

University-affiliated Spaceport Technology Development Contract NAS1003006

100933

TASK ORDER

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TO Ref.	Task Order No.	Contract Year	Task Order Revision	Reference Plan Revision	Laboratory/Area	Type:
SPI	00485	7	C	B	None required	Project

Title: **S&MA Products for CxP Subsystem Development**

Director Area	R&D:	Manager Group	Period of Performance:
Systems & Project Engineering	No	Project Engineering	From: 11/16/2007
	Scope Change: Yes		To: 09/30/2010

Note: Target Costs change only if scope changes	CY1 to CY5	CY6	Contract Year 7 (CY7) Cost Targets			CY8	OUTYEARS	TOTAL
	(K\$)	(K\$)	FROM:	DELTA:	TO:	(K\$)	(K\$)	(K\$)

TOTAL ADJUST TARGET LABOR COSTS								
ESTIMATED OTHER DIRECT COSTS								
SUBTOTAL TOTAL ESTIMATED COSTS								
AWARD FEE (on labor only)								
INCENTIVE FEE (on labor only)								
TOTAL COST AND FEE	0.00	1,935.55	\$3,561,113	-\$89,552	\$3,471,561	2,993.19	0.00	8,400.30

FS	PROGRAM	FUND CODE	COST TARGETS			INITIALS
			\$ FROM	\$ DELTA	\$ TO	
1	CONSTL	292360.09.30.09.01	\$2,000.00	\$0.00	\$2,000.00	
2	CONSTL	292360.09.25.05	\$1,365,747.00	\$0.00	\$1,365,747.00	
3	CONSTL	292360.09.21.04.05	\$150,400.00	\$0.00	\$150,400.00	
4	CONSTL	292360.09.21.03.05	\$100,260.00	\$0.00	\$100,260.00	
5	CONSTL	292360.09.20.05.05	\$24,400.00	\$0.00	\$24,400.00	
6	CONSTL	292360.09.20.02.05	\$902,156.00	\$0.00	\$902,156.00	
7	CONSTL	292360.09.20.03.05	\$183,300.00	\$0.00	\$183,300.00	
8	CONSTL	292360.09.20.01.05	\$30,500.00	\$0.00	\$30,500.00	
9	CONSTL	292360.09.24.04.05	\$150,400.00	\$0.00	\$150,400.00	
10	CONSTL	292360.09.24.05.05	\$33,400.00	\$0.00	\$33,400.00	
11	CONSTL	292360.09.23.01.05	\$233,900.00	\$0.00	\$233,900.00	
12	CONSTL	292360.09.30.05	\$14,707.00	\$0.00	\$14,707.00	
13	CONSTL	292360.09.24.04.01.03	\$128,000.00	\$0.00	\$128,000.00	
14	CONSTL	292360.09.20.05.01.03	\$60,100.00	\$0.00	\$60,100.00	
15	CONSTL	292360.09.20.02.20.03	\$918,072.00	\$0.00	\$918,072.00	
16	CONSTL	292360.09.20.03.01.03	\$183,300.00	\$0.00	\$183,300.00	
17	CONSTL	292360.09.21.01.05	\$24,600.00	\$0.00	\$24,600.00	
18	CONSTL	292360.09.21.04.05	\$8,200.00	\$0.00	\$8,200.00	
19	CONSTL	292360.09.21.06.05	\$10,900.00	\$0.00	\$10,900.00	
20	CONSTL	292360.09.20.01.20.03	\$53,300.00	\$0.00	\$53,300.00	
TOTAL CUMULATIVE FUND LIMIT (NOT TO EXCEED)			\$5,057,642.00	\$0.00	\$5,057,642.00	

NASA TASK ORDER MANAGER/ ORG / PHONE SIGNATURE: <i>Roger Matthews</i> / NE-D1 / (321)867-6094 DATE: 5/21/09	CUSTOMER TECH REP(OPTIONAL)/ ORG / PHONE SIGNATURE: Darren Gibson / SA-F / (321)861-0337 DATE:
CERTIFICATION OF FUNDING/ ORG / PHONE SIGNATURE: <i>Joyce McDowell</i> DATE: 6/1/09	CONTRACT TECHNICAL MANAGER/ ORG / PHONE SIGNATURE: <i>Meredith Chandler</i> / NE-12 / (321)867-4878 DATE: 5/28/09
CONTRACT OFFICER/ ORG / PHONE SIGNATURE: <i>Joyce McDowell</i> / OP-ES / (321)867-3437	ACCEPTANCE ACKNOWLEDGEMENT BY CONTRACTOR/ ORG / PHONE SIGNATURE: Martin Cummins / USTDC / (321)867-5408

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A. PROJECT DESCRIPTION & SCOPE

Task Order Rev C: Task Order Revision C is generated in response to Task Order Plan Revision B. The purpose of this revision is to perform the following: 1)Adjust deliverable due dates per the 5-15-09 edition released CxP NE Subsystem Design Phase schedules; 2)Reduce scope for an additional system where Failure Modes and Effects Analyses (FMEAs) are determined not required by NASA; 3)Clarify which subsystems are deemed Flight Critical; 4)Convert existing labor scope to ODC in order to utilize a subcontractor for specific System Assurance Analyses (SAA) deliverables and; 5)Increase competence in the Capability Maturity Model Integrated (CMMI) Version 1.2 Upgrade.

Task Order Rev B: Task Order Revision B is generated in response to Task Order Plan Revision A. The purpose of this revision is to perform the following: adjust deliverable due dates per the 04.08.09 edition released CxP NE Subsystem Design Phase schedules, define scope for LETF Quality support, delete requirements for VAB Highbay 2 platform analysis, delete scope for MPPF studies that are being performed as part of Level IV S & MA Task Order 552, and reduce scope for systems where Failure Modes and Effects Analyses (FMEAs) are determined not required by NASA.

This revision also changes the Task Order Manager from David Kruhm to Roger Mathews. (DK 4/21/09)TO Revision A: Task Order Revision A is generated without an accompanying plan; Task Order Plan Basic remains in effect. The purpose of this revision is to add authority for existing scope.

Basic: The purpose of this Revision is to define project scope continued from CY6/FY08 defined in Task Order (TO) 6SPI00485, Revision B. Unless specifically addressed below, the scope of work defined in 6SPI00485, Revision B remains unchanged.

CY6/FY08 Activity

During CY6/FY08, review schedules and associated scope were shifted into CY7/FY09. The target value of the Task Order has been adjusted to reflect this shift in scope. All remaining milestones that were planned for CY6/FY08 were accomplished successfully.

CY7/FY09

Activities for CY7/FY09 include previously planned activities with the following exceptions: Several systems were originally planned to have one System Assurance Analyses (SAA) for each design review. A decision was made to split some of the systems into Element Level reviews (i. e. , Spacecraft Processing area versus LC39 area). Due to splitting of systems into separate SAAs, this will require ~~This~~ requires (TO Rev B) additional scope due to multiple meetings and additional documentation requirements. Additionally, the extended schedule will result in an increased number of design meetings, which results in an increase of scope being required to keep the Safety and Mission Assurance (S & MA) team fully engaged with the design teams.

The purpose of this TO is to define a requirement for a contractor to perform S & MA tasks for the development of Constellation Ground System subsystems.

Safety and Reliability Engineering analyses (also called SAAs) are performed to identify hazards and critical items associated with facility systems, GSE, and operations. From these analyses, risk data is obtained and used to identify changes in the design or operation of systems, equipment and facilities to eliminate or minimize the associated risks. SAAs consist of Criticality Assessments, Hazard Analyses (HA), and Failure Mode and Effects Analyses (FMEA).

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Criticality Assessments are performed to determine the relative measure of the consequences of a failure mode. An initial evaluation is performed of each subsystem's/item's function to identify the effect(s) of loss or improper performance of that function and determine if the effect(s) could result in loss of life and/or flight vehicle, damage to a flight vehicle system, or loss of mission. Subsequent to the approval of Revision B to the Task Order, Criticality Assessments will no longer be performed, with the exception of those systems deemed GSE Flight Critical per NASA (TO Rev C). Those systems that require FMEAs will be identified by NASA. (TO Rev B)

Hazard Analyses are intended to identify and address the hazards that arise in the design, development, manufacturing, construction, facilities, transportation, operations and disposal activities associated with hardware, software, maintenance, operations and environments. Therefore, it is imperative that they are performed and updated during each phase of a development project's lifecycle. They are invaluable tools to ensure that hazards are eliminated or mitigated to acceptable levels in the design. Subsequent to the approval of Revision B to the Task Order, Hazard Reports will no longer be required. Hazards and other risks will be documented in a "System Risks and Recommended Mitigation" section of the SAA. This new section will replace the current "Concerns and Recommendations" section of the SAA. (TO Rev B)

Failure Modes and Effects Analyses (where required) (TO Rev B) are used during project design phases to determine hardware criticality, identify failure modes that do not meet applicable Program reliability requirements, identify the potential for single-point failures, and identify areas where the design does not meet the failure tolerance requirements. The FMEA is updated throughout the life of the program/project as design modifications and/or upgrades are made to ensure that the design meets program requirements, and to ensure new risks are eliminated and/or mitigated.

As part of the hazards analysis process, software safety analyses are also performed throughout all phases of the project's lifecycle to ensure potential hazards introduced by software are identified and assessed. Software safety analyses also ensure that identified hazard mitigations and/or hazard controls to be achieved through the execution of software. Hazards will be identified, and mitigating actions defined, that will ensure that software is ~~are~~ correctly designed, ~~into the software~~; ~~correctly~~ (TO Rev B) implemented, and successfully verified as an effective means for hazard mitigation/control. Software safety analyses are only performed upon the software contained within the LCS and KGCS subsystems, as defined per Tasks 6, 7, and 8. (TO Rev B)

Under this TO the contractor shall produce SAAs for the Constellation Ground System. The Constellation Ground System consists of the support equipment, systems and facilities required to handle, store, process, launch, land, retrieve, and refurbish flight hardware in support of Constellation missions. The CxP Ground System is comprised of three architectural levels:

- Level 3 - System (i. e. , the complete CxP Ground System)
- Level 4 - Element (a major component of the System; e. g. , "Mobile Launcher")
- Level 5 - Subsystem (a defined system supporting an Element; e. g. , "Launch Control System")

The contractor shall serve as the Prime Safety and Reliability Engineering team member on the Ground System's Level 5 subsystem design/development teams, and shall be responsible for performing all system safety and reliability engineering tasks necessary for successful project execution. The contractor is expected to produce SAAs for each Level 5 subsystem listed below. These analyses shall support each milestone (as defined in CxP 70038A (TO Rev B), *Constellation Program Hazard Analyses Methodology*), and will help ensure the appropriate disposition, tracking and resolution of identified hazards. The

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deliverable product documentation, process, and format are to comply with CxP 70038A (TO Rev B), CxP 70043A (*Constellation Program Hardware Failure Modes and Effects Analysis and Critical Items List Methodology*), as modified herein. CxP Level 2 Constellation Safety and Engineering Review Panel (CSERP) requirements, as well as KSC Level 3/4/5 review board(s) requirements. (TO Rev B)

Tasks 2, 3, 4, and 5:

Launch Equipment Test Facility (LETF) Subsystems

- Area Warning System
- Hazardous Gas Detection System
- ~~LETF~~ Electrical Power (TO Rev B)
- Cold Helium (GHe) Subsystem (note 2) (TO Rev C)

Hypergol Subsystem

- Spacecraft Processing Area
- LC39 Area

First Stage Aft Skirt TVC Hydraulic Subsystem

- Liquid Oxygen (LO2) Subsystem (note 2) (TO Rev C)
- Liquid Hydrogen (LH2) Subsystem (note 2) (TO Rev C)

Environmental Control System (ECS) (note 2) (TO Rev C)

- LC39 ECS

Gaseous Nitrogen System

- Spacecraft Processing Area
- LC39 Area

Gaseous Helium System

- Spacecraft Processing Area
- LC39 Area (note 2) (TO Rev C)

Breathing Air System

- Spacecraft Processing Area (TO Rev B)
- LC39 Area (TO Rev B)

Umbilical /Arms (ML / PAD)

- Service Module Umbilical (SMU) (note 2) (TO Rev C)
- First Stage Forward Skirt Avionics Umbilical (FSFAU)
- First Stage Aft Skirt Electrical Umbilical (FSASEU)
- First Stage Aft Skirt Purge Umbilical (FSASPU)
- Upper Stage Aft LH2 Umbilical (note 2) (TO Rev C)
- Upper Stage Instrumentation Unit Umbilical (USIUU) (note 2) (TO Rev C)
- Upper Stage Aft LO2 Umbilical (note 2) (TO Rev C)

Handling and Access - MLE equipment

Handling and Access - SPE equipment

Handling and Access - VIE equipment

Crew Access Arm (CAA) (note 2) (TO Rev C)

Vehicle Stabilization and Dampening System (VSIDS) (note 2) (TO Rev C)

Hazardous Gas Leak Detection System (HGLDS)

Ground Special Power (note 2) (TO Rev C)

- Spacecraft Processing Area
- LC39 Area

Launch Release System (LRS) (note 2) (TO Rev C)

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~~Communications and Tracking Station~~ Radio Frequency Telemetry System (TO Rev B)
First Stage Thermal Control System (FS TCS) (note 2) (TO Rev C)
Ignition Over Pressurization (IOP)/Sound Suppression (note 2) (TO Rev C)
Gaseous Oxygen
- Spacecraft Processing Area
- LC39 Area
Ground Cooling Subsystem (GCS)
Weather Instrumentation
Sensor Data Acquisition System (SDAS) (note 1) (TO Rev B)
Range Safety Checkout System (RSCS)
Vehicle Access Arm (VAA) (note 1) (TO Rev C)
Kennedy Complex Control System (KCCS)
Launch Control System (LCS)
Kennedy Ground Control System (KGCS)

Tasks 6, 7, and 8:

LCS (note 2) (TO Rev C) including Hardware, System Software and Simulation Software
Applications Software (Launch Control System and Programmable Logic controller applications)
Emergency Safing Software

Task 9:

TA Facility Subsystems

- ~~Vehicle Assembly Building (VAB) High Bay 2 Platforms~~ (TO Rev B)
- Vehicle Assembly Building (VAB) High Bay 3 Platforms
- Lightning Protection Subsystem (note 1) (TO Rev B)
- Emergency Egress System
- ~~Multi-Payload Processing Facility (MPPF)~~ (TO Rev B)
- HVAC (note 1) (TO Rev B)
- Fire Suppression (note 1) (TO Rev B)
- Utility Controls (KCCS) Supervisory Control and Data Acquisition System (SCADA)
- Elevators (note 1) (TO Rev B)
- Launch Mount (note 1) (TO Rev B)
- Cranes (note 1) (TO Rev B)
- Spacecraft Transporter
- ML Transporter
- Laser Alignment System
- AC Power
- Uninterruptible Power
- Oxygen Deficiency Monitoring System (ODMS) (note 1) (TO Rev B)

Note 1 - FMEA portion of SAA analyses is not required for these systems. (TO Rev B)

Note 2 - Flight Critical GSE subsystem (TO Rev C)

B. TASKS

1.0 The contractor shall review CxP technical documentation during Ground System development to assess impacts to Safety and Reliability planning and analyses produced under this Task Order, and

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provide Review Item Discrepancies (RIDs) / comments for consideration by NASA.

