, the Contractor shall use Commercial-off-the-Shelf and existing Government-off-the-Shelf products where cost effective to NASA. All IT applications, other than mission-specific flight and non-flight software shall comply with NASA requirements as outlined in NPR 7150.2, NASA Software Engineering Requirements for the appropriate software classes, limited to classes E, F, and G.

b. The Contractor shall develop, update, and implement a Contract Information Technology Security Program Plan (CITSP) in accordance with DRD1145CD-001.

c. The Contractor shall develop, update and implement an IT Security Requirements Compliance Document (ITSRCD) in accordance with DRD1145CD-002.

4.0 Systems Engineering and Integration (SE&I) (WBS 136905.08.05.02)

4.1 SE&I Producibility Engineering Support

During the initial transition and integration into the NDT, the Contractor shall provide producibility engineering support to the US Element and Subsystem Integrated Product Teams (IPTs) through participation in the design and development process leading up to the successful completion of the US DCR process. The Contractor shall:

a. Provide design and integration inputs to the US Element and Subsystem Design Analysis Cycle (DAC) processes.

b. Support the requirements flowdown and maintenance of the US Element and subsystem requirements and specification documents.

c. Support the development and maintenance of US Interface Control Documents that result from US Interfaces.

d. Provide component level design input to each US subsystem IPT

e. Develop and present data and participate in the US and Subsystem level PDR(s) via the Review Item Discrepancy (RID) development and closure process.

f. Develop and present data and participate in the US and Subsystem level CDR(s) via the RID development and closure process.

g. Participate in the US and Subsystem level DCR(s) via the RID development and closure process.

h. Support the NDT in the development and submittal of verification closure reports to support NASA Verification closure process and the system Validation process.

i. Support the NDT in the presentation, concurrence and closure of issues for the US Element DCR process via submittal of verification closures and data acceptance packages.

4.2 Upper Stage and Subsystem SE&I

During the initial transition and integration into the NDT, the Contractor shall support the US Element and Subsystem Integrated Product Teams (IPTs) by in the performance of systems engineering and integration.

a. The Contractor shall perform systems engineering and integration of all Upper Stage Element and Subsystem level contract tasks.

b. The Contractor shall provide an Integrated Mass Properties Report for all Source Controlled Items (SCI) in accordance with DRD1145SE-008.

c. The Contractor shall develop an integrated requirements flowdown matrix for SCI end items, and component specifications in accordance with DRD1145SE-009.

d. The Contractor shall develop and implement a Systems Engineering Management Plan in accordance with DRD1145SE-001.

e. The Contractor shall develop and implement an integrated Master Verification and Validation Plan in accordance with DRD1145VR-001 and shall manage, develop, and track the verification data for all SCI in accordance with the integrated Master Verification and Validation Plan.

f. The Contractor shall perform a review of the US design and existing supporting documentation prior to the US PDR and shall provide the NDT with an assessment report of the results.

g. The Contractor shall provide inputs to the US Structural Dynamics Analyses, Loads and Models Documentation, and Thermal Design Data books in accordance with DRD1145DE-007 and DRD1145DE-008.

h. The Contractor shall provide inputs to the NDT developed Fracture Control Plan in accordance with DRD 1145DE-005.

i. The Contractor shall provide inputs to the US Design Definition Data book submittal in accordance with DRD1145DE-014.

j. The Contractor shall provide inputs to the US Launch Commit Criteria as necessary to support the NDT in accordance with DRD1145SE-004.

4.3 Upper Stage Configuration Management

During the initial transition and integration into the NDT, the Contractor shall support the US Element and subsystem IPTs in the performance of configuration and data management. NASA plans to transition the responsibility for all US configuration and data management to the Contractor no later than 90 days after the completion of the US CDR process.

a. The Contractor shall develop and implement a Configuration Management Plan, to include transition, in accordance with DRD 1145CM-004.

b. Upon completion of the transfer of the configuration and data management responsibility, the Contractor shall integrate the CM / DM processes across US subsystems, including modeling and simulation, engineering drawing development and release, manufacturing, operations, and quality, as well as supplier chain CM systems.

c. The Contractor shall provide assessment reports and support the US through the evaluation of proposed requirement changes in accordance with DRD1145CM-004 and DRD1145CM-002.

d. The Contractor shall implement and maintain a configuration status accounting system that provides information defining and maintaining the as-designed and as-built configuration of the system hardware, and the status of changes to this configuration in accordance with DRD1145CM-006, DRD1145CM-001, DRD1145CM-007, and DRD1145CM-008.

e. The Contractor shall supply major review documentation in accordance with DRD1145MA-007.

4.4 Upper Stage Risk Management

During the initial transition and integration into the NDT, the Contractor shall support the US Element and subsystem IPTs in the performance of risk management. NASA will maintain the responsibility for risk management for the Upper Stage Element and the Contractor shall provide identification and risk mitigation inputs to ensure all risks associated with the Upper Stage, including the SCI, are adequately addressed.

a. The Contractor shall implement and maintain risk management in accordance with the US risk management process for all contract tasks.

b. The Contractor may elect to use the established Upper Stage risk management systems and tools: Active Risk Manager (ARM) and Integrated Risk Management Application (IRMA) databases. If not, all Contractor provided risk management systems and tools must be compatible with the ARM and IRMA databases. The Contractor shall develop, update, and implement the inputs into the risk management system in accordance with DRD1145MA-006.

4.5 Safety and Mission Assurance (S&MA)

a. The Contractor shall provide inputs to the NDT in support of the Certification of Flight Readiness (COFR) process and shall participate in S&MA reviews, US Element and subsystem reviews, and other reviews as applicable to ensure the overall safety, reliability, and quality assurance of the US Element.

b. The Contractor shall generate, document, and incorporate lessons learned for incorporation into NASA's Lessons Learned database in accordance with DRD 1145MA-006.

c. The Contractor shall develop, update, and implement data submittal in accordance with the following Data Requirement Descriptions:

DRD1145RM-004	Limited Life Items List
DRD1145QE-004	Certificate of Qualification
DRD1145QE-003	Certification Approval Request

4.5.1 System Safety

a. The Contractor shall support the NDT in the development of and shall update and maintain the US System Safety Hazard Analysis in accordance with DRD1145SA-001.

b. The Contractor shall support the NDT in the development of and shall update and maintain the US Fault Trees Analyses in accordance with DRD1145SA-002. The Contractor shall develop, update, and implement a System Safety Plan in accordance DRD1145SA-003, System Safety Plan.

4.5.2 Safety, Health, and Environmental (SHE) Program

The Contractor shall develop, update, and implement a Safety, Health, and Environmental Plan in accordance with DRD1145SA-004. The Contractor shall submit Mishap and Safety Reports in accordance with DRD1145SA-005.

4.5.3 Reliability, Maintainability, and Supportability (RMS)

a. The Contractor shall develop, update, and implement a Reliability and Maintainability Plan for all contract tasks in accordance with the DRD1145RM-001.

b. The Contractor shall support the NDT in the development of and shall update and maintain the Upper Stage Failure Modes Effects Analyses / Critical Items Lists (FMEA/CIL) in accordance DRD1145RM-002.

c. The Contractor shall support the NDT in developing a Probabilistic Risk Assessment.

d. The Contractor shall support the NDT in developing Reliability and Maintainability analyses for the US.

e. The Contractor shall utilize a problem reporting and corrective action process that is compatible with the Constellation system and provide all reportable problems, their status, and corrective actions, for both hardware and software in accordance with DRD1145RM-003.

f. The Contractor shall support NASA in developing a Limited Life Items List and update and maintain the list in accordance with the DRD1145RM-004.

g. The Contractor shall evaluate and respond to Acute Launch Emergency Reliability Tips (ALERTS) in accordance with the DRD1145RM-006.

4.5.4 Hardware Quality Assurance

a. The Contractor shall develop, update, and implement an AS9100 compliant Quality Plan in accordance with DRD1145QE-001.

b. The Contractor shall identify, track, and disposition all hardware and software non-conformances, anomalies, and discrepancies in a Contractor database and provide NASA with access to these records in accordance with NPR1441.1, NASA Records Retention Schedules.

c. The Contractor shall support the US Element and subsystems IPTs for the Material Review Board (MRB) and waiver / deviation process for non-conformances.

d. The Contractor shall support Exploration Launch Office (ELO) resident offices and the Defense Contract Management Agency (DCMA) Letter of Delegation

activities for US tasks, and in accordance with the USO-CLV-QA-25800, US Quality Plan.

e. The Contractor shall document the controls for those manufacturing processes where requirements compliance cannot be ensured by inspection alone (i.e. special processes, critical processes, Foreign Object Debris, and containment control) in accordance with the DRD1145MP-003.

f. The Contractor shall develop and submit Equipment Log Books in accordance with DRD1145QE-006.

g. The Contractor shall develop and submit Certificate of Qualification for design certification of all SCI flight hardware in accordance with DRD1145QE-004 for NASA approval.

h. The Contractor shall support customer audits of S&MA / Quality Assurance systems, engineering processes, and activities.

i. The Contractor shall support NASA led technical and programmatic audits of contractor's implementation and compliance of NASA's and Contractor's S&MA requirements in accordance with NPR 8705.1.

