SECTION C

DESCRIPTION/SPECIFICATION/WORK STATEMENT

C.1 STATEMENT OF WORK

The Contractor shall furnish all resources and facilities necessary for the performance of this Statement of Work (SOW), except for those items specifically identified as Government-furnished or installation-provided. The resources and facilities include personnel, materials, supplies, and equipment.

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1.0 INTRODUCTION AND BACKGROUND

1.1 The effort described by this SOW provides for the assurance, engineering, and risk assessment in the disciplines of safety, reliability, maintainability, supportability, availability and quality within the Johnson Space Center (JSC) and outside JSC, both domestic and abroad.

1.2 This contract provides for continuity of services to the NASA JSC Safety and Mission Assurance (S&MA) Directorate in the areas of safety, reliability, maintainability, and quality. The Government maintains responsibility for S&MA policies and decisions. The Contractor shall provide services and products that accomplish those policies and decisions as defined in this SOW.

1.3 This effort includes the review of work done by other contractors, International Space Station (ISS) Program International Partners (IPs), and other National Aeronautics and Space Administration (NASA) organizations. In addition, this SOW applies to future Programs and Projects as directed by NASA task order.

1.4 The major part of this work is located at JSC in Houston, Texas. However, resident support is required at JSC field offices at White Sands Test Facility (WSTF), New Mexico; Kennedy Space Center (KSC), Florida; and Huntington Beach, California. Contractor services shall be required at other locations, NASA contractor, subcontractor, or vendor facilities as requirements warrant.

1.5 Functions and tasks described herein shall not be construed as implying that the Contractor has the authority to approve or disapprove Government policies, procedures, specifications, or requirements or those of any other Government contractor. Nor will language herein be construed to mean that the Contractor has the authority to accept or reject on the Government's behalf any products or services. The Contractor's functions shall require presentation of its analysis to the appropriate Government official for further action. The Contractor is not authorized to act as an agent of the Government or to represent itself as such. Specific exceptions to this approval restriction will be directed by the Government in writing on a case-by-case basis.

2.0 GENERAL

The fundamental requirements for the work described in this SOW are based on NASA safety, reliability, maintainability, and quality policies, and Program and Project specific requirements. The work performed under this contract shall conform to the JSC processes.

2.1 Work Authorization

2.1.1 Work under paragraphs **3.0 CONTRACTOR MANAGEMENT RESPONSIBILITIES**, **4.0 S&MA PERSONNEL QUALIFICATION PROGRAM**, and **10.0 RECEIVING INSPECTION TEST FACILITY (RITF)** shall be performed as a completion form based effort. The completion form based effort is required for the duration of the contract.

2.1.2 All remaining paragraphs of the SOW shall be performed as Level-of-Effort (LOE). Work to accomplish LOE tasks shall be performed only through the issuance of task orders to the Contractor.

2.2 Data Requirements

2.2.1 The Data Requirements List (DRL) and the Data Requirements Descriptions (DRDs), found in Section J, are part of this SOW.

2.2.2 In addition to the data deliverables described in Section J, the Contractor shall manage all documentation and data produced in performance of this contract (e.g., assessments, evaluations, reports, presentations, reviews, and statuses) in accordance with the requirements of SOW Section 3.7 Information Technology (IT).

2.3 Reference

See Section J for applicable documents, definition of terms, and acronyms used in this SOW.

3.0 CONTRACTOR MANAGEMENT RESPONSIBILITIES (Completion Form)

The Contractor shall manage and administer all contract activity. The Contractor shall provide and maintain management interfaces to the S&MA Directorate, Contracting Officer (CO), Contracting Officer Technical Representative (COTR), and Technical Management. The Contractor shall report formally as required in the contract, and shall respond to JSC S&MA Management queries related to contracted activities.

3.1 Program Management

3.1.1 The Contractor shall develop and implement management functions to ensure that all contracted activities are accomplished in accordance with contract terms and conditions. The contractor shall accomplish these management functions through management approach, organization, and controls that are determined by the contractor to be optimum. The contractor shall provide and maintain management systems for the planning, organization, control, and reporting of all activities required by this contract. These systems shall assure accomplishment of program technical and schedule requirements, and cost objectives.

3.1.2 The Contractor shall integrate all tasks and elements of the contract to facilitate cross department communications, common processes and tools across appropriate support areas, effective measurement of performance, and identification of initiatives to improve overall safety or mission assurance for human spaceflight.

3.1.3 The Contractor shall perform in accordance with the Management Plan (DRD 01). The Contractor shall determine and document lessons learned in the performance of tasks under this SOW in accordance with DRD 02, Lessons Learned.

3.1.4 The Contractor shall provide Integrated Technical Management Reports in accordance with DRD 03, Integrated Technical Management Report.

Performance Standards - Program Management:

1. 90% of employees trained to do the job they are working on based on established and approved qualification standards and training plans.

2. Customer Satisfaction - Performance of all technical areas (resources, skills, and materials) receive an overall minimum rating of “good.”

3. 100% of Contract Data Deliverables delivered on time.