2.0 The contractor shall prepare the following inputs for the 30% Design Review for each subsystem listed above:

- a. Criticality Assessment (per CxP 70043, para 4.1, and App. D) to determine if subsystem is 1) Flight Critical, 2) Critical, or 3) Non-Critical.
- b. Draft Hazard Analysis (per CxP 70038A [TO Rev B]) sufficient to identify the major hazards and single-point failures needing to be addressed through the design/development process.
- c. ~~Concerns and recommendations~~: System Risks and Recommended Mitigation (TO Rev B)

3.0 The contractor shall prepare the following inputs for the 60% Design Review for each subsystem listed above:

- a. ~~For Flight Critical and Critical: updated Criticality Assessment and an initial draft FMEA and draft Critical Items List (CIL) per CxP 70043. For Non-Critical: updated Criticality Assessment:~~
 - a. For Flight Critical subsystems, perform FMEA per CxP 70043A, as modified herein; all other subsystems requiring an FMEA perform per KNPR 8700.2 Rev Basic (SA Internal Review DRAFT KSC System Safety and Reliability Analyses Methodology Procedural Requirements), as modified herein, or CxP 70043 as specified at the 30% design review. If the KNPR 8700.2 is used as the basis for performing the FMEA, the Reliability and Safety Assessment Report (RSAR) is not required. NASA will create the RSAR as a separately controlled document, not to be included as part of the SAA. All SAA related documentation is to be released via DDMS. (TO Rev B).
 - b. Updated Subsystem Hazard Analysis per CxP 70038A (TO Rev B), Appendix A. 2. (For those subsystems with critical control functions provided by software, a draft Software Hazard Analysis per CxP 70038A, (TO Rev B) Appendix A. 5 shall also be performed).
 - c. Definition of applicable inputs to Operations and Maintenance Requirements and Specifications Documents (OMRSDs).
 - d. ~~Updated concerns and recommendations~~ System Risk and Recommended Mitigations. (TO Rev B)

4.0 The contractor shall prepare the following inputs for the 90% Design Review for each subsystem listed above:

- a. ~~Flight Critical and Critical: updated Criticality Assessment and FMEA (where required) (TO Rev B) and an updated CIL. Non-Critical: updated Criticality Assessment: (TO Rev B)~~
- b. Updated Hazard Analysis representing the 90% design milestone.
- c. Updated definition of applicable inputs to OMRSDs.

5.0 The contractor shall prepare the following inputs for the Final Release for each subsystem listed above (Prior to Operational Phase):

- a. Prior to subsystem activation, the contractor shall provide final update of the analyses in Task 4.
- b. The contractor shall hold a table-top review of all updated analyses from Task 4. Signatures from the NASA Design organization and NASA S & MA organization are required. In the event that the design/development team is not responsible for operational certification/activation, the contractor shall provide the appropriate updates to the responsible party and support the tabletop review.

6.0 The contractor shall prepare the following inputs for the Command and Control Communications (CCC) Preliminary Design Review for the Launch Control System subsystem and associated software subsystems:

- a. For Flight Critical and Critical: a Criticality Assessment and an initial draft FMEA and draft CIL per CxP 70043. For Non-Critical: a Criticality Assessment.

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- b. Draft Hazard Analysis (per CxP 70038) sufficient to identify the major hazards and single-point failures needing to be addressed through the design/development process.
 c. Definition of applicable inputs to OMRSDs.
 d. Concerns and recommendations.

7.0 The contractor shall prepare the following inputs for the CCC Critical Design Review for the Launch Control System subsystem and associated software subsystems listed above:

- a. For Flight Critical and Critical: updated Criticality Assessment and an updated FMEA and CIL per CxP 70043. For Non-Critical: updated Criticality Assessment.
 b. Updated Subsystem Hazard Analysis per CxP 70038, Appendix A. 2. (For those subsystems with critical control functions provided by software, a draft Software Hazard Analysis per CxP 70038, Appendix A. 5 shall also be performed).
 c. Definition of applicable inputs to OMRSDs.
 d. Updated concerns and recommendations.

8.0 The contractor shall prepare the following inputs for the CCC Design Certification Review for the Launch Control System subsystem and associated software subsystems listed above (prior to Operational Phase):

- a. Prior to the Launch Control System's operational use, the contractor shall provide a final update of the analyses in Task 7.
 b. The contractor shall hold a table-top review of all updated analyses from Task 7. Signatures from the NASA CCC Chief Engineer, NASA CCC Project Manager, and NASA S & MA organization are required. In the event that the design/development team is not responsible for operational certification/activation, the contractor shall provide the appropriate updates to the responsible party and support the tabletop review.

9.0 The contractor shall prepare the following inputs for each subsystem listed above:

- a. The contractor shall hold a table-top review of all updated analyses. In the event that the design/development team is not responsible for operational certification/activation, the contractor shall provide the appropriate updates to the responsible party and support the tabletop review.
 b. Updated SAA representing the as-designed / as-built subsystem.
 c. Updated definition of applicable inputs to OMRSDs.
 d. Updated ~~concerns and recommendations~~ : System Risks and Recommended Mitigation (TO Rev B).

- 10.0** a. The contractor shall provide support to maintain the CCC Software Assurance Plan and CCC Hardware Assurance Plan and provide support to develop quality assurance review and audit processes.
 b. The contractor shall provide support for performance of quality assurance tasks identified in the CCC Software Assurance Plan and CCC Hardware Assurance Plan.

11.0 a. The contractor shall provide LETF Quality Assurance support in the development of review, audit, fabrication, assembly, and test processes and procedures in compliance with CxP72158 and supporting Kennedy Space Center Procedures KNPR_8720. 2 and KNPR_8730. 2.

- b. The contractor shall provide support for performance of LETF quality assurance tasks identified in the Ground Systems SR & QA Plan (CxP72158). (TO Rev B)

C. MILESTONES/DELIVERABLES

1. - Delivery of RIDS/comments on CxP technical documentation to assess impacts to existing Safety and Reliability planning and analyses.

Start Date : 10/01/2008 End Date : 09/30/2010

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2. - Complete SAA report for the LETF Area Warning System 30% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 11/26/2009
3. - Complete SAA report for the LETF Area Warning System 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/02/2010
4. - Complete SAA report for the LETF Area Warning System 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/10/2010
5. - Complete SAA report for the LETF Area Warning System Final Design Review (required NLT 19 working days prior to Design Review).
Due Date : 07/05/2010
6. - Complete SAA report for the LETF Hazardous Gas Detection System Final Release Review (required NLT 19 days prior to Design Review).
Due Date : 11/13/2008
Completed : 11/12/2008
7. - Complete SAA report for the LETF Electrical Power Activation (required NLT 19 working days prior to Design Review).
Due Date : 09/30/2010
8. - Complete SAA report for the Cold Helium (GHe) 30% Design Review (required NLT 19 days prior to Design Review).
Due Date : 08/04/2009
9. - Complete SAA report for the Cold Helium (GHe) 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 10/23/2009
10. - Complete SAA report for the Cold Helium (GHe) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/26/2010
11. - Complete SAA report for the Cold Helium (GHe) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 07/26/2010
12. - Complete SAA report for the Hypergol Subsystem MPPF Delta 30% Design Review (required NLT 19 days prior to Design Review).
Due Date : 04/17/2009
Completed : 04/17/2009
13. - Complete SAA report for the Hypergol Subsystem MPPF 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 11/09/2009

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- 14. - Complete SAA report for the Hypergol Subsystem MPPF 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/17/2010
- 15. - Complete SAA report for the Hypergol Subsystem MPPF Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 07/05/2010
- 16. - Complete SAA report for the Hypergol Subsystem PAD 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 06/10/2009
- 17. - Complete SAA report for the Hypergol Subsystem PAD 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 01/04/2010
- 18. - Complete SAA report for the Hypergol Subsystem PAD Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 04/05/2010
- 19. - Complete SAA report for the First Stage Aft Skirt TVC Hydraulic Subsystem 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 06/03/2009
- 20. - Complete SAA report for the First Stage Aft Skirt TVC Hydraulic Subsystem 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/03/2010
- 21. - Complete SAA report for the First Stage Aft Skirt TVC Hydraulic Subsystem Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 06/02/2010
- 22. - Complete SAA report for the Liquid Oxygen (LO2) Subsystem 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/25/2009
Completed : 02/17/2009
- 23. - Complete SAA report for the Liquid Oxygen (LO2) Subsystem 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 09/02/2009
- 24. - Complete SAA report for the Liquid Oxygen (LO2) Subsystem Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 11/10/2009
- 25. - Complete SAA report for the Liquid Hydrogen (LH2) System 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 02/25/2009
Completed : 02/17/2009
- 26. - Complete SAA report for the Liquid Hydrogen (LH2) System 90% Design Review (required NLT 19

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working days prior to Design Review).

Due Date : 09/02/2009

27. - Complete SAA report for the Liquid Hydrogen (LH2) System Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 11/10/2009

28. - Complete SAA report for the LC 39 Environmental Control System (ECS) Delta 30% Design Review (required NLT 19 days prior to Design Review).

Due Date : 09/04/2009

29. - Complete SAA report for the LC 39 Environmental Control System (ECS) 60% Design Review (required NLT 19 days prior to Design Review).

Due Date : 03/05/2010

30. - Complete SAA report for the LC 39 Environmental Control System (ECS) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 05/05/2010

31. - Complete SAA report for the LC 39 Environmental Control System (ECS) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 07/06/2010

32. - Complete SAA report for the Gaseous Nitrogen System PAD 60% Design Review (required NLT 19 days prior to Design Review).

Due Date : 10/12/2009

33. - Complete SAA report for the Gaseous Nitrogen System PAD 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 02/22/2010

34. - Complete SAA report for the Gaseous Nitrogen System PAD Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 05/17/2010

35. - Complete SAA report for the Gaseous Nitrogen System MPPF Delta 30% Design Review (required NLT 19 days prior to Design Review).

Due Date : 03/31/2009

Completed : 03/16/2009

36. - Complete SAA report for the Gaseous Nitrogen System MPPF 60% Design Review (required NLT 19 days prior to Design Review).

Due Date : 10/06/2009

37. - Complete SAA report for the Gaseous Nitrogen System MPPF 90% Design Review (required NLT 19 days prior to Design Review).

Due Date : 04/15/2010

38. - Complete SAA report for the Gaseous Nitrogen System MPPF Final Design Review (required NLT 19 days prior to Design Review).

Due Date : 06/03/2010

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39. - Complete SAA report for the Gaseous Helium System PAD 60% Design Review(required NLT 19 days prior to Design Review).
Due Date : 10/12/2009
40. - Complete SAA report for the Gaseous Helium System PAD 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/22/2010
41. - Complete SAA report for the Gaseous Helium System PAD Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 05/17/2010
42. - Complete SAA report for the Gaseous Helium System MPPF 30% Design Review(required NLT 19 days prior to Design Review).
Due Date : 03/31/2009
Completed : 03/16/2009
43. - Complete SAA report for the Gaseous Helium System MPPF 60% Design Review(required NLT 19 days prior to Design Review).
Due Date : 10/06/2009
44. - Complete SAA report for the Gaseous Helium System MPPF 90% Design Review(required NLT 19 days prior to Design Review).
Due Date : 04/15/2010
45. - Complete SAA report for the Gaseous Helium System MPPF Final Design Review(required NLT 19 days prior to Design Review).
Due Date : 06/03/2010
46. - Complete SAA report for the LC39 (TO Rev B) Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 10/12/2009
47. - Complete SAA report for the LC39 (TO Rev B) Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/22/2010
48. - Complete SAA report for the LC39 (TO Rev B) Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 05/17/2010
49. - Complete SAA report for the Service Module Umbilical (SMU) 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 01/22/2009
Completed: 01/22/2009
50. - Complete SAA report for the Service Module Umbilical (SMU) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 09/11/2009

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51. - Complete SAA report for the Service Module Umbilical (SMU) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 10/26/2009

52. - Complete SAA report for the First Stage Forward Skirt Avionics Umbilical (FSFSAU) 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/28/2009

53. - Complete SAA report for the First Stage Forward Skirt Avionics Umbilical (FSFSAU) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 08/19/2009

54. - Complete SAA report for the First Stage Forward Skirt Avionics Umbilical (FSFSAU) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 09/18/2009

55. - Complete SAA report for the First Stage Aft Skirt Electrical Umbilical (FSASEU) 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 10/09/2009

56. - Complete SAA report for the First Stage Aft Skirt Electrical Umbilical (FSASEU) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/08/2010

57. - Complete SAA report for the First Stage Aft Skirt Electrical Umbilical (FSASEU) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 03/19/2010

58. - Complete SAA report for the First Stage Aft Skirt Purge Umbilical (FSASPU) 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 10/16/2009

59. - Complete SAA report for the First Stage Aft Skirt Purge Umbilical (FSASPU) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/12/2010

60. - Complete SAA report for the First Stage Aft Skirt Purge Umbilical (FSASPU) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 04/02/2010

61. - Complete SAA report for the Aft LH2 Umbilical 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 01/12/2009
Completed : 01/12/2009

62. - Complete SAA report for the Aft LH2 Umbilical 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 09/03/2009

63. - Complete SAA report for the Aft LH2 Umbilical Final Release Review (required NLT 19 working days prior to Design Review).

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Due Date : 10/26/2009

64. - Complete SAA report for the Upper Stage Instrumentation Unit Umbilical (USIUU) 60% Design Review (required NLT 19 days prior to Design Review).

Due Date : 10/16/2008**Completed : 10/16/2008**

65. - Complete SAA report for the Upper Stage Instrumentation Unit Umbilical (USIUU) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 07/20/2009

66. - Complete SAA report for the Upper Stage Instrumentation Unit Umbilical (USIUU) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 10/26/2009

67. - Complete SAA report for the Upper Stage Aft LO2 Umbilical 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/12/2009**Completed : 01/12/2009**

68. - Complete SAA report for the Upper Stage Aft LO2 Umbilical 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 08/20/2009

69. - Complete SAA report for the Upper Stage Aft LO2 Umbilical Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 10/26/2009

70. - Complete SAA report for the Handling and Access - MLE Equipment 30% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 07/31/2009

71. - Complete SAA report for the Handling and Access - MLE Equipment 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 11/13/2009

72. - Complete SAA report for the Handling and Access - MLE Equipment 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 03/05/2010

73. - Complete SAA report for the Handling and Access - MLE Equipment Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 05/05/2010

74. - Complete SAA report for the Handling and Access - SPE Equipment 30% Design Review (required NLT 19 days prior to Design Review).

Due Date : 04/01/2009**Completed : 03/30/2009**

75. - Complete SAA report for the Handling and Access - SPE Equipment 60% Design Review (required NLT 19 working days prior to Design Review).

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Due Date : 07/20/2009

76. - Complete SAA report for the Handling and Access - SPE Equipment 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 11/13/2009

77. - Complete SAA report for the Handling and Access - SPE Equipment Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 01/14/2010

78. - Complete SAA report for the Handling and Access - VIE Equipment 30% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 09/11/2009

79. - Complete SAA report for the Handling and Access - VIE Equipment 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/15/2010

80. - Complete SAA report for the Handling and Access - VIE Equipment 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 05/10/2010

81. - Complete SAA report for the Handling and Access - VIE Equipment Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 05/24/2010

82. - Complete SAA report for the Crew Access Arm (CAA) 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 03/02/2009

Completed : 03/02/2009

83. - Complete SAA report for the Crew Access Arm (CAA) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 06/10/2009

84. - Complete SAA report for the Crew Access Arm (CAA) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 07/08/2009

85. - Complete SAA report for the Vehicle Stabilization and Dampening System (VSIDS) 30% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/16/2009

Completed : 01/15/2009

86. - Complete SAA report for the Vehicle Stabilization and Dampening System (VSIDS) 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 09/09/2009

87. - Complete SAA report for the Vehicle Stabilization and Dampening System (VSIDS) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/26/2010

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- 88. – Complete SAA report for the Vehicle Stabilization and Dampening System (VSDES) Final Release Review (required NLT 19 working days prior to Design Review).**
Due Date : 02/24/2010
- 89. – Complete SAA report for the Hazardous Gas Leak Detection System (HGLDS)60% Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 04/08/2009
Completed : 04/08/2009
- 90. – Complete SAA report for the Hazardous Gas Leak Detection System (HGLDS)90% Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 11/13/2009
- 91. – Complete SAA report for the Hazardous Gas Leak Detection System (HGLDS)Final Release Review (required NLT 19 working days prior to Design Review).**
Due Date : 02/24/2010
- 92. – Complete SAA report for the Ground Special Power PAD 60% Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 07/07/2009
- 93. – Complete SAA report for the Ground Special Power PAD 90% Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 01/07/2010
- 94. – Complete SAA report for the Ground Special Power PAD Final Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 04/01/2010
- 95. – Complete SAA report for the Ground Special Power MPPF 30% Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 04/08/2009
Completed : 03/25/2009
- 96. – Complete SAA report for the Ground Special Power MPPF 60% Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 08/07/2009
- 97. – Complete SAA report for the Ground Special Power MPPF 90% Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 01/08/2010
- 98. – Complete SAA report for the Ground Special Power MPPF Final Release Review (required NLT 19 working days prior to Design Review).**
Due Date : 04/02/2010
- 99. – Complete SAA report for the Launch Release System (LRS)60% Design Review (required NLT 19 working days prior to Design Review).**
Due Date : 06/26/2009

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100. - Complete SAA report for the Launch Release System (LRS) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 12/08/2009
101. - Complete SAA report for the Launch Release System (LRS) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 02/26/2010
102. - Complete SAA for the ~~Communications and Tracking Station~~ Radio Frequency Telemetry System (TO Rev B) 30% Design Review. (required NLT 19 working days prior to Design Review).
Due Date : 01/27/2010
103. - Complete SAA for the ~~Communications and Tracking Station~~ Radio Frequency Telemetry System (TO Rev B) 60% Design Review. (required NLT 19 working days prior to Design Review).
Due Date : 06/09/2010
104. - Complete SAA report for the First Stage Thermal Control System (FS TCS) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 07/31/2009
105. - Complete SAA report for the First Stage Thermal Control System (FS TCS) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 10/26/2009
106. - Complete SAA report for the Ignition Over Pressurization (IOP)/Sound Suppression 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 07/06/2009
107. - Complete SAA report for the Ignition Over Pressurization (IOP)/Sound Suppression 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 12/24/2009
108. - Complete SAA report for the Ignition Over Pressurization (IOP)/Sound Suppression Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 02/19/2010
109. - Complete SAA report for the Gaseous Oxygen MPPF 30% Design Review (required NLT 19 days prior to Design Review).
Due Date : 03/31/2009
Completed : 03/16/2009
110. - Complete SAA report for the Gaseous Oxygen MPPF 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 10/06/2009
111. - Complete SAA report for the Gaseous Oxygen MPPF 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 04/15/2010
112. - Complete SAA report for the Gaseous Oxygen MPPF Final Release Review (required NLT 19 working days prior to Design Review).