4.5.5 Software Assurance

a. The Contractor shall establish a Software Assurance Program for all software developed under this contract. The Software Assurance Program activities shall be documented in the Software Assurance Plan in accordance with the DRD1145QE-002 and NASA-STD 8739.8, NASA Software Assurance Standards.

b. The Contractor shall audit its own and any software suppliers internal software assurance activities to allow evaluation of both the progress and effectiveness of software assurance tasks and the need for adjustments or changes and document the results in accordance with the DRD1145QE-005.

c. The Contractor shall implement a systematic approach to software safety as an integral part of the project's overall system safety program per the NASA-STD-8719.13B, NASA Software Safety Standard.

4.6 Special Studies (IDIQ CLIN 2 and 4)

The Contractor shall perform special studies, engineering tasks and analyses as defined by individual task orders issued from the Contracting Officer in accordance with Clause H.4, Special Studies. The Contractor shall define the resources required as part of this directive response. The studies shall include the impact to safety and life-cycle cost.

4.7 Sustaining Engineering (IDIQ CLIN 2 and 4)

a. The Contractor shall plan for transition and implementation of all Upper Stage Element and Subsystem Sustaining Engineering tasks and activities not later than 90 days after the completion of the US DCR process.

b. The Contractor shall perform sustaining engineering in accordance with the applicable task order to maintain and support the operation of the US system.

c. The Contractor shall develop, update, and implement a Sustaining Engineering Plan in accordance with DRD1145-SE-006.

4.8 Umbilical Plates Subsystem (WBS 136905.08.05.02.01.11)

4.8.1 T-0 Umbilical Plates Producibility Engineering

a. The contractor shall provide producibility engineering support to the T-0 Umbilical Plates IPT as defined in SOW section 4.1.

b. The contractor shall support NDT specific T-0 Umbilical Plates IPT review process.

c. The Contractor shall provide inputs to the NDT to support the development of the Operations and Maintenance Manual for the Umbilical Plates in accordance with DRD1145OP-002.

4.8.2 Umbilical Plates Testing Support (IDIQ CLIN 2)

a. The Contractor shall provide support for Umbilical Plates test planning and procedures, test facility integration, engineering support for testing, data reduction, post-test data analysis and final test report, and problem resolution.

b. The Contractor shall provide test engineering and technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal, and storage.

5.0 Structures and Thermal (S&T) Subsystem (WBS 136905.08.05.03)

5.1 S&T Producibility Engineering

a. The Contractor shall provide producibility engineering support to the S&T subsystem IPT as defined in SOW section 4.1.

b. The Contractor shall support the NDT structures and thermal layout reviews.

5.2 S&T DDT&E

a. The Contractor shall provide the system engineering and integration for all Upper Stage Element and Subsystem level contract tasks as described in SOW section 4.2.

b. The Contractor shall be responsible for procurement of the specific pyrotechnic devices for NDT conducted DDT&E testing in accordance with the NASA Human Rated Spacecraft Pyrotechnic Specification (JSC 62809).

c. The Contractor shall develop an Operations and Maintenance Manual for the S&T subsystem in accordance with DRD1145OP-002.

5.3 S&T SCI DDT&E

NASA has identified specific components, sub-assemblies, and / or piece parts as Source Controlled Items (SCI) that shall be designed, developed and / or procured by the Contractor as an end item or an off-the-shelf item. The Contractor shall provide for and support NDT insight on all SCI DDT&E.

a. The Contractor shall provide the detailed design, development, acquisition, qualification, and certification of the S&T SCI in accordance with the NDT developed specifications and in accordance with Constellation Environmental Qualification and Acceptance Testing Requirements Document (CxP70036), Constellation Program Structural Design and Verification Requirements (CxP70135).

b. The Contractor shall provide all S&T SCI hardware required to manufacture, assemble, checkout, and test all US integrated test articles, simulation test articles including end effectors commanded by the US Avionics system, and the US flight units.

c. The Contractor shall be responsible for integrating the GFE pyrotechnic devices into the US pyrotechnic system design and shall participate in the technical oversight associated with the pyrotechnic GFE.

d. The Contractor shall be responsible for the receipt, storage, pre-flight verification testing and general logistics associated with both GFE and non-GFE supplied pyrotechnic hardware.

e. The Contractor shall provide all S&T SCI hardware and mass simulators for the development Ullage rocket separation and full-scale separation tests.

f. The Contractor shall provide all S&T SCI hardware and necessary mass simulators / hardware for the qualification Ullage rocket separation and full scale separation tests.

g. The Contractor shall install all pyrotechnic devices onto the US during the final assembly at MAF, with the exception of the initiators / detonators which shall be installed on the US during final preparations at KSC.

h. The Contractor shall provide inputs to the NDT to support the development of the S&T SCI specifications in accordance with DRD1145SE-002. The contractor shall provide SCI hardware for the development program delivered in time to meet critical DDT&E schedules.

i. Prior to and following the transition of the CM/DM responsibility from the NDT to the Contractor, the Contractor shall maintain the configuration control of the S&T SCI specifications and interface documents in accordance with SOW section 4.3.

j. The Contractor shall provide certification data for all S&T SCI in accordance with DRD1145CM-001.

k. The S&T SCI will include, but is not limited to the following:

Source Control Item	Description / Specification	NASA Advanced Development Task Initiated
Pyrotechnic Time Delay (Ullage rocket ejection)	USO-CLV-SE-25704	No
Separation Nut (Ullage rocket ejection)	USO-CLV-SE-25704	No
Pressure Cartridge (Powers separation nut for Ullage rocket ejection)	USO-CLV-SE-25704	No
Main Pyrotechnic Staging Joint (between Aft Skirt and Interstage)	USO-CLV-SE-25704	No
ETL Cutter (Ullage Rocket Ejection)	USO-CLV-SE-25704	No
Other S&T SCI - Debris containment devices, bulkhead connectors, mounting plates, and brackets.	USO-CLV-SE-25704	No

Table J-1-1

l. The S&T SCI contain electrical interfaces with the US Avionics and Software system via First Stage Avionics. As part of the S&T SCI DDT&E, the Contractor shall be responsible for the development and installation of the embedded instrumentation, electrical wiring, and connectors for power and data in all areas other than the IU primary structure as described in SOW section 10.0.

m. The Contractor shall develop, update, and implement data submittal for all S&T SCI in accordance with the following Data Requirements Descriptions:

DRD1145CD-003	Technology Reports
DRD1145CM-005	Functional Configuration / Physical Configuration Audit Documentation
DRD1145CM-003	Engineering Change Proposals and Associated Documentation
DRD1145CM-002	Deviation/Waiver Approval Requests
DRD1145CM-007	Engineering Drawings and Associated Lists
DRD1145CM-008	Specification and Drawing Tree
DRD1145DE-013	Structural Strength and Fatigue Analysis Reports
DRD1145DE-006	Fracture Control Reports Inputs
DRD1145DE-010	Development Test Report

DRD1145DE-011	Development Test Plan
DRD1145DE-007	Structural Dynamics Analyses, Loads and Models Documentation
DRD1145LS-002	Special Handling & Storage Requirements Documents
DRD1145MA-007	Major Review Documentation
DRD1145MP-002	Materials and Processes Identification and Usage List
DRD1145MP-003	Manufacturing and Assembly Plan
DRD1145MP-004	Materials and Processes Selection, Implementation, and Control Plan
DRD1145MP-005	Material Usage Agreement
DRD1145MP-006	Nondestructive Test Plan
DRD1145MP-001	Contamination Control Plan
DRD1145QE-004	Certificate of Qualification
DRD1145RM-006	MSFC ALERT System Documentation
DRD1145VR-002	Verification / Validation Requirements
DRD1145VR-007	Test Plans
DRD1145VR-008	Test Procedures
DRD1145VR-003	Verification / Validation Reports
DRD1145VR-006	Verification Requirements Compliance Document
DRD1145VR-004	Verification / Validation Success Criteria
DRD1145VR-005	Verification / Validation Procedures
DRD1145SA-002	Fault Tree Analysis
DRD1145SA-001	System Safety/Hazard Analysis
DRD1145SA-005	Mishap and Safety Statistics Report
DRD1145RM-003	Problem Reporting and Corrective Action
DRD1145RM-002	Failure Modes and Effects Analysis and Critical Items List
DRD1145SE-008	Mass Properties Report
DRD1145CM-001	Acceptance Data Package
DRD1145MA-013	Still Photographs, Video, and Motion Pictures
DRD1145SE-003	Interface Control Document
DRD1145SE-007	System Connectivity Diagrams and End to End Functional Schematics

5.4 S&T Subsystem Development and Qualification Testing Support (IDIQ CLIN 2)

a. The Contractor shall provide support for S&T subsystem test planning and procedures, test facility integration, engineering support for testing, data reduction, post-test data analysis and final test report, and problem resolution.

b. The Contractor shall provide test engineering and technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal, and storage.