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Due Date : 06/03/2010

113. - Complete SAA report for the Gaseous Oxygen PAD 30% Design Review (required NLT 19 days prior to Design Review).

Due Date : 03/31/2009

Completed : 03/16/2009

114. - Complete SAA report for the Gaseous Oxygen PAD 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 10/06/2009

115. - Complete SAA report for the Gaseous Oxygen PAD 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 04/15/2010

116. - Complete SAA report for the Gaseous Oxygen PAD Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 06/03/2010

117. - Complete SAA report for the Ground Cooling Subsystem (GCS) 30% Design Review (required NLT 19 working days prior to Review).

Due Date : 09/16/2009

118. - Complete SAA report for the Ground Cooling Subsystem (GCS) 60% Design Review (required NLT 19 working days prior to Review).

Due Date : 01/05/2010

119. - Complete SAA report for the Ground Cooling Subsystem (GCS) 90% Design Review (required NLT 19 working days prior to Review).

Due Date : 04/26/2010

120. - Complete SAA report for the Ground Cooling Subsystem (GCS) Final Release Review (required NLT 19 working days prior to Review).

Due Date : 07/26/2010

121. - Complete SAA report for the Weather Instrumentation 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 03/04/2009

Completed : 02/09/2009

122. - Complete SAA report for the Weather Instrumentation 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 08/14/2009

123. - Complete SAA report for the Weather Instrumentation Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 11/06/2009

124. - Complete SAA report for the Sensor Data Acquisition System (SDAS) 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/28/2009

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Completed : 12/12/2008

125. - Complete SAA report for the Sensor Data Acquisition System (SDAS) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 07/24/2009

126. - Complete SAA report for the Sensor Data Acquisition System (SDAS) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 10/19/2009

127. - Complete SAA report for the Range Safety Checkout System (RSCS) 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/05/2009**Completed : 12/10/2008**

128. - Complete SAA report for the Range Safety Checkout System (RSCS) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 06/26/2009

129. - Complete SAA report for the Range Safety Checkout System (RSCS) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 09/18/2009

130. - Complete SAA report for the Vehicle Access Arm (VAA) 60% Design Review. (required NLT 19 working days prior to Design Review).

Due Date : 07/08/2009

131. - Complete SAA report for the Vehicle Access Arm (VAA) 90% Design Review. (required NLT 19 working days prior to Design Review).

Due Date : 01/29/2010

132. - Complete SAA report for the Vehicle Access Arm (VAA) Final Release Review. (required NLT 19 working days prior to Design Review).

Due Date : 03/15/2010

133. - Complete SAA report for the Launch Control System (LCS) CDR (required NLT 19 working days prior to Design Review).

Due Date : 08/11/2009

134. - Complete SAA report for the Kennedy Ground Control System (KGCS) 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 05/01/2009**Completed : 04/15/2009**

135. - Complete SAA report for the Kennedy Ground Control System (KGCS) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 02/05/2010

136. - Complete SAA report for the Kennedy Ground Control System (KGCS) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 04/30/2010

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- 137. - Complete SAA report for the VAB Platforms HB2 (required NLT 19 working days prior to Review). (This milestone should have been deleted in Revision B to the Task Order, but was inadvertently left in.)(TO Rev C)
*** TBD *****
- 138. - Complete SAA report for the VAB Platforms HB3 (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 139. - Complete SAA report for the Lightning Protection Subsystem (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 140. - Complete SAA report for the Emergency Egress Subsystem (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 141. - Complete SAA report for the MPPF (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 142. - Complete SAA report for the HVAC system (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 143. - Complete SAA report for the Fire Suppression System (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 144. - Complete SAA report for the Utility Controls (KCCS) Supervisory Control and Data Acquisition System (SCADA) (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 145. - Complete SAA report for Elevators (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 146. - Complete SAA report for the Launch Mount System (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 147. - Complete SAA report for Cranes (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 148. - Complete SAA report for the Spacecraft Transporter (required NLT 19 working days prior to Design Review).
Due Date : 09/30/2010**
- 149. - Complete SAA report for the ML Transporter (required NLT 19 working days prior to Design Review).
Due Date : 09/30/2010**
- 150. - Complete SAA report for the Laser Alignment System (required NLT 19 working days prior to Review).
Due Date : 09/30/2010**
- 151. - Complete SAA report for the AC Power System (required NLT 19 working days prior to Review).**

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Due Date : 09/30/2010

152. - Complete SAA report for the Uninterruptible Power System (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

153. - Complete SAA report for the Oxygen Deficiency Monitoring System (ODMS) (required NLT 19 working days prior to Design Review).

Due Date : 09/30/2010

154. - Complete SAA report for the SPE Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) 60% Design Review (required NLT 19 days prior to Design Review). (TO Rev B)

Due Date : 10/12/2009

155. - Complete SAA report for the SPE Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) 90% Design Review (required NLT 19 days prior to Design Review). (TO Rev B)

Due Date : 02/22/2010

156. - Complete SAA report for the SPE Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) Final Release Review (required NLT 19 working days prior to Design Review). (TO Rev B)

Due Date : 05/17/2010

D. STANDARDS OF PERFORMANCE (METRICS)

1. - Task Order metrics will be collected in accordance with the USTDC Internal Surveillance Plan.

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Task Order Plan**

100933

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TO Status:	IN REVISION	PM:	Roger Mathews	NE-D1	USTDC Director:	Dennis Weaver	
Verified Date:		Customer:	Darren Gibson	SA-F	USTDC Manager:	Paul Gamble	ASRC-19
Program	CONSL				Lead	Kenneth Jacobs	ASRC-23
							ASRC-23

A. PROJECT DESCRIPTION & SCOPE

Task Order Rev C: Task Order Revision C is generated in response to Task Order Plan Revision B. The purpose of this revision is to perform the following: 1) Adjust deliverable due dates per the 5-15-09 edition released CxP NE Subsystem Design Phase schedules; 2) Reduce scope for an additional system where Failure Modes and Effects Analyses (FMEAs) are determined not required by NASA; 3) Clarify which subsystems are deemed Flight Critical; 4) Convert existing labor scope to ODC in order to utilize a subcontractor for specific System Assurance Analyses (SAA) deliverables and; 5) Increase competence in the Capability Maturity Model Integrated (CMMI) Version 1.2 Upgrade.

Task Order Rev B: Task Order Revision B is generated in response to Task Order Plan Revision A. The purpose of this revision is to perform the following: adjust deliverable due dates per the 04.08.09 edition released CxP NE Subsystem Design Phase schedules, define scope for LETF Quality support, delete requirements for VAB Highbay 2 platform analysis, delete scope for MPPF studies that are being performed as part of Level IV S & MA Task Order 552, and reduce scope for systems where Failure Modes and Effects Analyses (FMEAs) are determined not required by NASA.

This revision also changes the Task Order Manager from David Kruhm to Roger Mathews. (DK 4/21/09) TO Revision A: Task Order Revision A is generated without an accompanying plan; Task Order Plan Basic remains in effect. The purpose of this revision is to add authority for existing scope.

Basic: The purpose of this Revision is to define project scope continued from CY6/FY08 defined in Task Order (TO) 6SPI00485, Revision B. Unless specifically addressed below, the scope of work defined in 6SPI00485, Revision B remains unchanged.

CY6/FY08 Activity

During CY6/FY08, review schedules and associated scope were shifted into CY7/FY09. The target value of the Task Order has been adjusted to reflect this shift in scope. All remaining milestones that were planned for CY6/FY08 were accomplished successfully.

CY7/FY09

Activities for CY7/FY09 include previously planned activities with the following exceptions: Several systems were originally planned to have one System Assurance Analyses (SAA) for each design review. A decision was made to split some of the systems into Element Level reviews (i. e., Spacecraft Processing area versus LC39 area). Due to splitting of systems into separate SAAs, this will require This requires (TO Rev B) additional scope due to multiple meetings and additional documentation requirements. Additionally, the extended schedule will result in an increased number of design meetings,

USTDC Technical Lead SIGNATURE <i>Kenneth Jacobs</i> Kenneth Jacobs	DATE 5/21/09	USTDC S&MA SIGNATURE <i>Robert E. Hummel</i> Raymond Anderson Robert E. Hummel	DATE 05/21/09
USTDC Manager SIGNATURE <i>Paul Gamble</i> Paul Gamble	DATE 5/21/09	NASA Approvals	
USTDC Director SIGNATURE <i>Dennis Weaver</i> Dennis Weaver	DATE 5/21/09	Task Order Manager / Org. SIGNATURE <i>Roger Mathews</i> Roger Mathews / NE-D1	DATE 5/21/09
USTDC PCP SIGNATURE <i>Ned Voska</i> Ned Voska	DATE 5/21/09	Contract Technical Manager / Org. SIGNATURE <i>Ned Voska</i> Ned Voska / NE-I2	DATE 5/21/09

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which results in an increase of scope being required to keep the Safety and Mission Assurance (S & MA) team fully engaged with the design teams.

The purpose of this TO is to define a requirement for a contractor to perform S & MA tasks for the development of Constellation Ground System subsystems.

Safety and Reliability Engineering analyses (also called SAAs) are performed to identify hazards and critical items associated with facility systems, GSE, and operations. From these analyses, risk data is obtained and used to identify changes in the design or operation of systems, equipment and facilities to eliminate or minimize the associated risks. SAAs consist of Criticality Assessments, Hazard Analyses (HA), and Failure Mode and Effects Analyses (FMEA).

Criticality Assessments are performed to determine the relative measure of the consequences of a failure mode. An initial evaluation is performed of each subsystem's/item's function to identify the effect(s) of loss or improper performance of that function and determine if the effect(s) could result in loss of life and/or flight vehicle, damage to a flight vehicle system, or loss of mission. Subsequent to the approval of Revision B to the Task Order, Criticality Assessments will no longer be performed, with the exception of those systems deemed GSE Flight Critical per NASA (TO Rev C) . Those systems that require FMEAs will be identified by NASA. (TO Rev B)

Hazard Analyses are intended to identify and address the hazards that arise in the design, development, manufacturing, construction, facilities, transportation, operations and disposal activities associated with hardware, software, maintenance, operations and environments. Therefore, it is imperative that they are performed and updated during each phase of a development project's lifecycle. They are invaluable tools to ensure that hazards are eliminated or mitigated to acceptable levels in the design. Subsequent to the approval of Revision B to the Task Order, Hazard Reports will no longer be required. Hazards and other risks will be documented in a "System Risks and Recommended Mitigation" section of the SAA. This new section will replace the current "Concerns and Recommendations" section of the SAA. (TO Rev B)

Failure Modes and Effects Analyses (where required) (TO Rev B) are used during project design phases to determine hardware criticality, identify failure modes that do not meet applicable Program reliability requirements, identify the potential for single-point failures, and identify areas where the design does not meet the failure tolerance requirements. The FMEA is updated throughout the life of the program/project as design modifications and/or upgrades are made to ensure that the design meets program requirements, and to ensure new risks are eliminated and/or mitigated.

As part of the hazards analysis process, software safety analyses are also performed throughout all phases of the project's lifecycle to ensure potential hazards introduced by software are identified and assessed. Software safety analyses also ensure that identified hazard mitigations and/or hazard controls to be achieved through the execution of software. Hazards will be identified, and mitigating actions defined, that will ensure that software is ~~are~~ correctly designed, ~~into the software~~; ~~correctly~~ (TO Rev B) implemented, and successfully verified as an effective means for hazard mitigation/control. Software safety analyses are only performed upon the software contained within the LCS and KGCS subsystems, as defined per Tasks 6, 7, and 8. (TO Rev B)

Under this TO the contractor shall produce SAAs for the Constellation Ground System. The Constellation Ground System consists of the support equipment, systems and facilities required to handle, store, process, launch, land, retrieve, and refurbish flight hardware in support of Constellation missions. The CxP Ground System is comprised of three architectural levels:

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- Level 3 – System (i. e. , the complete CxP Ground System)
- Level 4 – Element (a major component of the System; e. g. , “Mobile Launcher”)
- Level 5 – Subsystem (a defined system supporting an Element; e. g. , “Launch Control System”)

The contractor shall serve as the Prime Safety and Reliability Engineering team member on the Ground System’s Level 5 subsystem design/development teams, and shall be responsible for performing all system safety and reliability engineering tasks necessary for successful project execution. The contractor is expected to produce SAAs for each Level 5 subsystem listed below. These analyses shall support each milestone (as defined in CxP 70038A (TO Rev B), *Constellation Program Hazard Analyses Methodology*), and will help ensure the appropriate disposition, tracking and resolution of identified hazards. The deliverable product documentation, process, and format are to comply with CxP 70038A (TO Rev B), CxP 70043A (*Constellation Program Hardware Failure Modes and Effects Analysis and Critical Items List Methodology*), as modified herein. ~~CxP Level 2 Constellation Safety and Engineering Review Panel (CSERP)~~ requirements; as well as KSC Level 3/4/5 review board(s) requirements. (TO Rev B)

Tasks 2, 3,4, and 5:

Launch Equipment Test Facility (LETF) Subsystems

- Area Warning System
- Hazardous Gas Detection System
- ~~LETF Electrical Power~~ (TO Rev B)

Cold Helium (GHe) Subsystem (note 2) (TO Rev C)

Hypergol Subsystem

- Spacecraft Processing Area
- LC39 Area

First Stage Aft Skirt TVC Hydraulic Subsystem

Liquid Oxygen (LO2) Subsystem (note 2) (TO Rev C)

Liquid Hydrogen (LH2) Subsystem (note 2) (TO Rev C)

Environmental Control System (ECS) (note 2) (TO Rev C)

- LC39 ECS

Gaseous Nitrogen System

- Spacecraft Processing Area
- LC39 Area

Gaseous Helium System

- Spacecraft Processing Area
- LC39 Area (note 2) (TO Rev C)

Breathing Air System

- Spacecraft Processing Area (TO Rev B)
- LC39 Area (TO Rev B)

Umbilical /Arms (ML / PAD)

- Service Module Umbilical (SMU) (note 2) (TO Rev C)
- First Stage Forward Skirt Avionics Umbilical (FSFAU)
- First Stage Aft Skirt Electrical Umbilical (FSASEU)
- First Stage Aft Skirt Purge Umbilical (FSASPU)
- Upper Stage Aft LH2 Umbilical (note 2) (TO Rev C)
- Upper Stage Instrumentation Unit Umbilical (USIUU) (note 2) (TO Rev C)