6.0 Main Propulsion System (MPS) (WBS 136905.08.05.04)

6.1 MPS Producibility Engineering

The Contractor shall provide producibility engineering support to the MPS subsystem IPT as defined in SOW section 4.1.

6.2 MPS Subsystem DDT&E

a. The Contractor shall provide the engineering and integration for all contract tasks including the MPS SCI as defined in SOW 4.2.

b. The Contractor shall develop an Operations and Maintenance Manual for the MPS subsystem in accordance with DRD1145OP-002.

6.3 MPS SCI DDT&E

NASA has identified specific components, sub-assemblies, and / or piece parts as SCI that shall be designed, developed and / or procured by the Contractor as an end item or an off-the-shelf item. The Contractor shall provide for and support NDT insight on all SCI DDT&E.

a. The Contractor shall provide the detailed design, development, acquisition, qualification, and certification of the MPS SCI in accordance with the NDT developed specifications and in accordance with Constellation Environmental Qualification and Acceptance Testing Requirements Document (CxP70036), Constellation Program Structural Design and Verification Requirements (CxP70135).

b. The Contractor shall provide all MPS SCI hardware required to manufacture, assemble, checkout, and test all US integrated test articles, simulation test articles including end effectors commanded by the US avionics system, and the US flight units.

c. The Contractor shall provide inputs to the NDT to support the development of the MPS SCI specifications in accordance with DRD1145SE-002.

d. The Contractor shall maintain the configuration control of the MPS SCI specifications and interface documents in accordance with SOW section 4.3.

e. The Contractor shall provide certification data for all MPS SCI in accordance with DRD1145CM-001.

f. The MPS SCI will include but is not limited to the following:

Source Control Item	Description/Specification	NASA Advanced Development Task Initiated
LH2 System		
LH2 Debris Screen (HF-200)	USO-CLV-SE-25704-1	No
LH2 Prevalve (HF-100)	MSFC-SPEC-3508	Yes
LH2 Recirculation Pump (H-200)	USO-CLV-SE-25704-1	No
LH2 Recirculation Isolation Valve (HR-100)	USO-CLV-SE-25704-1	No
LH2 Feedline (HF-150)	USO-CLV-SE-25704-1	No
LH2 Fill & Drain Line (HD-050,150)	USO-CLV-SE-25704-1	No
LH2 Fill & Drain Valve (HD-100)	USO-CLV-SE-25704-1	No
LH2 Recirculation Check Valve (HR-200)	USO-CLV-SE-25704-1	No
LH2 Recirculation Supply Lines (HR-050,150,250,350)	USO-CLV-SE-25704-1	No
LH2 Recirculation Return Line (HR-400)	USO-CLV-SE-25704-1	No
LH2 Recirculation Line Filter (HR-300)	USO-CLV-SE-25704-1	No
LO2 System		
LO2 Debris Screen (OF-200)	USO-CLV-SE-25704-1	No
LO2 Prevalve (OF-100)	MSFC-SPEC-3508	Yes
LO2 Recirculation Pump (O-200)	USO-CLV-SE-25704-1	No
LO2 Recirculation Isolation Valve (OR-100)	USO-CLV-SE-25704-1	No
LO2 Feedline (OF-150)	USO-CLV-SE-25704-1	No
LO2 Fill & Drain Line (OD-150)	USO-CLV-SE-25704-1	No
LO2 Fill & Drain Valve (OD-150)	USO-CLV-SE-25704-1	No
LO2 Recirculation Check Valve (OR-200)	USO-CLV-SE-25704-1	No
LO2 Recirculation Supply Lines (OR-050,150,250,350)	USO-CLV-SE-25704-1	No
LO2 Recirculation Return Line (OR-400)	USO-CLV-SE-25704-1	No
LO2 Recirculation Line Filter (OR-300)	USO-CLV-SE-25704-1	No
Pressurization and Pneumatics System		
Ambient Helium Regulator Panel (P-400)	USO-CLV-SE-25704-1	No
4 x Filter	USO-CLV-SE-25704-1	No
2 x Isolation Valve	USO-CLV-SE-25704-1	No
2 x Regulator	USO-CLV-SE-25704-1	No
2 x Relief Valve	USO-CLV-SE-25704-1	No
2 x Check Valve	USO-CLV-SE-25704-1	No
Ambient Helium Storage Tanks (P-050) (x2)	USO-CLV-SE-25704-1	No
Ambient Helium De-tank Isolation Valves (P-051,52) (x2)	USO-CLV-SE-25704-1	No
Ambient Helium Supply Check Valve (P-200)	USO-CLV-SE-25704-1	No
Ambient Helium Plenum (P-495)	USO-CLV-SE-25704-1	No
Cryogenic Helium Regulator Panel (P-700)	USO-CLV-SE-25704-1	No
4 x Filter	USO-CLV-SE-25704-1	No
2 x Isolation Valve	USO-CLV-SE-25704-1	No
2 x Regulator	USO-CLV-SE-25704-1	No

2 x Relief Valve	USO-CLV-SE-25704-1	No
2 x Check Valve	USO-CLV-SE-25704-1	No
Cryogenic Helium Storage Tanks (P-930) (x10)	USO-CLV-SE-25704-1	No
Cryogenic Helium De-tank Isolation Valves (P920,921) (x2)	USO-CLV-SE-25704-1	No
Cryogenic Helium Relief Valve (P-923,924)(x2)	USO-CLV-SE-25704-1	No
Cryogenic Helium Supply Check Valve (P-910)	USO-CLV-SE-25704-1	No
LH2 Tank Diffuser (H-250)	USO-CLV-SE-25704-1	No
LH2 Re-pressurization Control Panel (HP-600)	USO-CLV-SE-25704-1	No
Check Valve	USO-CLV-SE-25704-1	No
4 x Isolation Valve	USO-CLV-SE-25704-1	No
Filter	USO-CLV-SE-25704-1	No
Orifice	USO-CLV-SE-25704-1	No
LH2 Pressurization Control Panel (HP-800)	USO-CLV-SE-25704-1	No
Check Valve	USO-CLV-SE-25704-1	No
4 x Isolation Valve	USO-CLV-SE-25704-1	No
3x Orifice	USO-CLV-SE-25704-1	No
LH2 Pre-Pressurization Check Valve (HP-200)	USO-CLV-SE-25704-1	No
LH2 Re-Pressurization Supply Helium Check Valve (P-800)	USO-CLV-SE-25704-1	No
LH2 Tank Vent/Relief Valve (HV-100)	MSFC-SPEC-3509	Yes
LH2 Vent Line (HV-150)	USO-CLV-SE-25704-1	No
LO2 Tank Diffuser (O-250)	USO-CLV-SE-25704-1	No
LO2 Re-pressurization Control Panel (OP-600)	USO-CLV-SE-25704-1	No
Check Valve	USO-CLV-SE-25704-1	No
4 x Isolation Valve	USO-CLV-SE-25704-1	No
Filter	USO-CLV-SE-25704-1	No
Orifice	USO-CLV-SE-25704-1	No
LO2 Pressurization Control Panel (OP-800)	USO-CLV-SE-25704-1	No
Check Valve	USO-CLV-SE-25704-1	No
6 x Isolation Valve	USO-CLV-SE-25704-1	No
3 x Orifice	USO-CLV-SE-25704-1	No
LO2 Pre-Pressurization Check Valve (OP-200)	USO-CLV-SE-25704-1	No
LO2 Re-Pressurization Supply Helium Check Valve (P-500)	USO-CLV-SE-25704-1	No
LO2 Tank Vent/Relief Valve (OV-100)	MSFC-SPEC-3509	Yes
LO2 Vent Line (OV-150)	USO-CLV-SE-25704-1	No
Pre-Valve Control Panel (HF/OF 1001-1008)	USO-CLV-SE-25704-1	No
8 x Isolation Valve	USO-CLV-SE-25704-1	No
Recirculation Isolation Valve Control Panel (HR/OR 1001/1002)	USO-CLV-SE-25704-1	No
2 x Isolation Valve	USO-CLV-SE-25704-1	No
Other SCI: tubing, seals and miscellaneous brackets	USO-CLV-SE-25704-1	No

Table J-1-2

g. The MPS SCI contains electrical interfaces to the US Avionics and Software system. As part of the MPS SCI DDT&E, the Contractor shall be responsible for the development and installation of the embedded instrumentation, electrical wiring,

and connectors for power and data in all areas other than the IU primary structure as described in SOW section 10.0.

h. The Contractor shall develop, update and implement data submittal for all MPS SCI in accordance with the following Data Requirements Descriptions:

DRD1145CD-003	Technology Reports
DRD1145CM-005	Functional Configuration / Physical Configuration Audit Documentation
DRD1145CM-003	Engineering Change Proposals and Associated Documentation
DRD1145CM-002	Deviation/Waiver Approval Requests
DRD1145CM-001	Acceptance Data Package
DRD1145CM-007	Engineering Drawings and Associated Lists
DRD1145CM-008	Specification and Drawing Tree
DRD1145DE-007	Structural Dynamics Analyses, Loads and Models Documentation
DRD1145DE-009	Structural Assessment Plan
DRD1145DE-010	Development Test Report
DRD1145DE-011	Development Test Procedures
DRD1145DE-012	Thermal Analysis Report
DRD1145DE-015	Development Unit Test Planning
DRD1145MA-007	Major Review Documentation
DRD1145MP-001	Contamination Control Plan
DRD1145DE-013	Structural Strength and Fatigue Analysis Reports
DRD1145DE-006	Fracture Control Reports Inputs
DRD1145MP-002	Materials and Processes Identification and Usage List
DRD1145MP-003	Manufacturing and Assembly Plan
DRD1145MP-004	Materials and Processes Selection, Implementation, and Control Plan
DRD1145MP-005	Material Usage Agreement
DRD1145MP-006	Nondestructive Test Plan
DRD1145QE-004	Certificate of Qualification
DRD1145VR-002	Verification / Validation Requirements
DRD1145VR-007	Test Plans
DRD1145VR-008	Test Procedures
DRD1145VR-003	Verification / Validation Reports
DRD1145VR-006	Verification Requirements Compliance Document
DRD1145VR-004	Verification / Validation Success Criteria
DRD1145VR-005	Verification / Validation Procedures
DRD1145SA-002	Fault Tree Analysis
DRD1145SA-001	System Safety/Hazard Analysis
DRD1145SA-005	Mishap and Safety Statistics Report
DRD1145RM-003	Problem Reporting and Corrective Action
DRD1145RM-006	MSFC ALERT System Documentation
DRD1145RM-002	Failure Modes and Effects Analysis and Critical Items List
DRD1145SE-008	Mass Properties Report

DRD1145DE-017	Engine Thermal Data and Analysis
DRD1145LS-002	Special Handling and Storage Requirements Documents
DRD1145MA-013	Still Photographs, Video, and Motion Pictures
DRD1145SE-003	Interface Control Document
DRD1145SE-007	System Connectivity Diagrams and End to End Functional Schematics

6.4 MPS Subsystem Development and Qualification Testing (IDIQ CLIN 2)

a. The Contractor shall provide support for MPS Subsystem test planning and procedures, test facility integration, engineering support for testing, data reduction, post-test data analysis and final test report, and problem resolution.

b. The Contractor shall provide test engineering and technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal and storage.

7.0 Upper Stage Reaction Control System (USRCS) (WBS 136905.08.05.05)

7.1 Producibility Engineering Support

The Contractor shall provide producibility engineering support to the USRCS subsystem IPT as defined in SOW section 4.1

7.2 USRCS Subsystem DDT&E

a. The Contractor shall provide the engineering and integration for all contract tasks including the USRCS SCI as defined in SOW section 4.2.

b. The Contractor shall manufacture and assemble the USRCS Hot Fire Test Article (HFTA) in accordance with the NASA design and deliver to the NDT for testing of the USRCS components and systems.

c. The Contractor shall manufacture and assemble the USRCS Thruster Module Qualification Test Assembly in accordance with the NASA design and deliver to the NDT for testing of the Thruster Modules.

d. The Contractor shall support the NDT in the USRCS Qualification testing conducted on the USRCS HFTA.

e. The Contractor shall develop an Operations and Maintenance Manual for the USRCS subsystem in accordance with DRD1145OP-002.

7.3 USRCS SCI DDT&E

NASA has identified specific components, sub-assemblies, and / or piece parts as SCI that shall be designed, developed and / or procured by the Contractor as an end item or an off-the-shelf item. The Contractor shall provide for and support NDT insight on all SCI DDT&E.

a. The Contractor shall provide the detailed design, development, acquisition, qualification, and certification of the USRCS SCI in accordance with the NDT developed specifications and in accordance with Constellation Environmental Qualification and Acceptance Testing Requirements Document (CxP70036), Constellation Program Structural Design and Verification Requirements (CxP70135).

b. The Contractor shall provide all USRCS SCI hardware required to manufacture, assemble, checkout, and test all US integrated test articles, simulation test articles including end effectors commanded by the US Avionics system, and the US flight units.

c. The Contractor shall provide inputs the NDT to support the development of the USRCS SCI specifications in accordance with DRD1145SE-002.

d. The Contractor shall maintain the configuration control of the USRCS SCI specifications and interface documents in accordance with SOW section 4.3.

e. The Contractor shall provide certification data for all USRCS SCI in accordance with DRD1145CM-001.

f. The Contractor shall ensure verification of all SCI shall be conducted in accordance with the US Verification and Validation Plan (USO-CLV-SE-25703)

g. The USRCS SCI will include, but is not limited to the following:

Source Control Item	Description / Specification	NASA Advanced Development Task Initiated
USRCS Thruster Assembly (Thruster and thruster valve)	USO-CLV-SE-25704	No
USRCS Propellant Tank/Propellant Management Device (PMD)	USO-CLV-SE-25704	No
USRCS GHe Fill/Drain Valve	USO-CLV-SE-25704	No
USRCS Hydrazine Fill/Drain Valve	USO-CLV-SE-25704	No
USRCS Hydrazine Filter	USO-CLV-SE-25704	No
Other - Instrumentation, heaters and thermostats, lines, filters, orifices, screens, check valves, solenoids, sealing and non-sealing disconnects, miscellaneous brackets and secondary structure.	USO-CLV-SE-25704	No

Table J-1-3

h. The USRCS SCI contain electrical interfaces to the US Avionics and Software system. As part of the USRCS SCI DDT&E, the Contractor shall be

responsible for the development and installation of the embedded instrumentation, electrical wiring and connectors for power and data in all areas other than the IU primary structure as described in SOW section 10.0.

i. The Contractor shall develop, update and implement data submittal for all USRCS SCI in accordance with the following Data Requirements Descriptions:

DRD1145CD-003	Technology Reports
DRD1145CM-005	Functional Configuration / Physical Configuration Audit Documentation
DRD1145CM-003	Engineering Change Proposals and Associated Documentation
DRD1145CM-002	Deviation/Waiver Approval Requests
DRD1145CM-007	Engineering Drawings and Associated Lists
DRD1145CM-008	Specification and Drawing Tree
DRD1145DE-007	Structural Dynamics Analyses, Loads and Models Documentation
DRD1145DE-009	Structural Assessment Plan
DRD1145DE-010	Development Test Report
DRD1145DE-011	Development Test Procedures
DRD1145DE-012	Thermal Analysis Report
DRD1145DE-015	Development Unit Test Planning
DRD1145MA-007	Major Review Documentation
DRD1145MP-001	Contamination Control Plan
DRD1145DE-013	Structural Strength and Fatigue Analysis Reports
DRD1145DE-006	Fracture Control Reports Inputs
DRD1145MP-002	Materials and Processes Identification and Usage List
DRD1145MP-003	Manufacturing and Assembly Plan
DRD1145MP-004	Materials and Processes Selection, Implementation, and Control Plan
DRD1145MP-005	Material Usage Agreement
DRD1145MP-006	Nondestructive Test Plan
DRD1145QE-004	Certificate of Qualification
DRD1145VR-002	Verification / Validation Requirements
DRD1145VR-007	Test Plans
DRD1145VR-008	Test Procedures
DRD1145VR-003	Verification / Validation Reports
DRD1145VR-006	Verification Requirements Compliance Document
DRD1145VR-004	Verification / Validation Success Criteria
DRD1145VR-005	Verification/Validation Procedures
DRD1145SA-002	Fault Tree Analysis
DRD1145SA-001	System Safety/Hazard Analysis
DRD1145SA-005	Mishap and Safety Statistics Report
DRD1145RM-003	Problem Reporting and Corrective Action
DRD 1145RM-006	MSFC ALERT System Documentation
DRD1145RM-002	Failure Modes and Effects Analysis and Critical Items List
DRD1145SE-008	Mass Properties Report

DRD1145DE-017	Engine Thermal Data and Analysis
DRD1145LS-002	Special Handling and Storage Requirements Documents
DRD1145MA-013	Still Photographs, Video, and Motion Pictures
DRD1145SE-003	Interface Control Document
DRD1145SE-007	System Connectivity Diagrams and End to End Functional Schematics

7.4 USRCS Subsystem Development and Qualification Testing (IDIQ CLIN 2)

a. The Contractor shall provide support for USRCS subsystem test planning and procedures, test facility integration, engineering support for testing, data reduction, post-test data analysis and final test report, and problem resolution.

b. The Contractor shall provide test engineering technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal, and storage.