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<ul style="list-style-type: none"> - Upper Stage Aft LO2 Umbilical (note 2) (TO Rev C) Handling and Access - MLE equipment Handling and Access - SPE equipment Handling and Access - VIE equipment Crew Access Arm (CAA) (note 2) (TO Rev C) Vehicle Stabilization and Dampening System (VS DS) (note 2) (TO Rev C) Hazardous Gas Leak Detection System (HGLDS) <i>Ground Special Power (note 2) (TO Rev C)</i> - Spacecraft Processing Area - LC39 Area Launch Release System (LRS) (note 2) (TO Rev C) Communications and Tracking Station Radio Frequency Telemetry System (TO Rev B) First Stage Thermal Control System (FS TCS) (note 2) (TO Rev C) Ignition Over Pressurization (IOP)/Sound Suppression (note 2) (TO Rev C) <i>Gaseous Oxygen</i> - Spacecraft Processing Area - LC39 Area Ground Cooling Subsystem (GCS) Weather Instrumentation Sensor Data Acquisition System (SDAS) (note 1) (TO Rev B) Range Safety Checkout System (RSCS) Vehicle Access Arm (VAA) (note 1) (TO Rev C) Kennedy Complex Control System (KCCS) Launch Control System (LCS) <i>Kennedy Ground Control System (KGCS)</i> <p><u>Tasks 6, 7, and 8:</u></p> <p>LCS (note 2) (TO Rev C) including Hardware, System Software and Simulation Software Applications Software (Launch Control System and Programmable Logic controller applications) Emergency Safing Software</p> <p><u>Task 9:</u> <i>TA Facility Subsystems</i></p> <ul style="list-style-type: none"> - Vehicle Assembly Building (VAB) High Bay 2 Platforms (TO Rev B) - Vehicle Assembly Building (VAB) High Bay 3 Platforms - Lightning Protection Subsystem (note 1) (TO Rev B) - Emergency Egress System - Multi-Payload Processing Facility (MPPF) (TO Rev B) - HVAC (note 1) (TO Rev B) - Fire Suppression (note 1) (TO Rev B) - Utility Controls (KCCS) Supervisory Control and Data Acquisition System (SCADA) - Elevators (note 1) (TO Rev B) Launch Mount (note 1) (TO Rev B) Cranes (note 1) (TO Rev B) Spacecraft Transporter ML Transporter 		

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Laser Alignment System
AC Power
Uninterruptible Power
Oxygen Deficiency Monitoring System (ODMS) (note 1) (TO Rev B)

Note 1 – FMEA portion of SAA analyses is not required for these systems. (TO Rev B)

Note 2 – Flight Critical GSE subsystem (TO Rev C)

B. MILESTONES/DELIVERABLES

1. – Delivery of RIDS/comments on CxP technical documentation to assess impacts to existing Safety and Reliability planning and analyses.
Start Date : 10/01/2008 End Date : 09/30/2010
2. – Complete SAA report for the LETF Area Warning System 30% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 11/26/2009
3. – Complete SAA report for the LETF Area Warning System 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/02/2010
4. – Complete SAA report for the LETF Area Warning System 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/10/2010
5. – Complete SAA report for the LETF Area Warning System Final Design Review (required NLT 19 working days prior to Design Review).
Due Date : 07/05/2010
6. – Complete SAA report for the LETF Hazardous Gas Detection System Final Release Review (required NLT 19 days prior to Design Review).
Due Date : 11/13/2008
Completed : 11/12/2008
7. – Complete SAA report for the LETF Electrical Power Activation (required NLT 19 working days prior to Design Review).
Due Date : 09/30/2010
8. – Complete SAA report for the Cold Helium (GHe) 30% Design Review (required NLT 19 days prior to Design Review).
Due Date : 08/04/2009
9. – Complete SAA report for the Cold Helium (GHe) 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 10/23/2009
10. – Complete SAA report for the Cold Helium (GHe) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/26/2010

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- 11. - Complete SAA report for the Cold Helium (GHe) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 07/26/2010
- 12. - Complete SAA report for the Hypergol Subsystem MPPF Delta 30% Design Review (required NLT 19 days prior to Design Review).
Due Date : 04/17/2009
Completed : 04/17/2009
- 13. - Complete SAA report for the Hypergol Subsystem MPPF 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 11/09/2009
- 14. - Complete SAA report for the Hypergol Subsystem MPPF 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/17/2010
- 15. - Complete SAA report for the Hypergol Subsystem MPPF Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 07/05/2010
- 16. - Complete SAA report for the Hypergol Subsystem PAD 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 06/10/2009
- 17. - Complete SAA report for the Hypergol Subsystem PAD 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 01/04/2010
- 18. - Complete SAA report for the Hypergol Subsystem PAD Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 04/05/2010
- 19. - Complete SAA report for the First Stage Aft Skirt TVC Hydraulic Subsystem 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 06/03/2009
- 20. - Complete SAA report for the First Stage Aft Skirt TVC Hydraulic Subsystem 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/03/2010
- 21. - Complete SAA report for the First Stage Aft Skirt TVC Hydraulic Subsystem Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 06/02/2010
- 22. - Complete SAA report for the Liquid Oxygen (LO2) Subsystem 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/25/2009
Completed : 02/17/2009
- 23. - Complete SAA report for the Liquid Oxygen (LO2) Subsystem 90% Design Review (required NLT 19

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working days prior to Design Review).
Due Date : 09/02/2009

**24. – Complete SAA report for the Liquid Oxygen (LO2) Subsystem Final Release Review (required NLT 19 working days prior to Design Review).
 Due Date : 11/10/2009**

**25. – Complete SAA report for the Liquid Hydrogen (LH2) System 60% Design Review (required NLT 19 days prior to Design Review).
 Due Date : 02/25/2009
 Completed : 02/17/2009**

**26. – Complete SAA report for the Liquid Hydrogen (LH2) System 90% Design Review (required NLT 19 working days prior to Design Review).
 Due Date : 09/02/2009**

**27. – Complete SAA report for the Liquid Hydrogen (LH2) System Final Release Review (required NLT 19 working days prior to Design Review).
 Due Date : 11/10/2009**

**28. – Complete SAA report for the LC 39 Environmental Control System (ECS) Delta 30% Design Review (required NLT 19 days prior to Design Review).
 Due Date : 09/04/2009**

**29. – Complete SAA report for the LC 39 Environmental Control System (ECS) 60% Design Review (required NLT 19 days prior to Design Review).
 Due Date : 03/05/2010**

**30. – Complete SAA report for the LC 39 Environmental Control System (ECS) 90% Design Review (required NLT 19 working days prior to Design Review).
 Due Date : 05/05/2010**

**31. – Complete SAA report for the LC 39 Environmental Control System (ECS) Final Release Review (required NLT 19 working days prior to Design Review).
 Due Date : 07/06/2010**

**32. – Complete SAA report for the Gaseous Nitrogen System PAD 60% Design Review (required NLT 19 days prior to Design Review).
 Due Date : 10/12/2009**

**33. – Complete SAA report for the Gaseous Nitrogen System PAD 90% Design Review (required NLT 19 working days prior to Design Review).
 Due Date : 02/22/2010**

**34. – Complete SAA report for the Gaseous Nitrogen System PAD Final Release Review (required NLT 19 working days prior to Design Review).
 Due Date : 05/17/2010**

**35. – Complete SAA report for the Gaseous Nitrogen System MPPF Delta 30% Design Review (required NLT 19 days prior to Design Review).
 Due Date : 03/31/2009**

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<p>Completed : 03/16/2009</p> <p>36. – Complete SAA report for the Gaseous Nitrogen System MPPF 60% Design Review (required NLT 19 days prior to Design Review). Due Date : 10/06/2009</p> <p>37. – Complete SAA report for the Gaseous Nitrogen System MPPF 90% Design Review (required NLT 19 days prior to Design Review). Due Date : 04/15/2010</p> <p>38. – Complete SAA report for the Gaseous Nitrogen System MPPF Final Design Review (required NLT 19 days prior to Design Review). Due Date : 06/03/2010</p> <p>39. – Complete SAA report for the Gaseous Helium System PAD 60% Design Review(required NLT 19 days prior to Design Review). Due Date : 10/12/2009</p> <p>40. – Complete SAA report for the Gaseous Helium System PAD 90% Design Review (required NLT 19 working days prior to Design Review). Due Date : 02/22/2010</p> <p>41. – Complete SAA report for the Gaseous Helium System PAD Final Release Review (required NLT 19 working days prior to Design Review). Due Date : 05/17/2010</p> <p>42. – Complete SAA report for the Gaseous Helium System MPPF 30% Design Review(required NLT 19 days prior to Design Review). Due Date : 03/31/2009 Completed : 03/16/2009</p> <p>43. – Complete SAA report for the Gaseous Helium System MPPF 60% Design Review(required NLT 19 days prior to Design Review). Due Date : 10/06/2009</p> <p>44. – Complete SAA report for the Gaseous Helium System MPPF 90% Design Review(required NLT 19 days prior to Design Review). Due Date : 04/15/2010</p> <p>45. – Complete SAA report for the Gaseous Helium System MPPF Final Design Review(required NLT 19 days prior to Design Review). Due Date : 06/03/2010</p> <p>46. – Complete SAA report for the LC39 (TO Rev B) Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) 60% Design Review (required NLT 19 days prior to Design Review). Due Date : 10/12/2009</p> <p>47. – Complete SAA report for the LC39 (TO Rev B) Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) 90% Design Review (required NLT 19 working days prior to Design Review). Due Date : 02/22/2010</p>		5. DATE:

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- 48. – Complete SAA report for the LC39 (TO Rev B) Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 05/17/2010**
- 49. – Complete SAA report for the Service Module Umbilical (SMU) 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 01/22/2009
Completed : 01/22/2009**
- 50. – Complete SAA report for the Service Module Umbilical (SMU) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 09/11/2009**
- 51. – Complete SAA report for the Service Module Umbilical (SMU) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 10/26/2009**
- 52. – Complete SAA report for the First Stage Forward Skirt Avionics Umbilical (FSFSAU) 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/28/2009**
- 53. – Complete SAA report for the First Stage Forward Skirt Avionics Umbilical (FSFSAU) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 08/19/2009**
- 54. – Complete SAA report for the First Stage Forward Skirt Avionics Umbilical (FSFSAU) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 09/18/2009**
- 55. – Complete SAA report for the First Stage Aft Skirt Electrical Umbilical (FSASEU) 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 10/09/2009**
- 56. – Complete SAA report for the First Stage Aft Skirt Electrical Umbilical (FSASEU) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/08/2010**
- 57. – Complete SAA report for the First Stage Aft Skirt Electrical Umbilical (FSASEU) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 03/19/2010**
- 58. – Complete SAA report for the First Stage Aft Skirt Purge Umbilical (FSASPU) 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 10/16/2009**
- 59. – Complete SAA report for the First Stage Aft Skirt Purge Umbilical (FSASPU) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 02/12/2010**
- 60. – Complete SAA report for the First Stage Aft Skirt Purge Umbilical (FSASPU) Final Release Review (required NLT 19 working days prior to Design Review).**

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Due Date : 04/02/2010

61. - Complete SAA report for the Aft LH2 Umbilical 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/12/2009**Completed : 01/12/2009**

62. - Complete SAA report for the Aft LH2 Umbilical 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 09/03/2009

63. - Complete SAA report for the Aft LH2 Umbilical Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 10/26/2009

64. - Complete SAA report for the Upper Stage Instrumentation Unit Umbilical (USIUU) 60% Design Review (required NLT 19 days prior to Design Review).

Due Date : 10/16/2008**Completed : 10/16/2008**

65. - Complete SAA report for the Upper Stage Instrumentation Unit Umbilical (USIUU) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 07/20/2009

66. - Complete SAA report for the Upper Stage Instrumentation Unit Umbilical (USIUU) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 10/26/2009

67. - Complete SAA report for the Upper Stage Aft LO2 Umbilical 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/12/2009**Completed : 01/12/2009**

68. - Complete SAA report for the Upper Stage Aft LO2 Umbilical 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 08/20/2009

69. - Complete SAA report for the Upper Stage Aft LO2 Umbilical Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 10/26/2009

70. - Complete SAA report for the Handling and Access - MLE Equipment 30% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 07/31/2009

71. - Complete SAA report for the Handling and Access - MLE Equipment 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 11/13/2009

72. - Complete SAA report for the Handling and Access - MLE Equipment 90% Design Review (required NLT 19 working days prior to Design Review).

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Due Date : 03/05/2010

**73. – Complete SAA report for the Handling and Access – MLE Equipment Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 05/05/2010**

**74. – Complete SAA report for the Handling and Access – SPE Equipment 30% Design Review (required NLT 19 days prior to Design Review).
Due Date : 04/01/2009
Completed : 03/30/2009**

**75. – Complete SAA report for the Handling and Access – SPE Equipment 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 07/20/2009**

**76. – Complete SAA report for the Handling and Access – SPE Equipment 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 11/13/2009**

**77. – Complete SAA report for the Handling and Access – SPE Equipment Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 01/14/2010**

**78. – Complete SAA report for the Handling and Access – VIE Equipment 30% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 09/11/2009**

**79. – Complete SAA report for the Handling and Access – VIE Equipment 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 01/15/2010**

**80. – Complete SAA report for the Handling and Access – VIE Equipment 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 05/10/2010**

**81. – Complete SAA report for the Handling and Access – VIE Equipment Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 05/24/2010**

**82. – Complete SAA report for the Crew Access Arm (CAA) 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 03/02/2009
Completed : 03/02/2009**

**83. – Complete SAA report for the Crew Access Arm (CAA) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 06/10/2009**

**84. – Complete SAA report for the Crew Access Arm (CAA) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 07/08/2009**

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85. - Complete SAA report for the Vehicle Stabilization and Dampening System (VSDS) 30% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/16/2009

Completed : 01/15/2009

86. - Complete SAA report for the Vehicle Stabilization and Dampening System (VSDS) 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 09/09/2009

87. - Complete SAA report for the Vehicle Stabilization and Dampening System (VSDS) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/26/2010

88. - Complete SAA report for the Vehicle Stabilization and Dampening System (VSDS) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 02/24/2010

89. - Complete SAA report for the Hazardous Gas Leak Detection System (HGLDS) 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 04/08/2009

Completed : 04/08/2009

90. - Complete SAA report for the Hazardous Gas Leak Detection System (HGLDS) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 11/13/2009

91. - Complete SAA report for the Hazardous Gas Leak Detection System (HGLDS) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 02/24/2010

92. - Complete SAA report for the Ground Special Power PAD 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 07/07/2009

93. - Complete SAA report for the Ground Special Power PAD 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 01/07/2010

94. - Complete SAA report for the Ground Special Power PAD Final Design Review (required NLT 19 working days prior to Design Review).

Due Date : 04/01/2010

95. - Complete SAA report for the Ground Special Power MPPF 30% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 04/08/2009

Completed : 03/25/2009

96. - Complete SAA report for the Ground Special Power MPPF 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 08/07/2009

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- 97. – Complete SAA report for the Ground Special Power MPPF 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 01/08/2010
- 98. – Complete SAA report for the Ground Special Power MPPF Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 04/02/2010
- 99. – Complete SAA report for the Launch Release System (LRS) 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 06/26/2009
- 100. – Complete SAA report for the Launch Release System (LRS) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 12/08/2009
- 101. – Complete SAA report for the Launch Release System (LRS) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 02/26/2010
- 102. – Complete SAA for the ~~Communications and Tracking Station~~ Radio Frequency Telemetry System (TO Rev B) 30% Design Review. (required NLT 19 working days prior to Design Review).
Due Date : 01/27/2010
- 103. – Complete SAA for the ~~Communications and Tracking Station~~ Radio Frequency Telemetry System (TO Rev B) 60% Design Review. (required NLT 19 working days prior to Design Review).
Due Date : 06/09/2010
- 104. – Complete SAA report for the First Stage Thermal Control System (FS TCS) 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 07/31/2009
- 105. – Complete SAA report for the First Stage Thermal Control System (FS TCS) Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 10/26/2009
- 106. – Complete SAA report for the Ignition Over Pressurization (IOP)/Sound Suppression 60% Design Review (required NLT 19 days prior to Design Review).
Due Date : 07/06/2009
- 107. – Complete SAA report for the Ignition Over Pressurization (IOP)/Sound Suppression 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 12/24/2009
- 108. – Complete SAA report for the Ignition Over Pressurization (IOP)/Sound Suppression Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 02/19/2010
- 109. – Complete SAA report for the Gaseous Oxygen MPPF 30% Design Review (required NLT 19 days prior to Design Review).