8.0 First Stage Reaction Control System (FSRCS) (WBS 136905.08.05.06)

8.1 Producibility Engineering Support

The Contractor shall provide producibility engineering support to the FSRCS subsystem IPT as defined in SOW section 4.1

8.2 FSRCS Subsystem DDT&E

a. The Contractor shall provide the engineering and integration for all contract tasks including the FSRCS SCI as defined in SOW section 4.2.

b. The Contractor shall manufacture and assemble the FSRCS HFTA in accordance with the NASA design and deliver to the NDT for testing of the FSRCS components and systems.

c. The Contractor shall manufacture and assemble the USRCS Thruster Module Qualification Test Assembly in accordance with the NASA design and deliver to the NDT for testing of the Thruster Modules.

d. The Contractor shall support the NDT FSRCS qualification testing conducted on the FSRCS HFTA.

e. The Contractor shall develop an Operations and Maintenance Manual for the FSRCS subsystem in accordance with DRD1145OP-002

8.3 FSRCS SCI DDT&E

NASA has identified specific components, sub-assemblies, and / or piece parts as SCI that shall be designed, developed and / or procured by the Contractor as an end item or an off-the-shelf item. The Contractor shall provide for and support NDT insight on all SCI DDT&E.

a. The Contractor shall provide the detailed design, development, acquisition, qualification and certification of the FSRCS SCI in accordance with the NDT developed specifications and in accordance with Constellation Environmental Qualification and Acceptance Testing Requirements Document (CxP70036), Constellation Program Structural Design and Verification Requirements (CxP70135).

b. The Contractor shall provide all FSRCS SCI hardware required to manufacture, assemble, checkout, and test all US integrated test articles, simulation test articles including end effectors commanded by the US Avionics system, and the US flight units.

c. The Contractor shall provide inputs the NDT to support the development of the FSRCS SCI specifications in accordance with DRD1145SE-002.

d. The Contractor shall maintain the configuration control of the FSRCS SCI specifications and interface documents in accordance with SOW section 4.3.

e. The Contractor shall ensure verification of all SCI shall be conducted in accordance with the US Verification and Validation Plan (USO-CLV-SE-25703)

f. The Contractor shall provide certification data for all FSRCS SCI in accordance with DRD1145CM-001.

g. The USRCS SCI will include, but is not limited to the following:

Source Control Item	Description / Specification	NASA Advanced Development Task Initiated
FSRCS Thruster Assembly (Thruster and thruster valve)	USO-CLV-SE-25704	Yes
FWRCS Propellant Tank/Propellant Management Device (PMD)	USO-CLV-SE-25704	No
FSRCS Pressurization Storage Tank	USO-CLV-SE-25704	No
FSRCS Accumulators	USO-CLV-SE-25704	No
FSRCS Pressure Regulator	USO-CLV-SE-25704	No
FSRCS Ghe Control Valve	USO-CLV-SE-25704	No
FSRCS Ghe Fill/Drain Valve	USO-CLV-SE-25704	No
FSRCS Propellant Fill/Drain Valve	USO-CLV-SE-25704	No
FSRCS Ghe Filter	USO-CLV-SE-25704	No
FSRCS Propellant Filter	USO-CLV-SE-25704	No
FSRCS Ghe Isolation Valve	USO-CLV-SE-25704	No
FSRCS Propellant Isolation Valve	USO-CLV-SE-25704	No
FSRCS Burst Disk	USO-CLV-SE-25704	No

FSRCS Relief Valve	USO-CLV-SE-25704	No
FSRCS Ghe Pneumatic Check Valve	USO-CLV-SE-25704	No
Other FSRCS SCI - Instrumentation, heaters and thermostats, lines, filters, orifices, screens, check valves, solenoids, sealing and non-sealing disconnects, miscellaneous brackets and secondary structure	USO-CLV-SE-25704	No

Table J-1-4

h. The FSRCS SCI contains electrical interfaces to the US Avionics and Software system. As part of the FSRCS SCI DDT&E, the Contractor shall be responsible for the development and installation of the embedded instrumentation, electrical wiring, and connectors for power and data in all areas other than the IU primary structure as described in SOW section 10.0.

i. The Contractor shall develop, update, and implement data submittal for all FSRCS SCI in accordance with the following Data Requirements Descriptions:

DRD1145CD-003	Technology Reports
DRD1145CM-005	Functional Configuration / Physical Configuration Audit Documentation
DRD1145CM-003	Engineering Change Proposals and Associated Documentation
DRD1145CM-002	Deviation/Waiver Approval Requests
DRD1145CM-007	Engineering Drawings and Associated Lists
DRD1145CM-008	Specification and Drawing Tree
DRD1145DE-007	Structural Dynamics Analyses, Loads and Models Documentation
DRD1145DE-009	Structural Assessment Plan
DRD1145DE-010	Development Test Report
DRD1145DE-011	Development Test Procedures
DRD1145DE-012	Thermal Analysis Report
DRD1145DE-015	Development Unit Test Planning
DRD1145MA-007	Major Review Documentation
DRD1145MP-001	Contamination Control Plan
DRD1145DE-013	Structural Strength and Fatigue Analysis Reports
DRD1145DE-006	Fracture Control Reports
DRD1145MP-002	Materials and Processes Identification and Usage List
DRD1145MP-003	Manufacturing and Assembly Plan
DRD1145MP-004	Materials and Processes Selection, Implementation, and Control Plan
DRD1145MP-005	Material Usage Agreement
DRD1145MP-006	Nondestructive Test Plan
DRD1145QE-004	Certificate of Qualification
DRD1145VR-002	Verification / Validation Requirements
DRD1145VR-007	Test Plans
DRD1145VR-008	Test Procedures
DRD1145VR-003	Verification / Validation Reports
DRD1145VR-006	Verification Requirements Compliance Document

DRD1145VR-004	Verification / Validation Success Criteria
DRD1145VR-005	Verification/Validation Procedures
DRD1145SA-002	Fault Tree Analysis
DRD1145SA-001	System Safety/Hazard Analysis
DRD1145SA-005	Mishap and Safety Statistics Report
DRD1145RM-003	Problem Reporting and Corrective Action
DRD1145RM-006	MSFC ALERT System Documentation
DRD1145RM-002	Failure Modes and Effects Analysis and Critical Items List
DRD1145SE-008	Mass Properties Report
DRD1145DE-017	Engine Thermal Data and Analysis
DRD1145LS-002	Special Handling and Storage Requirements Documents
DRD1145MA-013	Still Photographs, Video, and Motion Pictures
DRD1145SE-003	Interface Control Document
DRD1145SE-007	System Connectivity Diagrams and End to End Functional Schematics

8.4 FSRCS Subsystem Development and Qualification Testing (IDIQ CLIN 2)

a. The Contractor shall provide support for FSRCS subsystem test planning and procedures, test facility integration, engineering support for testing, data reduction, post-test data analysis and final test report, and problem resolution.

b. The Contractor shall provide test engineering and technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal, and storage.

9.0 Thrust Vector Control (TVC) System (WBS 136905.08.05.07)

9.1 Producibility Engineering Support

The Contractor shall provide producibility engineering support to the TVC subsystem IPT as defined in SOW section 4.1.

9.2 TVC DDT&E

a. The Contractor shall provide the engineering and integration for all contract tasks including the TVC SCI as defined in SOW 4.2.

b. The Contractor shall develop an Operations and Maintenance Manual for the TVC subsystem in accordance with DRD1145OP-002.

9.3 TVC SCI DDT&E

NASA has identified specific components, sub-assemblies, and / or piece parts as SCI that shall be designed, developed and / or procured by the Contractor as an end item or an off-the-shelf item. The Contractor shall provide for and support NDT insight on all SCI DDT&E.

a. The Contractor shall provide the detailed design, development, acquisition; qualification and certification of the TVC SCI in accordance with the NDT developed specifications and in accordance with the Constellation Environmental Qualification and Acceptance Testing Requirements Document (CxP70036), Constellation Program Structural Design and Verification (CxP70135).

b. The Contractor shall provide all TVC SCI hardware required to manufacture, assemble, checkout, and test all US integrated test articles, simulation test articles including end effectors commanded by the US Avionics system, and the US flight units.

c. The Contractor shall provide inputs the NDT to support the development of the TVC SCI specifications in accordance with DRD1145SE-002.

d. The Contractor shall maintain the configuration control of the TVC SCI specifications and interface documents in accordance with SOW section 4.3.

e. The Contractor shall provide certification data for all TVC SCI in accordance with DRD1145CM-001.

f. The TVC SCI will include, but is not limited to the following:

Source Control Item	Description / Specification	NASA Advanced Development Task Initiated
Hydraulic Actuators and Controllers	GRC-TVC-SPEC-001	Yes
Hydraulic System Components	GRC-TVC-SPEC-002	No
Turbine Pump Assembly	GRC-TVC-SPEC-003	Yes
Hydraulics GSE Cart	GRC-TVC-SPEC-004	No
Other TVC SCI - Instrumentation, heaters and thermostats, small lines, filters, orifices, screens, check valves, solenoids, sealing and non-sealing disconnects, isolation mounts, thermal control components, electrical cables and connectors, miscellaneous brackets and secondary structure	USO-CLV-SE-25704	No

Table J-1-5

g. The TVC SCI contains electrical interfaces to the US Avionics and Software system. As part of the TVC SCI DDT&E, the Contractor shall be responsible for the development and installation of the embedded instrumentation, electrical wiring, and connectors for power and data in all areas other than the IU primary structure as described in SOW section 10.0.

h. The Contractor shall develop, update, and implement data submittal for all TVC SCI in accordance with the following Data Requirements Descriptions:

i.

DRD1145CD-003	Technology Reports
DRD1145CM-005	Functional Configuration / Physical Configuration Audit Documentation

DRD1145CM-003	Engineering Change Proposals and Associated Documentation
DRD1145CM-002	Deviation/Waiver Approval Requests
DRD1145CM-007	Engineering Drawings and Associated Lists
DRD1145CM-008	Specification and Drawing Tree
DRD1145DE-007	Structural Dynamics Analyses, Loads and Models Documentation
DRD1145DE-013	Structural Strength and Fatigue Analysis Reports
DRD1145DE-006	Fracture Control Reports Inputs
DRD1145MP-002	Materials and Processes Identification and Usage List
DRD1145MP-003	Manufacturing and Assembly Plan
DRD1145MP-004	Materials and Processes Selection, Implementation, and Control Plan
DRD1145MP-005	Material Usage Agreement
DRD1145MP-006	Nondestructive Test Plan
DRD1145QE-004	Certificate of Qualification
DRD1145VR-002	Verification / Validation Requirements
DRD1145VR-007	Test Plans
DRD1145VR-008	Test Procedures
DRD1145VR-003	Verification / Validation Reports
DRD1145VR-006	Verification Requirements Compliance Document
DRD1145VR-004	Verification / Validation Success Criteria
DRD1145VR-005	Verification/Validation Procedures
DRD1145SA-002	Fault Tree Analysis
DRD1145SA-001	System Safety/Hazard Analysis
DRD1145SA-005	Mishap and Safety Statistics Report
DRD1145RM-003	Problem Reporting and Corrective Action
DRD1145RM-006	MSFC ALERT System Documentation
DRD1145RM-002	Failure Modes and Effects Analysis and Critical Items List
DRD1145SE-008	Mass Properties Report
DRD1145LS-002	Special Handling and Storage Requirements Documents
DRD1145DE-004	As-Designed EEE Parts List
DRD1145DE-001	EEE Nonstandard Parts Approval Request
DRD1145DE-016	Programmable Devices Design Documentation
DRD1145DE-003	Programmable Devices Development Plan
DRD1145DE-002	EEE Parts Control Plan
DRD1145SE-010	Electromagnetic Effects Design Analysis Report
DRD1145SE-005	Electromagnetic Effects Systems Control Plan
DRD1145SW-002	Software Configuration Management Plan
DRD1145SW-004	Software Design Description
DRD1145SW-003	Software Maintenance Plan
DRD1145SW-001	Software Requirements Specification
DRD1145SW-005	Software Test Plan
DRD1145SW-006	Software Test Procedure
DRD1145SW-007	Software Test Report

DRD1145MA-013	Still Photographs, Video, and Motion Pictures
DRD1145SE-003	Interface Control Document
DRD1145SE-007	System Connectivity Diagrams and End to End Functional Schematics

9.4 TVC Subsystem Development and Qualification Testing (IDIQ CLIN 2)

a. The Contractor shall provide support for TVC subsystem test planning and procedures, test facility integration, engineering support for testing, data reduction, post-test data analysis and final test report, and problem resolution.

b. The Contractor shall provide test engineering and technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal, and storage.

10.0 Avionics and Software (A&S) (WBS 136905.08.05.08/.09)

The avionics and mission specific flight software design, development, and production efforts are not part of this contract. NASA plans to procure the avionics, including all boxes, cables, and supporting systems that will be located in the US IU primary structure via a separate acquisition. The NDT is responsible for the mechanical and electrical integration of the avionics hardware into the final US design.

a. The Contractor shall provide the US IU primary structure to the IUPC for installation and checkout of all avionics boxes, cables, and supporting systems. Upon the successful installation and checkout of the avionics hardware, the IUPC will return the IU primary structure (complete with avionics installed and checked out) to the Contractor for final assembly and checkout of the US Element.

b. The Contractor shall support the NDT in the analytical integration of the avionics boxes and supporting systems not located on the IU primary structure.

c. The Contractor shall be responsible for the physical installation and integration of the avionics boxes, cables, and supporting systems not located within the IU primary structure. These will include, but are not limited to: antennas, batteries, data acquisition units, cameras, and cable harnesses.

11.0 Integrated Test (WBS 136905.08.05.10)

11.1 Integrated Test Producibility Engineering Support

The Contractor shall provide producibility engineering support to the subsystem IPT as defined in SOW section 4.1 and shall perform the following:

a. Support the implementation, coordination and operation of integrated level development and qualification ground test programs using development test articles.

b. Provide inputs to the NDT during the development and presentation of data for the test facility design reviews and Operational Readiness Inspections (ORI)

c. Support the NDT in the development of test plans including test facility requirements documentation.

11.2 US Element Ground Test Program Support - (IDIQ CLIN 2 and 4)

a. The Contractor shall provide support to the NDT in the planning, development, and execution of the US Element level development and qualification test programs, listed below. Each test program is described in the US Development Plan.

1. Main Propulsion Test Article (MPTA)
2. Dynamic – Modal & Vibration Test Program
3. Structural Development Test Articles (SDTA)
4. US Thermal Test Program
5. US Green Run Test Program
6. US Composite Test Program
7. US Qualification Test Program

b. The Contractor shall provide test technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal, and storage.

c. The Contractor shall support the planning and implementation of the test, verification (T&V) and certification of the US Element and associated sub-systems in accordance with the US Verification and Validation Plan (USO-CLV-SE-25703)

d. The Contractor shall support the design, development, and fabrication support for all US Element level special test equipment (STE).

11.3 Constellation Flight Test Program Support (IDIQ CLIN 2)

a. The Contractor shall provide engineering support to the US Element and Subsystem IPTs during the planning, development, coordination and execution of the planned Constellation flight test program to include Ares 2, Orion 3, and Orion 4.

b. The Contractor shall provide test engineering and technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal, and storage.

12.0 Logistics Support Infrastructure (LSI) (WBS 136905.08.05.11)

a. During the initial transition and integration into the NDT, the Contractor shall provide logistics planning and implementation support to the NDT leading up to transition of all US logistics tasks from NASA not later than 90 days after the completion of the US PDR process.

b. NASA will provide the US Element ground support equipment for the US Element test articles and flight test units including up through the Orion 4 mission.

12.1 LSI Producibility Engineering

The Contractor shall provide producibility engineering support to the LSI IPT as defined in SOW section 4.1 and including the following:

a. Support the development of an Integrated Logistics Support (ILS) System designed to meet the Ares I system support requirements, and minimize life cycle cost.

b. Support the NDT in the modification of existing packaging, shipping, handling & transportation (PSH&T) equipment and identification of new / unique US PSH&T equipment required for MAF, MSFC, KSC, and SSC.

c. Support the NDT in the development of requirements for NASA facilities for the manufacture, assembly, and checkout of the Upper Stage.

d. Provide inputs to the US Quarterly Construction of Facilities (CoF) Call Letter and the subsequent NASA CoF Annual Call Letter to support the NDT development of DRD1145LS-004.

e. Support the modification of existing NASA GSE required to support the development and delivery of the Upper Stage units.

f. Support the identification and certification of new and unique Upper Stage GSE, modeling and testing of the GSE required for activities at MAF, MSFC, KSC, and SSC.

g. The Contractor shall provide Human Factors Engineering support to the LSI IPT through the participation in the design and development process.

12.2 Logistics Infrastructure and Implementation

a. Upon the successful completion of the transition of the responsibility for the US logistics, the Contractor shall conduct logistics modeling, analysis, logistics engineering and data integration, Human Factors Engineering and management for all Contractor-provided hardware.

b. The Contractor shall conduct an ILS and logistics support analysis (LSA) program in accordance with the Integrated Logistics Support Plan (ILSP) (USO-CLV-

LS-25401). The Contractor LSA database shall be compliant with MIL-STD-1388. The Contractor shall develop and update operations and maintenance manuals in accordance with DRD 1145OP-002.

c. The Contractor shall provide spares, repair parts, and materials to support all US manufacturing and assembly through DD250 of the US Element in accordance with the ILSP. These spares, repair parts, and materials are not an IDIQ task and the Contractor shall provide in accordance with CLIN 1. The Contractor shall develop, update, and implement data submittal in accordance with DRD1145LS-002.

d. Ground and flight segment spares, repair parts, and materials, after final acceptance by NASA (via DD250), will be provisionally ordered in accordance with IDIQ CLIN 4. The Contractor shall develop, implement, and update an Integrated Supportability Plan (ISP) in support of the Integrated Logistics Support Plan (ILSP) (USO-CLV-LS-25401) describing the plans, methodologies, and processes for the ILS system for the ground and flight segments in accordance with DRD1145LS-002.