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Due Date : 03/31/2009
Completed : 03/16/2009

110. - Complete SAA report for the Gaseous Oxygen MPPF 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 10/06/2009

111. - Complete SAA report for the Gaseous Oxygen MPPF 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 04/15/2010

112. - Complete SAA report for the Gaseous Oxygen MPPF Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 06/03/2010

113. - Complete SAA report for the Gaseous Oxygen PAD 30% Design Review (required NLT 19 days prior to Design Review).
Due Date : 03/31/2009
Completed : 03/16/2009

114. - Complete SAA report for the Gaseous Oxygen PAD 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 10/06/2009

115. - Complete SAA report for the Gaseous Oxygen PAD 90% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 04/15/2010

116. - Complete SAA report for the Gaseous Oxygen PAD Final Release Review (required NLT 19 working days prior to Design Review).
Due Date : 06/03/2010

117. - Complete SAA report for the Ground Cooling Subsystem (GCS) 30% Design Review (required NLT 19 working days prior to Review).
Due Date : 09/16/2009

118. - Complete SAA report for the Ground Cooling Subsystem (GCS) 60% Design Review (required NLT 19 working days prior to Review).
Due Date : 01/05/2010

119. - Complete SAA report for the Ground Cooling Subsystem (GCS) 90% Design Review (required NLT 19 working days prior to Review).
Due Date : 04/26/2010

120. - Complete SAA report for the Ground Cooling Subsystem (GCS) Final Release Review (required NLT 19 working days prior to Review).
Due Date : 07/26/2010

121. - Complete SAA report for the Weather Instrumentation 60% Design Review (required NLT 19 working days prior to Design Review).
Due Date : 03/04/2009

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<p>Completed : 02/09/2009</p> <p>122. - Complete SAA report for the Weather Instrumentation 90% Design Review (required NLT 19 working days prior to Design Review). Due Date : 08/14/2009</p> <p>123. - Complete SAA report for the Weather Instrumentation Final Release Review (required NLT 19 working days prior to Design Review). Due Date : 11/06/2009</p> <p>124. - Complete SAA report for the Sensor Data Acquisition System (SDAS) 60% Design Review (required NLT 19 working days prior to Design Review). Due Date : 01/28/2009 Completed : 12/12/2008</p> <p>125. - Complete SAA report for the Sensor Data Acquisition System (SDAS) 90% Design Review (required NLT 19 working days prior to Design Review). Due Date : 07/24/2009</p> <p>126. - Complete SAA report for the Sensor Data Acquisition System (SDAS) Final Release Review (required NLT 19 working days prior to Design Review). Due Date : 10/19/2009</p> <p>127. - Complete SAA report for the Range Safety Checkout System (RSCS) 60% Design Review (required NLT 19 working days prior to Design Review). Due Date : 01/05/2009 Completed : 12/10/2008</p> <p>128. - Complete SAA report for the Range Safety Checkout System (RSCS) 90% Design Review (required NLT 19 working days prior to Design Review). Due Date : 06/26/2009</p> <p>129. - Complete SAA report for the Range Safety Checkout System (RSCS) Final Release Review (required NLT 19 working days prior to Design Review). Due Date : 09/18/2009</p> <p>130. - Complete SAA report for the Vehicle Access Arm (VAA) 60% Design Review. (required NLT 19 working days prior to Design Review). Due Date : 07/08/2009</p> <p>131. - Complete SAA report for the Vehicle Access Arm (VAA) 90% Design Review. (required NLT 19 working days prior to Design Review). Due Date : 01/29/2010</p> <p>132. - Complete SAA report for the Vehicle Access Arm (VAA) Final Release Review. (required NLT 19 working days prior to Design Review). Due Date : 03/15/2010</p> <p>133. - Complete SAA report for the Launch Control System (LCS) CDR (required NLT 19 working days prior to Design Review). Due Date : 08/11/2009</p>		

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134. - Complete SAA report for the Kennedy Ground Control System (KGCS) 60% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 05/01/2009

Completed : 04/15/2009

135. - Complete SAA report for the Kennedy Ground Control System (KGCS) 90% Design Review (required NLT 19 working days prior to Design Review).

Due Date : 02/05/2010

136. - Complete SAA report for the Kennedy Ground Control System (KGCS) Final Release Review (required NLT 19 working days prior to Design Review).

Due Date : 04/30/2010

137. - Complete SAA report for the VAB Platforms HB2 (required NLT 19 working days prior to Review). (This milestone should have been deleted in Revision B to the Task Order, but was inadvertently left in.)(TO Rev C)

***** TBD *****

138. - Complete SAA report for the VAB Platforms HB3 (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

139. - Complete SAA report for the Lightning Protection Subsystem (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

140. - Complete SAA report for the Emergency Egress Subsystem (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

141. - Complete SAA report for the MPPF (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

142. - Complete SAA report for the HVAC system (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

143. - Complete SAA report for the Fire Suppression System (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

144. - Complete SAA report for the Utility Controls (KCCS) Supervisory Control and Data Acquisition System (SCADA) (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

145. - Complete SAA report for Elevators (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

146. - Complete SAA report for the Launch Mount System (required NLT 19 working days prior to Review).

Due Date : 09/30/2010

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- 147. – Complete SAA report for Cranes (required NLT 19 working days prior to Review).
Due Date : 09/30/2010
- 148. – Complete SAA report for the Spacecraft Transporter (required NLT 19 working days prior to Design Review).
Due Date : 09/30/2010
- 149. – Complete SAA report for the ML Transporter (required NLT 19 working days prior to Design Review).
Due Date : 09/30/2010
- 150. – Complete SAA report for the Laser Alignment System (required NLT 19 working days prior to Review).
Due Date : 09/30/2010
- 151. – Complete SAA report for the AC Power System (required NLT 19 working days prior to Review).
Due Date : 09/30/2010
- 152. – Complete SAA report for the Uninterruptible Power System (required NLT 19 working days prior to Review).
Due Date : 09/30/2010
- 153. – Complete SAA report for the Oxygen Deficiency Monitoring System (ODMS) (required NLT 19 working days prior to Design Review).
Due Date : 09/30/2010
- 154. – Complete SAA report for the SPE Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) 60% Design Review (required NLT 19 days prior to Design Review). (TO Rev B)
Due Date : 10/12/2009
- 155. – Complete SAA report for the SPE Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) 90% Design Review (required NLT 19 days prior to Design Review). (TO Rev B)
Due Date : 02/22/2010
- 156. – Complete SAA report for the SPE Breathing Air System (CEV/CM Cabin Pressurization / Breathing Air) Final Release Review (required NLT 19 working days prior to Design Review). (TO Rev B)
Due Date : 05/17/2010

C. TECHNICAL APPROACH

Task 1. The contractor shall review CxP technical documentation during Ground System development to assess impacts to Safety and Reliability planning and analyses produced under this Task Order, and provide Review Item Discrepancies (RIDs) / comments for consideration by NASA.

USTDC will review CxP technical documentation associated with work performed under this TO to assess impacts to Safety and Reliability planning and technical analyses produced under this TO. CxP technical documentation may include CxP Change Requests related to CxP requirements that drive the technical approach or process for safety analyses, technical documentation associated with design/development or hazards identification and analyses of other CxP systems, subsystems, or the flight vehicle. Where impacts are identified, USTDC will submit comments using the appropriate review comment mechanism (e. g. , RIDs).

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Task 2. The contractor shall prepare the following inputs for the 30% Design Review for each subsystem listed above:

USTDC will prepare all Safety and Reliability documentation (SAA, PHA) for the 30% Design Review as described below:

Task 2.a. Criticality Assessment (per CxP 70043, para 4.1, and App. D) to determine if subsystem is 1) Flight Critical, 2) Critical, or 3) Non-Critical.

USTDC will assess each design to determine system criticality early in the development process. An initial Criticality Assessment will be conducted by analyzing the loss of system function(s) and how these losses affect human lives and the vehicle systems. USTDC will perform the Criticality Assessment according to the process, methodology, criticality assessment criteria, and criticality ratings as defined in CxP70043. On critical systems USTDC will complete a Hazard Analyses (HA), and a full Failure Modes and Effect Analyses (FMEA) and Critical Items List (CIL). On non-critical systems USTDC will complete a Hazard Analysis only.

USTDC will establish ground rules to determine the scope of the SAA. USTDC will develop the FMEA according to CxP70043 by evaluating the preliminary subsystem design and identifying potential risk areas for further assessment throughout the remainder of the design phase. The FMEA will be prepared by analyzing each component to provide constructive feedback to the design process. During the FMEA process, all component failure modes will be analyzed per CxP70043 and assigned a Criticality Category (1, 1S, 1R, 2, 2R and 3) in order to provide a quantitative consequence to each item failure. Subsequent to the approval of Revision B to the Task Order, Criticality Assessments are no longer required to be performed, with the exception of those systems deemed GSE Flight Critical per NASA (TP Rev B). FMEAs will be required on those systems specified by NASA per Task 3 of the Task Order. USTDC will receive a risk-based assessment from NASA by the 30% review. This assessment will be the basis of direction for performing or not performing FMEAs. For those subsystems that are determined to require an FMEA, USTDC will perform an assessment of subsystem inputs and outputs to be used as guidance to further decide which portions of the subsystem should require FMEA. (TP Rev A)

Task 2.b. Draft Hazard Analysis (per CxP 70038A [TP Rev A]) sufficient to identify the major hazards and single-point failures needing to be addressed through the design/development process.

For all subsystems determined to require an FMEA, (TP Rev A) USTDC will identify safety hazards and their causes early in the project life cycle to ensure that measures to eliminate, reduce, or control the risks associated with hazards are identified and properly analyzed. USTDC will also ensure that safety mitigation/elimination methods can be implemented and verified for all potential hazards. USTDC will perform the Preliminary Hazards Analysis using CxP 72189 (~~Ground Systems Preliminary Hazards Assessments (PHA)~~) as input and (TP Rev A) according to the process and methodology defined in CxP 70038A. (TP Rev A) USTDC will also initiate the preliminary System Assurance Analyses (SAA) by completing the System Descriptions and the Reliability Block Diagrams, Document List, and by finalizing the Criticality Assessment Summary. (TP Rev A)

Task 2.c. Concerns and recommendations: System Risks and Recommended Mitigation (TP Rev A)

USTDC will support the 30% design process by providing recommendations identifying risks and recommended mitigations (TP Rev A) for the elimination/mitigation of identified hazards, and by

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documenting concerns where hazard mitigations already identified in the design appear to be insufficient. (TP Rev A) Findings will be presented in a Concerns and Recommendations Report Risks and Recommended Mitigation section of the SAA (TP Rev A) up to the 90% design review. After the 90% review all findings will require a Hazard Report. (TP Rev A)

Task 3. The contractor shall prepare the following inputs for the 60% Design Review for each subsystem listed above:

USTDC will prepare all Safety and Reliability documentation (SAA) for the 60% Design Review as described below:

~~*Task 3.a. For Flight Critical and Critical: updated Criticality Assessment and an initial draft FMEA and draft Critical Items List (CIL) per CxP 70043. For Non-Critical: updated Criticality Assessment.*~~ (TP Rev A)

Task 3.a. For Flight Critical subsystems, perform FMEA per CxP 70043A, as modified herein; all other subsystems requiring an FMEA perform per KNPR 8700.2 Rev Basic (SA Internal Review DRAFT KSC System Safety and Reliability Analyses Methodology Procedural Requirements), as modified herein, or CxP 70043 as specified at the 30% design review. If the KNPR 8700.2 is used as the basis for performing the FMEA, the Reliability and Safety Assessment Report (RSAR) is not required. NASA will create the RSAR as a separately controlled document, not to be included as part of the SAA. All SAA related documentation is to be released via DDMS. (TP Rev A).

In preparation for risk acceptance, USTDC will develop the FMEA (where required) (TP Rev A) and Critical Items List to identify maintenance mitigations and controls in the area of hardware design, test, operation, (TP Rev A) and inspection for components with failure modes that can result in Critical/Catastrophic events. For those subsystems where no FMEA is required, and where the Criticality Assessment and FMEA have already been incorporated into the SAA, USTDC will remove the Criticality Assessment and FMEA from the SAA prior to subsequent release of the SAA.

Task 3.b. Updated Subsystem Hazard Analysis per CxP 70038A (TP Rev A), Appendix A. 2. (For those subsystems with critical control functions provided by software, a draft Software Hazard Analysis per CxP 70038A, (TP Rev A) Appendix A. 5 shall also be performed).

USTDC will, throughout the design process, review the system development to address any new potential hazards that may develop as the design progresses per ~~CxP 70038~~ (TP Rev A). USTDC will review 60% drawings and design documentation to identify potential critical/catastrophic hazards using the subsystems hazards analysis process and methodology defined in CxP70038A (TP Rev A) Appendix A. 2 and CxP 70038A (TP Rev A) Appendix A. 5 if critical functions are provided by software. USTDC will prepare Hazard Reports to document the results of the formal hazard analysis process and establish management acceptance (Cx SERP [Safety and Engineering Review Panel]) of hazards not eliminated during design. (TP Rev A)

Task 3.c. Definition of applicable inputs to Operations and Maintenance Requirements and Specifications Documents (OMRSDs).

The task is predicated on there being a need to verify functionality and/or reliability of flight critical and critical equipment prior to its critical usage periods, maintenance intervals, and inspections and test requirements. Using the CILs, FMEAs (where required) (TP Rev A), and hazards analyses, USTDC will evaluate the need to demonstrate functionality and reliability and/or the need for maintenance and

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inspection, and submit these inputs to the system designers for inclusion into OMRSDs.

Task 3.d. Updated concerns and recommendations System Risk and Recommended Mitigations. (TP Rev A)

USTDC will support the 60% design process by providing recommendations for the elimination/mitigation of identified hazards, and by updating system risk and associated mitigations and documenting concerns where hazard mitigations already identified in the design appear to be insufficient. (TP Rev A)

Task 4. The contractor shall prepare the following inputs for the 90% Design Review for each subsystem listed above.

USTDC will prepare all Safety and Reliability documentation (SAA) for the 90% Design Review as described below:

Task 4.a. Flight Critical and Critical: updated Criticality Assessment and FMEA (where required) (TP Rev A) and an updated CIL. Non-Critical: updated Criticality Assessment. (TP Rev A)

Component failure modes (TP Rev A) will be analyzed per CxP70043A (where required) or KNPR 8700.2 as applicable (TP Rev A) using 90% design information and assigned a Criticality Category (1, 1S, 1R, 2, 2R and 3) (TP Rev A) in order to provide a quantitative consequence to each item failure. USTDC will update the Critical Items List to identify maintenance mitigations and controls in the area of hardware design, test, and inspection for components with failures modes that can result in Critical/Catastrophic events.

Task 4.b. Updated Hazard Analysis representing the 90% design milestone.

USTDC will continue to develop the SAA through the 90% design by completing the FMEA (where required), HA and CIL, HA, CIL, and updated risks (TP Rev A), and by providing information to the lead design engineer for elimination/mitigation of risks. USTDC will develop a top-down Fault Tree Analysis for all hazard types (system and operational). Safety control and operational mitigations will be determined for each event in the Fault Tree. For subsystems determined to require an FMEA, (TP Rev A) USTDC will perform an End-to-End Analysis, including subsystem inputs and outputs (TP Rev A), by assessing how interfacing subsystem failures on both sides can affect the supporting subsystems. All subsystem (TP Rev A) failures that can affect the subsystem performance will be identified and documented in the SAA with recommendations for elimination.

USTDC will document all anomalies detected during the development of SAA that were not addressed in the analysis and make recommendations to eliminate them. (TP Rev A)

Task 4.c. Updated definition of applicable inputs to OMRSDs.