12.3 Property Management

a. The Contractor shall develop, update, and implement a Government Property Management Plan consistent with the requirements identified in FAR 52.245-1and in accordance with DRD1145LS-001, Government Property Management Plan.

b. The Contractor shall develop and implement an Inventory Management System (IMS) for the tracking and management of equipment, spares, repair parts, supplies, material and shipping containers, and identify excess or obsolete assets and initiate disposal in accordance with DRD1145LS-003.

12.4 Training Support (IDIQ CLIN 2 and 4)

a. The Contractor shall support NASA in the development and maintenance of crew training and flight controller training information.

b. The Contractor shall support NASA in the training and certification of ground operations personnel in ground processing activities.

c. The Contractor shall support NASA in the training and certifications of the Ares I launch operations personnel for countdown activities, including launch simulations, contingency operations and emergency preparedness.

12.5 Ground and Flight Operations Support (IDIQ CLIN 2 and 4)

a. The Contractor shall provide ground and flight operations support for Ares I launch vehicle assembly, checkout, countdown, launch and flight phase activities, including simulations, contingency operations and emergency preparedness.

b. To ensure proficiencies with the US the Contractor shall develop information manuals and description documents that describe details of the US element

and subsystem design, analytical models, and operation concepts in accordance with DRD1145OP-002.

c. The Contractor shall support the development of US specific post-flight reports to address overall US Element and Subsystem level performance and issues and shall submit all post-flight reports in accordance with DRD1145OP-001.

d. The Contractor shall provide still photographs, video, and motion picture coverage of key events in accordance with DRD1145MA-013.

12.6 Upper Stage Production Phase GSE (IDIQ CLIN 4)

The Contractor shall provide any additional US Element GSE (excluding EGSE) during the production and sustaining engineering phases.

13. 0 Manufacturing and Assembly (M&A) (WBS 136905.08.05.12)

a. The Contractor shall plan for the transition and implementation of all M&A tasks, including any new tooling development and acquisition. The Contractor shall assume complete responsibility of the M&A activities not later than 90 days after the completion of the US PDR process.

b. After the successful transition from supporting the NDT to assuming complete responsibility for all US manufacturing and assembly tasks, the Contractor shall assemble the US including installation of the Government provided US Engine, Booster Separation Motors, US IU, and other Government-furnished hardware in accordance with the US M&A Plan. The US Element final assembly and check out shall be performed at MAF by the Contractor. The Government will be responsible for the loading and transportation, via NASA provided barges, of all US Element Test Flight and Operational Flight Units as required to meet the milestones as defined in Attachment J-8, Ares I / Upper Stage Milestones.

c. The Contractor shall develop, submit, and update a Make or Buy Program in accordance with NFS 1852.215-78, Make or Buy Program Requirements and Attachment J-17, Make or Buy Program.

d. The Contractor shall build and deliver the following items during the US DDT&E phase of this contract.

USRCS Hot Fire Test Article (HFTA)
USRCS Thruster Module Qualification Test Assembly
FSRCS Hot Fire Test Article (HFTA)
FSRCS Thruster Module Qualification Test Assembly

e. The Contractor shall build and deliver the Operational Upper Stage Flight Units for the following missions during the US Production phase of this contract.

Orion 5
Orion 6
Orion 7
Orion 8
Orion 9
Orion 10

Optional Flight Units

f. Upon written authorization by the Government in accordance with Clause B.4, Option for Increased Quantity-Separately Priced Line Item, the Contractor shall build and deliver up to four additional Operational US Flight Units per contract year.

13.1 M&A Producibility Engineering

The Contractor shall provide producibility engineering support to the M&A IPT as defined in SOW section 4.1 and including the following:

a. Support the NDT in the design and development of tooling, processes, procedures and techniques necessary to optimize the manufacture and assembly of the US Demonstration, Development, Qualification and Flight articles.

b. Support the NDT in the development of the draft Manufacturing and Assembly Plan and the Manufacturing and Resource Planning System.

c. Support the NDT in the integration and planning of supplier chain delivery, installation, and checkout of subassemblies, components and piece parts.

d. Support the NDT in the material, process, technology readiness and risk reduction activities to include but not limited to: friction stir welding and friction stir plug process development, weld tools and associated tooling development, forming of components, Nondestructive evaluation technique development, composite hardware development and development of Thermal Protection System (TPS) Spray On Foam Insulation (SOFI).

e. Support the development of automated and manual TPS processing.

f. Support the development and demonstration of the Nondestructive Evaluation (NDE) plan and processes.

g. Support the NDT in the identification of all long lead tooling and material items required to support the DDT&E of the US Element.

h. Support the development of material allowable and other material properties to be used in the design and development of the US Element.

i. Provide inputs to the NDT to populate the MSFC Materials and Process Technical Information System (MAPTIS)-II with materials properties in accordance to NASA-STD-(I)-6016. All materials properties and data requirement deliverables shall be delivered electronically in a format compatible with the MAPTIS-II.

j. Support the development and implementation of the US Qualification program including the manufacture and assembly of all test articles in accordance with the US Manufacturing and Assembly Plan.

k. Support the development of modeling and simulation of the manufacturing and assembly process to fabricate and assemble the US Element.

l. Support the development, fabrication and assembly of the manufacturing demonstration and test articles, as described in the US Development Plan, and support the NDT in the development of the processes associated with each.

13.1.1 Upper Stage Demonstration and Ground Test Article(s)

The Contractor shall support NASA in the manufacture, assembly, checkout, and delivery of the accepted US demonstration and test articles and associated STE, as described in the US Development Plan. All Upper Stage demonstration and ground test articles listed below shall be manufactured, assembled and checked out at the MSFC.

13.1.1.1 Upper Stage Main Propulsion Test Article (MPTA)

MPTA, described in USO-CLV-SE-25704, US Design Definition Document, will be manufactured, installed and tested at MSFC to demonstrate the performance of the integrated US propulsion system and associated avionics components. The Contractor shall support the NDT during the manufacture and assembly of the MPTA and will provide all SCI hardware as defined in the specific sections of the SOW.

13.1.1.2 Manufacturing Demonstration Article (MDA)

The Contractor shall support the NDT in development of a full scale manufacturing demonstration test article to evaluate the effectiveness of the manufacturing process.

13.1.1.3 Composite Manufacturing Demonstration Article (CMDA)

The Contractor shall support NASA in the development and manufacture of CMDA.

13.1.1.4 Structural Development Test Articles

The Contractor shall support NASA in the development and manufacture of Structural Development Test Articles.

13.2 Upper Stage Development and Production

a. Upon the successful completion of the transition of the responsibility for the US M&A, the Contractor shall provide the final M&A Plan in accordance with DRD1145MP-003.

b. The Contractor shall develop, update, and maintain the Materials and Processes Control Plan in accordance with DRD1145MP-004.

c. The Contractor shall update and implement the NDE plan in accordance with DRD1145MP-006.

d. The Contractor shall update and implement the Contamination Control Plan in accordance with DRD1145MP-001.

e. The Contractor shall acquire long lead tooling and material items required to support the DDT&E and production of the US in accordance with the written authorization of the Contracting Officer.

f. The Contractor shall conduct producibility analyses of the US designs during the US DACs to assure the ability to fabricate, inspect, and assemble hardware.

g. The Contractor shall develop and maintain a centralized manufacturing database such that all manufacturing data, CAD geometry, process steps and process parameters related to production are stored and organized such that all levels of data can be accessed securely and efficiently by the NDT.

13.2.1 Material Control

a. The Contractor shall develop the Materials Identification Usage List (MIUL) in accordance with DRD1145MP-002.

b. The Contractor shall develop the Material Usage Agreements (MUA) in accordance with DRD1145MP-005.

13.2.2 Environmental Compliance and Controls

The Contractor shall comply with all federal, state, local, and international environmental regulations that are applicable to the affected facilities, sites, and operations. These regulations include but are not limited to the Clean Air Act, Clean Water Act, NEPA OSHA, and the Montreal Protocol. The Contractor shall comply with the environmental permitting requirements at affected facilities such as the Title V

requirements of the Clean Air Act. The Contractor shall use applicable environmental controls in hazardous operations to protect personnel from hazardous exposures.