Using the CILs, FMEAs, and hazards analyses, USTDC will evaluate the need to demonstrate functionality and reliability and/or the need for maintenance and inspection, and submit these inputs to the system designers for inclusion into OMRSDs.

Task 5. The contractor shall prepare the following inputs for the Final Release for each subsystem listed above (Prior to Operational Phase):

USTDC will prepare all Safety and Reliability documentation (SAA) for the Final Design Review as

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described below.

a. Prior to subsystem activation, the contractor shall provide final update of the analyses in Task 4.

Design changes occurring after the 90% review will be analyzed using the same technical approach and using the same processes and methodologies as described in Task 4. Where applicable, the hazards analysis, FMEAs, CILs, and SAA will be updated to address any newly identified hazards, failure modes and effects, and to identify any new critical items. USTDC will develop CIL Presentation Packages for Engineering Review Board acceptance of Critical Items.

b. The contractor shall hold a table-top review of all updated analyses from Task 4. Signatures from the NASA Design organization and NASA S & MA organization are required. In the event that the design/development team is not responsible for operational certification/activation, the contractor shall provide the appropriate updates to the responsible party and support the tabletop review.

USTDC will hold a tabletop review of the SAA, and incorporate all applicable (TP Rev A) comments from the tabletop review of the SAA (TP Rev A) and obtain signatures of approvals to finalize the SAA for publication. The NASA Design organization's Lead Design Engineer and the assigned NASA S & MA representative will be invited to attend the tabletop review since their signatures are required.

Task 6.0 The contractor shall prepare the following inputs for the Command and Control Communications Preliminary Design Review (PDR) for the Launch Control System subsystem and associated software subsystems:

USTDC will document the results of Task 6 in an SAA for the CCC Preliminary Design Review. USTDC will also update the *CCC System & Software Safety Plan (GOP507010)* for the CCC Preliminary Design Review such that the plan for performing system safety and software safety is reflective of the tasking described in this TO.

Task 6.a. For Flight Critical and Critical: a Criticality Assessment and an initial draft FMEA and draft CIL per CxP 70043. For Non-Critical: a Criticality Assessment.

USTDC will support the CCC PDR with technical analyses leading to production of a CxP 70043-compliant FMEA and CIL sufficient to identify the LCS critical hardware items and failure modes and effects of the LCS hardware. The CCC system is decomposed into two major systems: the Command and Control system (hereafter referred to as the Launch Control System, or LCS) and the Communications system. The LCS and Communications systems contain subsystems within themselves. The FMEAs, CILs and SAAs associated with the Communications system are the responsibility of another contractor, so that those Communications system related products will not be developed under this TO, but may be reviewed by USTDC analysts in conjunction with the work described in this TO to ensure hazards are properly identified and mitigated, with failure modes and effects appropriately identified in those products.

The Criticality Assessment and initial draft FMEA that USTDC will perform is a multi-step process, which will begin by USTDC performing a functional FMEA of the CCC system to document the overall LCS criticality according to the methodology and technique described in CxP70043. USTDC will use the Preliminary Hazards List developed under a prior task order as the primary functional FMEA input during this LCS system-level functional FMEA/CIL process.

Next, USTDC will perform a draft Criticality Assessment and draft functional FMEA of the Hardware Configuration Items (HWCI) within the LCS portion of the CCC system. The draft functional FMEAs will be

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performed upon each of the HWCI's identified as flight critical or critical, once again with the analysis conducted using the same methodology, technique, assessment criteria, and criticality ratings defined in CxP70043. The major difference between this FMEA/CIL and the one described above is the level of detail available from the development organization with which the analysis is performed. Because software often executes on hardware, the combined functionality of hardware and software will be considered when performing the FMEAs such that software failures will be considered a cause of HWCI failure, with the safety-criticality of software (from Task 6b) also considered in the HWCI FMEAs where appropriate.

Should the USTDC analyst find that a FMEA/CIL deficiency exists in a Communications subsystem or another subsystem that is not within the scope of this TO, the USTDC analyst will notify the CCC NASA Project Manager, CCC NASA S & MA Lead of the deficiency so that they can address the deficiency with the responsible party and/or determine a course of action.

Task 6.b. Draft Hazard Analysis (per CxP 70038) sufficient to identify the major hazards and single-point failures needing to be addressed through the design/development process.

USTDC will support the CCC PDR with technical analyses leading to production of a CxP 70038 Draft Hazard Analysis sufficient to identify the major hazards and single-point failures needing to be addressed through the design/development process. Note that a Preliminary Hazards Analysis was completed and a Preliminary Hazards List (PHL) for the LCS was delivered under a prior TO. This PHL will be used as an input to the hazards analysis that will be conducted in accordance with CxP70038 for the CCC Preliminary Design Review. Where commonality exists and makes sense, like hazards that were identified in the previously delivered PHL will be grouped together and captured in Hazard Reports. The Hazard Reports will contain all data required per CxP70038. Additional hazards may also be identified as the technique for performing hazards analysis is repeated in support of the CCC PDR, and any new hazards identified will also be captured in Hazard Reports. Hazards affecting other subsystems and/or other Elements will be escalated for the purpose of Hazards Analysis integration, which is beyond the scope of this TO. This TO assumes Hazards Analysis integration includes notifying the affected subsystems' Safety representative of the specific hazards identified and ensuring the affected subsystems' hazards analysis is limited to analysis of these identified hazards. Likewise, this TO assumes hazards identified by other subsystems will be flowed down via the Hazards Analysis integration activity and will be addressed within the LCS hazard analysis.

A subsystem hazard analysis for each HWCI and software hazard analysis for each CSCI (Computer Software Configuration Item) in the LCS will be included in the Draft Hazard Analysis. The hazards analysis of HWCI's will be performed according to the Subsystem Hazards Analysis technique in CxP 70038. The hazards analysis of CSCIs will be performed according to the Software Hazards Analysis technique described in CxP 70038, with software safety requirements analysis, software safety design analysis, software safety implementation analysis, and software safety test analysis performed according to CxP 70059.

Because the LCS is developing its software according to an incremental software development lifecycle as defined in a Build Plan, all four software safety analyses (requirements, design, implementation, test analyses) will NOT be performed upon each CSCI for each build. Rather, these software safety analyses will be performed incrementally upon each CSCI. The CSCI's composition of safety-critical software, its software Class, and planned software content in each build will be taken into account when defining the associated level of software safety analyses to be applied upon each CSCI for each build. The intent is that more software safety analyses will be performed upon safety-critical, Class A software in earlier

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builds and all software safety analyses will be performed upon each safety-critical CSCI sometime prior to the CSCI's operational deployment. Hence, the software safety analyses that will be performed are summarized as follows:

Software Safety Analyses Summary by Build:

(Begin TP Rev A)

- #CSIs in Build with Requirements Analysis: Dev 1, 16; Dev 2, 13; Ver 1, 10; Ver 2, 8; Ret 1.0, 6;
- #CSIs in Build with Requirements & 45% Design Analyses: Dev 1, 2; Dev 2, 4; Ver 1, 0; Ver 2, 0; Ret 1.0, 0;
- #CSIs in Build with Requirements & 90% Design Analyses: Dev 1, 1; Dev 2, 4; Ver 1, 0; Ver 2, 0; Ret 1.0, 0;
- #CSIs in Build with Requirements, Design, and Implementation Analyses: Dev 1, 4; Dev 2, 0; Ver 1, 0; Ver 2, 0; Ret 1.0, 0;
- #CSIs in Build with All Analyses: Dev 1, 1; Dev 2, 2; Ver 1, 4; Ver 2, 6; Ret 1.0, 1;
- #CSIs in Build with Requirements Analysis: Dev 1, 16; Build 10-1, 10; Build 10-2, 5.
- #CSIs in Build with Requirements & 45% Design Analyses: Dev 1, 2; Build 10-1, 5; Build 10-2, 5.
- #CSIs in Build with Requirements & 90% Design Analyses: Dev 1, 1; Build 10-1, 4; Build 10-2, 4.
- #CSIs in Build with Requirements, Design, and Implementation Analyses: Dev 1, 4; Build 10-1, 4; Build 10-2, 4.
- #CSIs in Build with All Analyses: Dev 1, 1; Build 10-1, 4; Build 10-2, 4.

(End TP Rev A)

As part of the Software Hazards Analysis, USTDC will evaluate the CSCI's safety-criticality rating using the test defined in the NASA Software Safety Standard (NASA-STD-8719. 13B), with CSIs receiving a criticality rating of "safety-critical" or "not safety-critical" according to this process. The safety-criticality of the CSIs will be documented in the LCS System Assurance Analysis report and will also be used during hardware FMEAs to assess the criticality of HWCs where software is the identified as the cause of failure.

The hazards analysis will then progress to an end-to-end hazards analysis. This requires analysis of LCS hardware and software for failure modes and effects on LCS operation, inclusive of the Communications subsystems and other subsystems along a given command/data/control path from the user to the flight vehicle. This analysis will begin as a LCS stand-alone analysis that explores all configuration options including single string, and parallel/concurrent processing used to command and control GSE and flight end items. This analysis will progress into an end-to-end analysis of the LCS system in combination with other subsystems used for commanding, controlling, and communicating to the flight vehicle. The failure modes/effects effects and hazards will be determined for the LCS configuration selected for use with each interfacing subsystem having an operational interface with LCS; however, the effect of these failure modes and hazards on each subsystem will be determined within the hazards analysis and FMEAs of each subsystem. For each postulated failure mode, software will be considered as a possible subsystem failure cause, where appropriate. The end-to-end hazards analyses and FMEAs will include all LCS hardware and

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software failure modes and effects, including LCS system software, LCS application software, Industrial Controllers/Programable Logic Controllers (PLC) hardware, Industrial Controllers/PLC-resident software, and "smart component" hardware, software, firmware applications as well as other subsystems' hardware failure modes and effects and the interfacing hardware failure modes and effects, with the results of this end-to-end analyses documented within subsystem hazards analyses and subsystem FMEAs (for the case where LCS provides the command/control of the subsystem). This phase of the analysis will also include any known critical applications such as pre-requisite and reactive software, redundancy management software, safing software; and will incorporate failure modes and effects from interfacing subsystems such as pneumatics and electrical power. All hazards analyses will be performed according to CxP70038 and CxP70043.

Task 6.c. Definition of applicable inputs to Operations and Maintenance Requirements and Specifications Documents (OMRSDs).

The task is predicated on there being a need to verify functionality and/or reliability of flight critical and critical equipment prior to its critical usage periods, maintenance intervals, and inspections and test requirements. The purpose of performing this task is to provide inputs to OMRSDs, with emphasis placed on verification of critical equipment's operation and/or reliability prior to its critical usage periods, and as late as possible in the ground processing flow as is feasible such that the process of re-verification is not required again at a later point with no added value or with duplicative operation and/or maintenance cost. Using the CILs, FMEAs, and hazards analyses, USTDC will evaluate the need to demonstrate functionality and reliability and/or the need for maintenance and inspection, and submit these inputs to the system designers for inclusion into OMRSDs.

Task 6.d. Concerns and recommendations.

Hazards identified in the hazards analysis that remain unmitigated or insufficiently mitigated and for which the analyst believes forward plans for design/development will result in insufficient resolution will be summarized and included as inputs to the CCC Preliminary Design Review, along with supporting rationale. The need for deviations and waivers will also be identified, along with any other safety or reliability risks that the analyst believes require a broader audience's cognizance. These risks will be summarized and included as inputs to the CCC Preliminary Design Review, along with supporting risk rationale, likelihood, consequence, and any recommendations for mitigation.

Task 7. The contractor shall prepare the following inputs for the CCC Critical Design Review for the Launch Control System subsystem and associated software subsystems listed above:

USTDC will document the results of Task 6 in an updated SAA for the CCC Critical Design Review. USTDC will also update the CCC System & Software Safety Plan (GOP507010) for the CCC Critical Design Review such that the plan for performing system safety and software safety is reflective of the tasking described in this TO.

Task 7.a. For Flight Critical and Critical: updated Criticality Assessment and an updated FMEA and CIL per CxP 70043. For Non-Critical: updated Criticality Assessment.

USTDC will support the CCC Critical Design Review with technical analyses leading to production of a CxP 70043-compliant FMEA and CIL sufficient to identify the LCS critical hardware items and failure modes and effects of the LCS hardware. The same processes, methodologies, and techniques that were described to perform Task 6a will be repeated, with the major difference being the level of detail in the development

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organization's HWCI design products, set unique drawings, and hardware installation drawings, which will have substantially matured by the CCC CDR. Likewise, interfacing subsystems' definitions will have matured, so the FMEA process to identify failure modes and effects related to interfacing subsystems will be repeated. As such, the failure modes and effects of more detailed designs of HWCI's and interfacing subsystems will be re-analyzed, with the FMEAs and CILs being updated to reflect newly identified failure modes and effects and any changes in LCS hardware criticality.

Task 7.b. Updated Subsystem Hazard Analysis per CxP 70038, Appendix A. 2. (For those subsystems with critical control functions provided by software, a draft Software Hazard Analysis per CxP 70038, Appendix A. 5 shall also be performed).

USTDC will support the CCC Critical Design Review with technical analyses leading to production of a CxP 70038-compliant Hazard Analysis sufficient to identify the major hazards and single-point failures needing to be addressed through the remainder of the design/development process. The same processes, methodologies, and techniques that were used used to perform Task 6b are repeated, with the major difference being the level of detail in the development organization's design products, which have substantially matured. As such, the hazards analysis will be updated to include any newly identified potential hazards, whether a result of the hazard analysis conducted as part of this task or the result of hazards identified during the Hazard Analysis Integration activity (beyond the scope of this Task Order) that have been flowed down to the LCS Safety representative. The goal is that by CDR the majority of hazards within the LCS and within the ground system will have been fully mitigated/eliminated in the design, with others having been controlled in accordance with the hazard reduction order of precedence per CxP70038; or if not, the project has a plan in place to take further action to mitigate the remaining hazards or intends to notify the program and receive program approval to proceed as-is, with supporting rationale as to why the associated risks are acceptable.

Task 7.c. Definition of applicable inputs to Operations and Maintenance Requirements and Specifications Documents (OMRSDs).

The technical approach to performing this task is identical to that described in Task 6c. Using the CILs, FMEAs, and hazards analyses, USTDC will evaluate the need to demonstrate functionality and reliability and/or the need for maintenance and inspection, and submit these inputs to the system designers for inclusion into OMRSDs. In addition, USTDC will verify that OMRSD inputs submitted in Task 6c have been incorporated into OMRSDs; if not, USTDC will request from the designers the rationale for the exclusion.

Task 7.d. Updated concerns and recommendations.

The technical approach to performing this task is identical to that described in Task 6d, with concerns, recommendations, risks, and needs for deviations and waivers summarized and included as inputs to the CCC Critical Design Review, along with supporting rationale. In addition, concerns and recommendations made in task 6d will be re-evaluated to ensure those concerns and recommendations made at the CCC PDR which were to be acted upon by the CCC Element Project were, in fact, sufficiently resolved by the Project's development organization and, if not, are again provided as inputs to the CCC Critical Design Review.

Task 8. The contractor shall prepare the following inputs for the CCC Design Certification Review for the Launch Control System subsystem and associated software subsystems listed above (prior to Operational Phase):

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Task 8.a. Prior to the Launch Control System's operational use, the contractor shall provide a final update of the analyses in Task 7.

USTDC will document the results of Task 8a in an updated SAA for the CCC Design Certification Review. USTDC will also update the CCC System & Software Safety Plan (GOP507010) for the CCC Design Certification Review such that the plan for performing system safety and software safety is reflective of the tasking described in this TO.

The technical approaches used in performing this task are identical to those described in Tasks 7a, 7b, 7c, and 7d. The hazards analysis, FMEAs, and CILs associated with the subsystem designs, LCS design, and the overall ground system design (inclusive of all subsystems and facilities in the operational path involving the LCS) will be revisited post-CDR as the overall ground system design is completed to ensure hazards are mitigated in the design or reduced, using the hazard reduction order of precedence in CxP70038. Typically, this re-evaluation is completed by the Test Readiness Review timeframe, with changes to the design of only the flight critical and critical items reviewed after CDR and thereafter, — unless a major design change occurs. The scope of this task does not include a complete re-review of the entire design should a major design change occur after the CCC Critical Design Review.