13.3 Upper Stage Element Ground Vibration Test (GVT) Article

a. The Contractor shall manufacture, assemble and deliver the Ground Vibration Test (GVT) article, defined in the US Design Definition Document, USO-CLV-SE-25704, in accordance with the US M&A Plan. The US GVT shall be manufactured, assembled, and checked out at MAF and delivered in accordance with the milestones as defined in Attachment J-8, Ares I / Upper Stage Milestones.

b. The Contractor shall plan and perform the in-process and post-production inspections and tests of flight articles and their interfaces necessary to support Government acceptance and post-delivery checkout consistent with product assurance plans and qualified acceptance test procedures in accordance with DRD1145CM-001.

13.4 Upper Stage Flight Test Articles

a. The Contractor shall manufacture and assemble the US Flight Test articles required to support the Constellation flight test program in accordance with the US M&A Plan. The US Flight Test articles shall be manufactured, assembled, and checked out at MAF and shall be delivered to the launch site in accordance with the milestones as defined in Attachment J-8, Ares I / Upper Stage Milestones.

b. The US Element for the Ares 2 mission will be a high fidelity engineering development unit (EDU) that simulates all aspects of the US flight unit during ascent and separation. The unit will not contain an operational TVC system. The Contractor shall install the Government Furnished mass simulator in place of an operational Upper Stage Engine.

c. The US Element for the Orion 3 mission will be a fully functional flight stage per the design defined in the US Design Definition Document, USO-CLV-SE-25704.

d. The US Element for the Orion 4 mission will be a fully functional flight stage per the design defined in the US Design Definition Document, USO-CLV-SE-25704. This mission has been designated by NASA as demonstration of the Initial Operational Capability for Constellation.

e. The Contractor shall plan and perform the in-process and post-production inspections and tests of flight articles and their interfaces necessary to support Government acceptance and post-delivery checkout in accordance with DRD1145CM-001.

13.5 Upper Stage Qualification Hardware

The Contractor shall manufacture, assemble and deliver the US Qualification test article(s) in accordance with US M&A Plan.

13.6 Upper Stage Operational Flight Units

a. The Contractor shall manufacture and assemble all US Operational Flight Units in accordance with the US M&A Plan.

b. Final manufacture, assembly, and checkout of the US Operational Flight Units shall be conducted at MAF. The US Elements shall be delivered in accordance with the milestones as defined in Attachment J-8, Ares I / Upper Stage Milestones.

c. The Contractor shall perform the in-process and post-production inspections and tests of flight articles and their interfaces necessary to support Government acceptance and post-delivery checkout in accordance with DRD1145CM-001.

13.7 Provisioning and Tooling (IDIQ CLIN 4)

The Contractor shall modify, obtain, and procure test equipment, facilities, tooling, fixtures, or post DD250 ground and flight operation spares as directed by the Government as necessary to maintain the production and delivery of the US Elements. If additional tooling or equipment is required to support an increase in the production rate from the baseline of two US Elements per contract year to a maximum of six US Elements per contract year, the Contractor shall provide the analysis and supporting rationale to the Government for written approval prior to the initiation of any procurement. Any additional tooling, equipment and / or processing hardware required to support the additional option quantities shall be identified and procured in accordance with this section.

13.8 Long Lead Items for Follow On Production (CLIN TBD)

The Contractor shall procure long lead materials and components for follow on production of Upper Stage Operational Units as defined by Contracting Officer direction. This applies to Units to be manufactured in a follow on production contract.

13.9 Optional Upper Stage Elements (CLIN 5)

Upon written notification from the Government, the Contractor shall manufacture and assemble additional US Elements above the base level of two per contract year not to exceed a total of up to six US Elements per contract year in accordance with the US M&A Plan.

14.0 Upper Stage Ullage Settling Motor System (USMS) (WBS 136905.08.05.13)

14.1 Producibility Engineering Support

The Contractor shall provide producibility engineering support to the USMS subsystem IPT as defined in SOW section 4.1

14.2 USM Subsystem DDT&E

a. Contractor shall provide the engineering and integration for all Upper Stage Element and Subsystem-level contract tasks including the USMS SCI as defined in SOW section 4.2.

b. Contractor shall support the NDT in the USMS Development testing and Qualification testing conducted on the USMS.

c. The Contractor shall develop an Operations and Maintenance Manual for the USM subsystem in accordance with DRD1145OP-002.

14.3 USMS SCI DDT&E

NASA has identified specific components, sub-assemblies, and / or piece parts as SCI that shall be designed, developed and / or procured by the Contractor as an end item or an off-the-shelf item. The Contractor shall provide for and support NDT insight on all SCI DDT&E.

a. The Contractor shall provide the detailed design, development, acquisition, qualification, and certification of the USMS SCI in accordance with the NDT developed specifications and in accordance with Constellation Environmental Qualification and Acceptance Testing Requirements Document (CxP70036), Constellation Program Structural Design and Verification Requirements (CxP70135).

b. The Contractor shall provide all USMS SCI hardware required to manufacture, assemble, checkout, and test all US integrated test articles, simulation test articles including end effectors commanded by the US Avionics system, and the US flight units.

c. The Contractor shall provide inputs to the NDT to support the development of the USMS SCI specifications in accordance with DRD1145SE-002.

d. The Contractor shall maintain the configuration control of the USMS SCI specifications and interface documents in accordance with SOW section 4.3.

e. The Contractor shall provide certification data for all USMS SCI in accordance with DRD1145CM-001.

f. The Contractor shall ensure verification of all SCI shall be conducted in accordance with the US Verification and Validation Plan (USO-CLV-SE-25703)

g. The USMS SCI will include, but is not limited to the following:

Source Control Item	Description / Specification	NASA Advanced Development Task Initiated
Instrumentation/pressure transducers	TBD	No

Table J-1-3

h. The USMS SCI contains electrical interfaces to the US Avionics and Software system. As part of the USMS SCI DDT&E, the Contractor shall be responsible for the development and installation of the embedded instrumentation, electrical wiring, and connectors for power and data in all areas other than the IU primary structure as described in SOW section 10.0

i. The Contractor shall develop, update and implement data submittal for all USMS SCI in accordance with the following Data Requirements Descriptions:

DRD1145CD-003	Technology Reports
DRD1145CM-005	Functional Configuration / Physical Configuration Audit Documentation
DRD1145CM-003	Engineering Change Proposals and Associated Documentation
DRD1145CM-002	Deviation/Waiver Approval Requests
DRD1145CM-007	Engineering Drawings and Associated Lists
DRD1145CM-008	Specification and Drawing Tree
DRD1145DE-007	Structural Dynamics Analyses, Loads and Models Documentation
DRD1145DE-009	Structural Assessment Plan
DRD1145DE-010	Development Test Report
DRD1145DE-011	Development Test Procedures
DRD1145DE-012	Thermal Analysis Report
DRD1145DE-015	Development Unit Test Planning
DRD1145MA-007	Major Review Documentation
DRD1145MP-001	Contamination Control Plan
DRD1145DE-013	Structural Strength and Fatigue Analysis Reports
DRD1145DE-006	Fracture Control Reports Inputs
DRD1145MP-002	Materials and Processes Identification and Usage List
DRD1145MP-003	Manufacturing and Assembly Plan
DRD1145MP-004	Materials and Processes Selection, Implementation, and Control Plan
DRD1145MP-005	Material Usage Agreement
DRD1145MP-006	Nondestructive Test Plan
DRD1145QE-004	Certificate of Qualification
DRD1145VR-002	Verification / Validation Requirements

DRD1145VR-007	Test Plans
DRD1145VR-008	Test Procedures
DRD1145VR-003	Verification / Validation Reports
DRD1145VR-006	Verification Requirements Compliance Document
DRD1145VR-004	Verification / Validation Success Criteria
DRD1145VR-005	Verification/Validation Procedures
DRD1145SA-002	Fault Tree Analysis
DRD1145SA-001	System Safety/Hazard Analysis
DRD1145SA-005	Mishap and Safety Statistics Report
DRD1145RM-003	Problem Reporting and Corrective Action
DRD 1145RM-006	MSFC ALERT System Documentation
DRD1145RM-002	Failure Modes and Effects Analysis and Critical Items List
DRD1145SE-008	Mass Properties Report
DRD1145DE-017	Engine Thermal Data and Analysis
DRD1145LS-002	Special Handling and Storage Requirements Documents
DRD1145MA-013	Still Photographs, Video, and Motion Pictures
DRD1145SE-003	Interface Control Document
DRD1145SE-007	System Connectivity Diagrams and End to End Functional Schematics

14.4 USMS Subsystem Development and Qualification Testing (IDIQ CLIN 2)

a. The Contractor shall provide support for USMS subsystem test planning and procedures, test facility integration, engineering support for testing, data reduction, post-test data analysis and final test report, and problem resolution. The Contractor shall provide support for integrated pyrotechnics testing and verification.

b. The Contractor shall provide test engineering technician support as required to support test article preparation, installation, checkout, anomaly resolution, test article removal, and storage.

[END OF ATTACHMENT]