In addition to the re-visitation of hazards analysis, FMEAs, and CILs resulting from design changes occurring after the CCC CDR, USTDC will also review CCC LCS (TP Rev A) HWCI and CCC LCS (TP Rev A) CSCI subsystem-level formal acceptance test/verification results and test/verification reports as well as LCS system-level formal acceptance test/verification results and test/verification reports to ensure that hazard mitigations to be verified through testing, analysis, demonstration, inspection, or a combination of these verification methods were in fact, verified, with verification results indicating hazard mitigations were successful and effective. Should any LCS hazard mitigations that are implemented via software be verified by a verification method other than "test", USTDC will verify the development organization has documented the rationale for doing so, and has obtained approval from the NASA CCC S & MA Lead.

Task 8.b. The contractor shall hold a table-top review of all updated analyses from Task 7. Signatures from the NASA CCC Chief Engineer, NASA CCC Project Manager, and NASA S & MA organization are required. In the event that the design/development team is not responsible for operational certification/activation, the contractor shall provide the appropriate updates to the responsible party and support the tabletop review.

USTDC will hold a table-top review of all the updated analyses from Task 7 and those conducted in Task 8a to date prior to operational certification/activation of the LCS subsystem. The USTDC analyst will present a summary of the contents of the Final SAA, and summarize the final status of all hazards associated with the LCS subsystem, as well as any safety and reliability risks, concerns, and recommendations associated with the LCS subsystem prior to its operational use. As a minimum, USTDC will invite the NASA CCC Chief Engineer, NASA CCC Project Manager, and NASA CCC S & MA Lead to participate in the review because their signatures will be required on the Final SAA. The USTDC analyst will also document any additional concerns and recommendations voiced by the NASA CCC Chief Engineer, NASA CCC Project Manager, and NASA CCC S & MA Lead in the Final SAA for the CCC Design Certification Review. The purpose of this review is to inform the participants of the remaining risks to safety and reliability in the LCS subsystem in an informal setting such that resolution of any remaining disconnects can occur prior to the formal CCC Design Certification Review and all parties are in agreement, or have agreed to disagree, about risk acceptance going into the formal CCC Design Certification Review.

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- Task 9. The contractor shall prepare the following inputs for each subsystem listed above:*
- a. The contractor shall hold a table-top review of all updated analyses. In the event that the design/development team is not responsible for operational certification/activation, the contractor shall provide the appropriate updates to the responsible party and support the tabletop review.*
 - b. Updated SAA representing the as-designed / as-built subsystem.*
 - c. Updated definition of applicable inputs to OMRSDs.*
 - d. Updated concerns and recommendations - System Risks and Recommended Mitigation (TP Rev A).*

USTDC will prepare/update all Safety and Reliability documentation (SAA) prior to activation as described below:

SAs previously performed on CxP new design and on Space Shuttle Program (SSP) legacy subsystems will be reviewed and upgraded. SAs will be revised or new analyses performed for changes in design and functionality to correct any noted inaccuracies, and to ensure conformance to CxP requirements. The scope of this effort includes specifically identified NE, PH, TA or IT subsystems and equipment as listed above for this task. The effort will consist of the following: preparation and/or revision of the SAs, documentation of all Hazard Reports in the CxP (AMES developed) Hazard Analysis Database, (TP Rev A) providing inputs regarding Hazard Reports and Critical Items to Program/Project/Element Design Reviews (such as PDR and CDR), and providing inputs/support pertaining to Constellation Safety and Engineering Review Panel (CSERP) presentations of Hazard Reports and Critical Items by NASA SA.

Subsystems with TA or IT design responsibility not specifically identified above but with functional interfaces to SAs performed in the statement above, will be reviewed for consistency with CxP design and functionality. Any discrepancies noted will be identified.

Task 10. Quality Assurance Support

Task 10.a. The contractor shall provide support to maintain the CCC Software Assurance Plan and CCC Hardware Assurance Plan and provide support to develop quality assurance review and audit processes. (WBS 1.32.5)

USTDC will provide support to update the CCC Software Assurance Plan and CCC Hardware Assurance Plan (GOP507011 and GOP507012) to describe software and hardware assurance levels and activities necessary for compliance with Constellation Program (CxP) SR & QA Requirements (CxP70059) and the Ground Systems SR & QA Plan (CxP72158). USTDC will provide support to impact assess Change Requests (CRs) to CxP70059 and CxP72158, and update GOP507011 and GOP507012 as necessary to maintain compliance with approved CRs. USTDC will also provide support to develop software and hardware assurance review and audit processes and checklists needed to perform quality assurance activities described in GOP507011 and GOP507012.

Task 10.b. The contractor shall provide support for performance of quality assurance tasks identified in the CCC Software Assurance Plan and CCC Hardware Assurance Plan. (WBS 1.32.5)

USTDC will provide support to perform hardware and software assurance reviews, audits, and tasks per the CCC Software Assurance Plan and CCC Hardware Assurance Plan.

11.0 LETF Quality Assurance Support

11.1 The contractor shall provide LETF Quality Assurance support in the development of review, audit,

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fabrication, assembly, and test processes and procedures in accordance with CxP 72158 and supporting Kennedy Space Center Procedures KNPR 8720.2 and KNPR 8730.2.

USTDC will provide support to impact \ assess Change Requests (CRs) to CxP 70059 and CxP 72158, and update LETF quality assurance review and audit processes as necessary to maintain compliance with approved CRs. USTDC will also provide support to develop quality assurance review and audit processes and checklists needed to perform quality assurance activities described in CxP 72158 and KNPR 8730.2.

11.2 The contractor shall provide support for performance of LETF quality assurance tasks identified in the Ground Systems SR & QA Plan (CxP 72158).

USTDC will provide support to perform quality assurance reviews, audits, and checklists per the processes developed in Task 11.1, and maintain quality records for work performed. (TP Rev A)

D. BASIS OF ESTIMATE

The estimate for this TO was developed by USTDC space program Safety and Mission Assurance experts and managers and is supported by experience gained in the previous year on TO 6SPI00485. These experts/managers used a combination of knowledge gained on a current and similar task order at KSC, decades of personal experience performing similar tasks, information generated during meetings with NASA CxP Senior Project Managers and S & MA managers, and program/NASA regulatory requirements regarding safety analyses to develop the work volume estimate. The labor associated with analysis of each subsystem was estimated by assigning it a complexity factor. The labor associated with analysis of the LCS subsystem, including Quality Engineering and Assurance activities, also included end-to-end analysis and a software safety analyses for this software intensive subsystem. A detailed matrix was developed to correlate skill requirements, analysis hours needed to perform specific tasks, analysis products required, and schedule factors for each major review. This information was then used to calculate effort required to produce each deliverable and support each review. Requirements for each review are unique, and effort for each was consequently computed individually. For example, subsystems vary in complexity and schedule, required products for subsequent reviews (e. g. , 30%, 60%, etc.) require different amounts of effort/skills to complete, and assessment time available is schedule-dependent. These variables were all taken into consideration to determine required resources.

The estimate for Revision A to the Task Order Plan was developed by USTDC space program Safety and Mission Assurance experts and managers. Scope was reduced for those systems where no FMEA is required. Scope was also reduced for those systems no longer requiring an SAA. Scope was increased for the Breathing Air system due to the separation of review schedules into two distinct design efforts. The added scope for LETF Quality support was reviewed for the appropriate skillset based on experience gained on Task Order 6SPI00381 and similar quality work on Task Order 7SPI00485 at KSC. (TP Rev A)

The effort previously planned to be accomplished by USTDC resources was determined to be hours of Engineering III, IV, and V time at a cost of . This is the basis of subcontractor support estimate. Additional funding added to the current contract will allow for continuity in existing subcontractor support. This estimate allows for continued support from Nelson Engineering through the remainder of CY7. (TP Rev B)

The labor classifications were chosen to provide the range of skills and experience that are the minimum necessary for the successful completion of the planned work effort. Subject Matter Experts and Engineer Vs assigned to this TO have specific expertise in the systems, technologies and concepts required by this

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TO. In addition to performing tasks requiring that skill level, these senior resources will direct, instruct and guide more junior-level engineers performing lower level tasks. A representative of the S & MA team will be sent to each of three types of training in order to ensure the most current knowledge and expertise in core software applications is available. This person will impart knowledge gained from the training to the rest of the team members.

Other Direct Charges (ODC)

ODCs to support this TO consist of subcontractor support, equipment, software, training, and travel.

Subcontractor support is a continuation of scope defined in CY6. Specific tasks for S & MA SAA development will continue through 3/31/09 using funds remaining from CY6. The estimate is based on work performed during CY6.

Travel will be performed to support technical meetings, reviews, and training. Travel costs were derived from commercial airline and rental car websites, estimated timeframe and length of travel. Lodging, mileage to and from the Orlando Airport, and meals were based on government per diem rates during the period of travel.

<u>Total ODC Cost:</u>	(TP Rev A)	(TP Rev B)
- CY7/FY09 ODC Total	(TP Rev A)	(TP Rev B)
- CY8/FY10 ODC Total:		

CY7/FY09

Subcontractor support: Total Cost: (Nelson Engineering)

Subcontractor support: Total Cost: (Nelson Engineering additional funding) (TP Rev B)

Subcontractor support: Total Cost: (Washington Safety Management Solutions LLC) Note: This amount is returned to the Task Order due to an invoice for work performed in CY6, but billed and paid out of CY7 funds. The CY6 Year end Task Order did not account for this amount due to the late invoice from Washington Safety. (TP Rev A)

- POV, local travel for all POV billed in FY09. USTDC personnel will travel to sites on and off KSC property to perform the activities on this TO, Qty: miles @ per mile. All estimates based on Government rate.

- Travel for one individual for to go to Tampa, FL for three days in September, 2009 for RsLogix 5000 Level 1: ControlLogix System Fundamentals CCP146. Training - , Rental car - lodging - M & IE - misc (taxes, phones, parking, tolls, gas) - All estimates based on Government rates and vendor quotes.

- Travel for one individual for to go to Houston, TX for six days during 2009 for the NASA Software Safety Course. Airfare - , Rental car - lodging - M & IE - misc (taxes, phones, parking, tolls, gas) - All estimates based on Government rates and vendor quotes.

- Travel for one individual to go to Orlando, FL for five days in December 2008 for Java training. Training cost: M & IE - misc (taxes, phones, parking, tolls, gas) - All estimates based on Government rates and vendor quotes.

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- Capability Maturity Model Integrated (CMMI) Version 1.2 Upgrade Online Training course, July 2009. Estimate based on vendor quote. (TP Rev B)

CY8/FY10

- Travel for three personnel for to go to Houston, TX for six days in 2010 for S & MA support for Ground System CDR and technical meetings at Johnson Space Center. Airfare - , Rental car - lodging - , M & IE - , misc (taxes, phones, parking, tolls, gas) - ... All estimates based on Government rates and vendor quotes with a escalation rate.

E. STANDARDS OF PERFORMANCE (METRICS)

1. - Task Order metrics will be collected in accordance with the USTDC Internal Surveillance Plan.

F. RISK ASSESSMENT

1 - Schedule RAC 12: Yellow (3/4/Near term)

Design review schedules have slipped from CY6 into CY7 such that there are a large quantity of reviews that will require additional resources. There is a possibility that: a) the skilled resources needed will not be available in time to support all the reviews; b) the individuals hired will take longer than expected to become proficient in NASA designs and safety requirements, resulting in missed project milestones.

Risk Response: Mitigate

Mitigation Strategy: In order to meet the anticipated review schedule, USTDC must do several things. (1) USTDC must pursue a hiring campaign to bring in Engineers IV immediately after TO approval. (2) The TO Plan includes moderate amounts of overtime and use of a subcontractor with CY6 funds to partially offset the manpower shortage. (3) Managers will actively participate in the performance of safety analyses until staffing catches up.

2. Schedule RAC 9: Yellow (3/3/Near term)

Given that the NASA produced Risk Based Assessment is required in order to complete other aspects of the SAA package; if the delivery of this assessment is delayed, there is a risk that the SAA packages will not be able to be completed on time.

Condition - NASA is required to provide a Risk Based Assessment to the subsystem design teams at the 30% review. This Assessment is the key document that will dictate whether or not an FMEA is required in the SAA development process. Delay in the delivery of the assessment could cause the SAA development schedule to be delayed, and there is a risk of missed milestones.

Risk Response: Mitigate

Response Plan: This risk will be mitigated by frequent communications with the NASA TOM with regard to the status and need for criticality assessments as design reviews approach. This communication will occur during weekly tag-up meetings with the TOM and the Customer Tech Rep. (TP Rev A)

3. Schedule RAC 16: Red (4/4/Near term)

Given that full NASA funding is required in order to complete all of the scope in the task order; there is a risk that milestones may not be able to be met without adequate funding.

Condition - To date, the Task Order has been significantly under funded. There are numerous products

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<p>upcoming that will require additional staff. Without adequate funding, there is a risk of missed milestones and unperformed work.</p> <p>Risk Response: Mitigate</p> <p>Response Plan: This risk will be mitigated by frequent communications with the NASA TOM with regard to the status and need for additional funding or added reduction of scope. Should the situation manifest itself such that there is the inability to perform specific tasks, the TOM will be consulted to determine priority of tasks. This communication will occur during weekly tag-up meetings with the TOM and the Customer Tech Rep. (TP Rev A)</p> <p>The Risk Assessment has been reviewed and remains valid. (TP Rev B)</p> <p style="text-align: center;"><u>G. OTHER PERTINENT INFORMATION</u></p> <p>S & MA Statement: S & MA activities are the primary deliverable under this TO.</p> <p>University Affiliation: No University Affiliation has been identified at this time.</p> <p>New Technology Reports: No New Technology Reports are expected for this Project TO.</p> <p>Export Control Compliance: All documents prepared and/or received under this TO will be reviewed for Export Control requirements. Documents not properly marked will be processed using the appropriate administrative and management controls.</p> <p>Success Story: A Success Story will be submitted at the completion of this TO.</p> <p>Organizational Conflict of Interest (OCI): The opportunity for the identified OCI risk has been mitigated by the signing of a waiver and Non-Disclosure Agreement (NDA) by Nelson Engineering. All staff members assigned to this task have executed Non-Disclosure Agreements, and therefore would be prohibited from using knowledge gained during subsequent procurements.</p> <p>The OCI assessment has been reviewed and remains valid. (TP Rev A)</p> <p>The OCI Assessment has been reviewed and remains valid. (TP Rev B)</p>		

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USTDC Task Order Plan Detail (ASRC)

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Productive Man-Hours	WYE	CY1-5	CY6	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	CY8	CY9	From	Delta	Totals	
Engineer IV																						
Engineering Designer III																						
Engineering Designer IV																						
IT Security Administrator III																						
Manager																						
Project Administrator I																						
Project Administrator II																						
Project Manager IV																						
Quality Assurance Engineer III																						
Quality Assurance Engineer V																						
Reliability Engineer III																						
Reliability Engineer IV																						
Reliability Engineer V																						
Software Engineer V																						
Subject Matter Expert																						
Total WYE:																						

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 Cummins, Martin

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Productive Man-Hours	CY1-5	CY6	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	CY8	CY9	From	Delta	Totals
Labor Hours																				
Engineer IV																				
Engineering Designer III																				
Engineering Designer IV																				
IT Security Administrator III																				
Manager																				
Project Administrator I																				
Project Administrator III																				
Project Manager IV																				
Quality Assurance Engineer III																				
Quality Assurance Engineer V																				
Reliability Engineer III																				
Reliability Engineer IV																				
Reliability Engineer V																				
Software Engineer V																				
Subject Matter Expert																				
Total Hr																				

Shirley C. Cummins
 Shirley C. Cummins
 5.21.09

Task Order#: 00485

CY: 7 Rev: C Plan Rev: B

USTDC Task Order Plan Detail (ASRC)

Labor Costs	CY7 Rate	CY1-5	CY6	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	CY8	CY9	From	Delta	Totals	
Engineer IV																						
Engineering Designer III																						
Engineering Designer IV																						
IT Security Administrator III																						
Manager																						
Project Administrator I																						
Project Administrator III																						
Project Manager IV																						
Quality Assurance Engineer III																						
Quality Assurance Engineer V																						
Reliability Engineer III																						
Reliability Engineer IV																						
Reliability Engineer V																						
Software Engineer V																						
Subject Matter Expert																						
ASRC Labor																						

Projected ODC	CY1-5	CY6	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	CY8	CY9	From	Delta	Totals	
ODC																					
Consultants																					
ODC Sub-Total																					

Signature
 Cummins, Martin

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TASK ORDER PLAN CHECKLIST

Task Order No. 7SPI00485 TO Rev. C TP Rev. B Validated By (PA): Cassandra Jacobs

Technology Outreach: Was USTDC involved in securing funding? Yes() No()
If yes, notify Tech Outreach

PLAN TEXT	N/A	SCHEDULE	N/A
<u>Contact Information</u>		<u>Gantt Chart</u>	
Names and Mailstops	<input checked="" type="checkbox"/>	Tasks	<input checked="" type="checkbox"/>
		Milestones	<input checked="" type="checkbox"/> <input type="checkbox"/>
		Deliverables	<input checked="" type="checkbox"/> <input type="checkbox"/>
		Resources	<input checked="" type="checkbox"/>
<u>Risks Identified(*Required)</u>		<u>Resource Requirements</u>	
Cost*	<input checked="" type="checkbox"/>	<u>Engineering Support</u>	
Schedule*	<input checked="" type="checkbox"/>	Technical Writing	<input type="checkbox"/> <input checked="" type="checkbox"/>
Technical*	<input checked="" type="checkbox"/>	Editing	<input checked="" type="checkbox"/> <input type="checkbox"/>
Safety*	<input checked="" type="checkbox"/> <input type="checkbox"/>	Word Processing	<input type="checkbox"/> <input checked="" type="checkbox"/>
Other		Graphics/Illustrations	<input type="checkbox"/> <input checked="" type="checkbox"/>
Security	<input type="checkbox"/> <input checked="" type="checkbox"/>	Drafting	<input type="checkbox"/> <input checked="" type="checkbox"/>
Export Control	<input type="checkbox"/> <input checked="" type="checkbox"/>	Web Page Design	<input type="checkbox"/> <input checked="" type="checkbox"/>
Health	<input type="checkbox"/> <input checked="" type="checkbox"/>	Web-Based Database Dev.	<input type="checkbox"/> <input checked="" type="checkbox"/>
Innovations	<input type="checkbox"/> <input checked="" type="checkbox"/>	Project Photography	<input type="checkbox"/> <input checked="" type="checkbox"/>
New Process	<input type="checkbox"/> <input checked="" type="checkbox"/>	Video/Audio	<input type="checkbox"/> <input checked="" type="checkbox"/>
Environment	<input type="checkbox"/> <input checked="" type="checkbox"/>	3D Animation/Modeling	<input type="checkbox"/> <input checked="" type="checkbox"/>
		CD-ROM	<input type="checkbox"/> <input checked="" type="checkbox"/>
<u>Quality Statement</u>	<input checked="" type="checkbox"/>	<u>Technical Services</u>	
<u>Other Pertinent Information</u>		Welding	<input type="checkbox"/> <input checked="" type="checkbox"/>
<u>ODCs</u>		Machine Shop	<input type="checkbox"/> <input checked="" type="checkbox"/>
Travel	<input checked="" type="checkbox"/> <input type="checkbox"/>	Cable Shop	<input type="checkbox"/> <input checked="" type="checkbox"/>
Training	<input checked="" type="checkbox"/> <input type="checkbox"/>	Pneumatic	<input type="checkbox"/> <input checked="" type="checkbox"/>
Material	<input type="checkbox"/> <input checked="" type="checkbox"/>	Instrum./Data Acquisition	<input type="checkbox"/> <input checked="" type="checkbox"/>
Equipment	<input type="checkbox"/> <input checked="" type="checkbox"/>	Safety Engineering	<input type="checkbox"/> <input checked="" type="checkbox"/>
Procurement	<input type="checkbox"/> <input checked="" type="checkbox"/>	Quality Inspection	<input type="checkbox"/> <input checked="" type="checkbox"/>
Consultants	<input type="checkbox"/> <input checked="" type="checkbox"/>	Reliability Engineering	<input type="checkbox"/> <input checked="" type="checkbox"/>
Services	<input checked="" type="checkbox"/> <input type="checkbox"/>	Environmental Engineering	<input type="checkbox"/> <input checked="" type="checkbox"/>
Identify Large Procurements	<input type="checkbox"/> <input checked="" type="checkbox"/>	Project Administrator	<input type="checkbox"/> <input checked="" type="checkbox"/>
University Affiliation	<input type="checkbox"/> <input checked="" type="checkbox"/>	Supervisor	<input type="checkbox"/> <input checked="" type="checkbox"/>
New Technology Report	<input type="checkbox"/> <input checked="" type="checkbox"/>	Matrixed Personnel	<input type="checkbox"/> <input checked="" type="checkbox"/>
Success Story	<input type="checkbox"/> <input checked="" type="checkbox"/>	IT Security Plan (Sys. Adm.)	<input type="checkbox"/> <input checked="" type="checkbox"/>
Tech. Dev. & App'l Report	<input type="checkbox"/> <input checked="" type="checkbox"/>		
Commercialization Potential	<input type="checkbox"/> <input checked="" type="checkbox"/>		
Innovations Data Base	<input type="checkbox"/> <input checked="" type="checkbox"/>		
		<u>PLAN PACKAGE</u>	
<u>COST SHEET</u>		Checklist	<input checked="" type="checkbox"/>
		Plan	<input checked="" type="checkbox"/>
<u>Subcontractor Concurrence</u>		Cost Sheet	<input checked="" type="checkbox"/>
Swales	<input type="checkbox"/> <input checked="" type="checkbox"/>	Schedule	<input checked="" type="checkbox"/>
Sierra Lobo	<input type="checkbox"/> <input checked="" type="checkbox"/>	NASA TOM Tech.Eval Sheet	<input checked="" type="checkbox"/>
UCF/SRTI	<input type="checkbox"/> <input checked="" type="checkbox"/>		
Overtime Planned	<input type="checkbox"/> <input checked="" type="checkbox"/>		

05-2002-0001 (1.3.37)

TASK ORDER 00485 CY7 Rev C

	<u>CY6</u>			<u>CY7 Baseline</u>			<u>CY8</u>			<u>TOTAL</u>
	RATE	HRS	COST	RATE	HRS	COST	RATE	HRS	COST	
<u>Direct Labor</u>										
Engineer IV										
Engineering Designer III										
Engineering Designer IV										
IT security Administrator III										
Manager										
Project Administrator I										
Project Administrator III										
Project Manager IV										
Quality Assurance Engineer III										
Quality Assurance Engineer V										
Reliability Engineer III										
Reliability Engineer IV										
Reliability Engineer V										
Software Engineer V										
Subject Matter Expert										
Total ASRC Labor										
Total Subcontract Labor										
TOTAL LABOR										
M&A										
Total Labor										
Other Direct Costs										
Subtotal										
Subcontract G&A										
ODC G&A										
Subtotal G&A										
Total Estimated Cost										
Adjusted Target Cost (less ODC)										
Award Fee										
Incentive Fee										
Total Est Cost & Fee										
			<u>\$1,935,551</u>			<u>\$3,471,562</u>			<u>\$2,993,190</u>	<u>\$8,400,302</u>

Figures may differ from task order summary due to rounding.

**University-affiliated Spaceport Technology Development Contract (USTDC)
Combination Pre-Negotiation/Price Negotiation Memorandum**

Title – S&MA Products for CxP Subsystem Development

Purpose and Description of Task Order

The purpose of this task order is to define a requirement for the contractor to perform Safety & mission Assurance (S&MA) tasks for the development of Constellation Ground System Subsystem. **The purpose of this revision is to perform the following: (1) Adjust deliverable due dates per the 5-15-09 edition released CxP NE Subsystem Design Phase schedules; (2) Reduce scope for an additional system where Failure Modes and Effects Analyses (FMEAs) are determined not required by NASA; (3) Clarify which subsystems are deemed Flight Critical; (4) Convert existing labor scope to ODC in order to utilize a subcontractor for specific System Assurance Analyses (SAA) deliverables and; (5) Increase competence in the Capability Maturity Model Integrated (CMMI) Version 1.2 Upgrade.**

The period of performance for this Task Order will be from November 16, 2007 through September 30, 2010.

The Task Order Plan and ASRC's final cost proposal is the product of a series of requirements definition meetings undertaken between the contractor and the Government to arrive at a fair and reasonable technical approach, skill mix, necessary ODC's, and the associated costs. This memorandum details the resultant task order value.

Participants

Contracting Officer – Joyce McDowell/OP-ES
NASA Task Order Manager – Roger MatthewNE-D1

CTM – Meredith Chandler/NE-I2
USTDC Lead – K. Jacobs
USTDC TOM – P. Gamble

Status of Contractor Systems

ASRC's Accounting system has been determined to be adequate for the accumulation, reporting and billing of costs under government contracts. (Reference DCAA Audit Report No. 6311-2005D17740010, dated March 30, 2005.) The Billing system has also been determined to be adequate for billing costs accumulated under government contracts. (Reference DCAA Audit Report No. 6311-2005D17740011, dated April 6, 2005.) A Purchasing system review was performed by NASA/KSC and determined ASRC's purchasing policies and practices to be adequate for protecting the Government's interest. (Reference Contractor Purchasing System Review, dated August 27, 2008).

Certificate of Current Cost or Pricing Data

A certificate of cost or pricing data is not required at this dollar value.

Cost Elements

Labor

The total proposed adjusted target labor cost of the work associated with the subject Task Order (TO) is decreased by _____ for a revised total of _____. The labor classifications and rates proposed by ASRC are in compliance with contract clause B.6, Task Order Pricing. The NASA Task Order Manager (TOM) has reviewed ASRC's task order plan and found the proposed labor hours and skill mix appropriate and reasonable to facilitate successful completion of the subject TO as evidenced by his signature on the Task Order Plan as well as the attached Technical Evaluation dated May 21, 2009.

Other Direct Costs (ODC's)

ASRC has proposed an increase in ODC's by _____. The revised task total is _____. The NASA Task Order Manager (TOM) has reviewed ASRC's proposed ODC's and found them acceptable and reasonable as evidenced by the attached Technical Evaluation.

Fee

The total fee is calculated in accordance with that negotiated at the time of contract award and established in contract clause B.2, Contract Value, Award Fee, and Incentive Fee.

Other Data

The Resource Management Office (RMO) has verified that funds are available in the amount of \$5,057,642 for this effort. Additional funds will be added at a later date. If additional funds are not available, the scope of the work will be reduced. The period of performance is from November 16, 2007 through September 30, 2010.

Summary

Based on the above, the Contracting Officer has determined that the proposed decrease in the estimated cost and fee of \$6,730 for the subject Task Order Revision is fair and reasonable and finds it in the best interest of the Government to issue Task Order 00485 CY7 Rev C in the total Cost Plus Award/Incentive Fee amount of \$8,400,302.



Joyce McDowell
Contracting Officer



Date

Enclosures\
Government Negotiation Position
Technical Evaluation
Task Order Plan

NAS10-03006: USTDC TECHNICAL EVALUATION FORM

(Use of this form is mandatory for all Task Order Plan changes)

WHEN A BASIS OF DETERMINATION BLOCK IS CHECKED, FILL INS ARE REQUIRED.

PROJECT TITLE S&MA Products for CxP Subsystem Development	Task Order No.: 485	
Technical Evaluator's Statement: I have reviewed the referenced Task Order Plan to confirm the Contractor's understanding of the scope of work and to ascertain the reasonableness of the kinds and quantities of resources proposed to accomplish that work. My findings and the rationale are provided below.	Revision: <u>C</u>	Task Order Plan Revision: <u>B</u>

1. JOINT DEVELOPMENT OF TECHNICAL REQUIREMENTS

Prior to meeting with the contractor to develop the detailed technical requirements of this task, the NASA Task Order Manager (TOM) estimated the total cost of the work to be: _____.

On 5/6/09 NASA and the contractor met to jointly develop the technical requirements of this task order plan.

Discussion with the contractor during the technical requirement definition meeting(s) and application of the rates required by the basic contract, resulted in a total estimated cost of: _____.

Differences (if any) between the original Government estimate and the results of the technical requirement definition meeting is due to the following general factors:

THIS REVISION DOES NOT ADJUST FUNDING. THIS REVISION

ADJUSTS SCOPE AND ADJUSTS OPC LIMITS TO ALLOW AT

SUBCONTRACTOR SUPPORT.

2. ADEQUACY OF THE CONTRACTOR'S UNDERSTANDING OF THE STATEMENT OF WORK (SOW):

STATEMENT OF WORK:

The contractor's description of the work to be performed, methods of accomplishment, schedules and/or plan of execution are () are not consistent with the intent of the Task Order and reflect a reasonable basis to proceed.

3. ADEQUACY OF LABOR RESOURCE REQUIREMENTS:

ASSESSMENT OF LABOR HOURS:

The kinds, quantities, and distribution of labor hours proposed (including those of subcontractors, university affiliates, and/or the use of overtime, if proposed) are () are not considered appropriate and reasonable to accomplish the scope of work. The basis for this determination is:

Previous experience with task order number 486 from CY 7. The hours and skill mix are consistent with the actuals experienced on this successfully completed task.

Previous experience with the work performed on contract number _____. The work successfully performed on this past contract was similar in nature and scope to the work being considered on this task.

NAS10-03006: USTDC TECHNICAL EVALUATION FORM

(Use of this form is mandatory for all Task Order Plan changes)

WHEN A BASIS OF DETERMINATION BLOCK IS CHECKED, FILL INS ARE REQUIRED.

- Engineering judgment gained from 25 years working on similar projects.
- Government engineering breakdown/analysis of all elements. (Attached)
- Detailed comparison with independent Government estimate. (Attached. Include an explanation of Inconsistencies between the Government Estimate and the final Task Order Plan)
- Other basis:

4. ASSESSMENT OF OTHER DIRECT COSTS (ODC):

a. MATERIAL and OTHER SUBCONTRACT COST:

The kinds and quantities of materials, equipment, and/or other subcontracts (including consultants, temporary services, etc.) are () are not () N/A considered appropriate and reasonable to accomplish the scope of work. The basis for this determination is:

- Previous experience with task order number 486 from CY 7. The proposed ODC's are consistent with the actuals experienced on this successfully completed task.
- Previous experience with the work performed on contract number _____. The work successfully performed on this past contract was similar in nature and scope the work being considered on this task.
- Engineering judgment gained from 25 years working on similar projects.
- Government engineering breakdown/analysis of all elements. (Attached)
- Detailed comparison with independent Government estimate. (Attached. Include an explanation of Inconsistencies between the Government Estimate and the final Task Order Plan)
- Other basis:

b. TRAVEL:

The contractor's proposed use of travel () is () is not N/A considered appropriate regarding the number and nature of trips and travelers, destinations and duration of stays. The basis for this determination is:

- Previous experience with task order number _____ from CY _____. The proposed travel is consistent with the actuals experienced on this successfully completed task.
- Previous experience with the work performed on contract number _____. The work successfully performed on this past contract was similar in nature and scope the work being considered on this task.
- Engineering judgment gained from ___ years working on similar projects.
- Government engineering breakdown/analysis of all elements. (Attached)
- Detailed comparison with independent Government estimate. (Attached. Include an explanation of Inconsistencies between the Government Estimate and the final Task Order Plan)
- Other basis:

NAS10-03006: USTDC TECHNICAL EVALUATION FORM

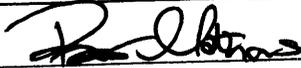
(Use of this form is mandatory for all Task Order Plan changes)

WHEN A BASIS OF DETERMINATION BLOCK IS CHECKED, FILL INS ARE REQUIRED.

5. ANY OTHER COMMENTS (SCHEDULES, ETC):

NASA Task Order Manager: Roger Mathews

Signed:



Date: 5/21/09