3.2 Cost and Schedule

The Contractor shall establish a Work Breakdown Structure (WBS) in accordance with DRD 04, Work Breakdown Structure, to serve as the framework for contract planning, budgeting, cost reporting and schedule status reporting. The Contractor shall report accrued costs to NASA in accordance with DRD 05, Contractor Financial Management Report. The Contractor shall present the Integrated Technical Management Reports (DRD 03) and discuss costs, cost variances, technical status, and schedules during status meetings with the CO, COTR, and S&MA management.

Performance Standard - Cost and Schedule:

1. Customer Satisfaction –Technical Management Reports provide timely and necessary insight regarding Contractor activities, progress, accomplishments, and any documented contract performance problems with their corresponding resolutions and corrective actions.

3.3 JSC Program Safety and Mission Assurance (S&MA) Panels

a. The JSC Program S&MA Panels, chaired by civil servants, are responsible for ensuring that all applicable S&MA-related requirements are incorporated into JSC Projects and Programs. The Contractor shall perform tasks that assist the Panel Chairs in the execution of their responsibilities. Contractor participation shall be required prior to and during the S&MA Panels in order to effectively accomplish the tasks identified below. Note that individual S&MA Panels require different suites of tasks in order to sustain their function and scope depending on agreements between the JSC S&MA Directorate and the Programs.

b. Primary objectives of tasks performed by the Contractor are to assist the Panel Chair to verify that the interpretation and implementation of safety-related requirements are consistent with NASA issuance, and assure that safety-critical subsystems, payloads, and operations are appropriately verified. In order to accomplish these objectives, the Contractor shall recommend requirement implementations, evaluate implementation documents and waiver requests, negotiate resolution of safety issues, assist the Programs and Projects with interpretation, and assist with the integration of safety processes across Programs, Projects, contractors, and International Partners.

c. The anticipated JSC Program S&MA Panels that the JSC S&MA Directorate will support are:
   - ISS Flight Safety Review Panel (SRP)
     SRP Workload Estimates:
     - Number of in-board meetings per year: 87
     - Number of items reviewed: 572
     - Number of panel members: 13

- JSC Safety Engineer Review Panel (JSERP)
- Integration Safety Engineering Review Panel (ISERP)
  JSERP and ISERP Combined Workload Estimates:
  - Number of in-board meetings per year: 61
  - Number of items reviewed: 684
  - Number of panel members: 8 each
- SSP/ISS Payload Safety Review Panel (PSRP)
  PSRP Workload Estimates:
  - Number of in-board meetings per year: 184
  - Number of items reviewed: 1500
  - Number of panel members: 11
- Government-Furnished Equipment (GFE) Safety and Mission Assurance Review Team (SMART)
  GFE SMART Workload Estimates:
  - Number of in-board meetings per year: 235
  - Number of items reviewed: 424
  - Number of panel members: 16
- ISS Quality & Product Assurance Panel (QPAP)
  QPAP Workload Estimates:
  - Number of in-board meetings per year: 26
  - Number of items reviewed: 260
  - Number of panel members: 18
- ISS Reliability and Maintainability (R&M) Panel
  R&M Panel Workload Estimates:
  - Number of in-board meetings per year: 30
  - Number of items reviewed: 150
  - Number of panel members: 11

  <u>Combined S&MA Panel Workload Estimates</u>:
  - Number of in-board meetings per year: 623
  - Number of items reviewed: 3590

3.3.1 Administrative Tasks

The Contractor shall perform the following tasks to coordinate and document Panel activities:

a. Schedule S&MA Panel meetings and reserve meeting facilities.

b. Develop and post S&MA Panel meeting agendas.

c. Develop and post S&MA Panel meeting minutes.

d. Develop and maintain S&MA Panel distribution lists.

e. Develop and maintain processes to track and provide current status of S&MA Panel actions and issues.

f. Develop and maintain S&MA Panel databases to ensure availability, completeness, accuracy, and security of the data.

g. Develop and maintain S&MA Panel websites to provide NASA access to meeting documentation.

h. Develop and maintain data management processes for S&MA data [e.g., Safety Data Packages (SDPs), Hazard Reports (HRs), Failure Modes and Effects Analysis / Critical Items Lists (FMEA/CILs), Non-Conformance Reports (NCRs)] to ensure that the data is received, distributed, filed, archived, and made available to the panel and reviewers.

i. Develop and maintain a process to ensure that export control regulations (reference NPD 2190.1, NASA Export Control Program Policy) are applied to data handled by the S&MA Panels and that appropriate restrictions are applied to applicable NASA data and/or information distributions.

j. Upload or input safety data into non-S&MA databases [e.g., Vehicle Master Database (VMDB)] that are maintained by the Programs to provide single data source for related system information required by the Programs.

Performance Standards - S&MA Panel Administrative Tasks:

1. Customer Satisfaction – Administrative support receives an overall minimum rating of “good.”

2. Adequate meeting minutes prepared and ready for Chair signature within two working days of the formal meeting.

3.3.2 Technical Tasks

The Contractor shall perform the following tasks:

a. Provide technical interpretation of safety requirements and implementation strategies based on technical merit for acceptability and recommendations on S&MA Panel review and acceptance.

b. Develop narratives and presentation products for all items and topics submitted to S&MA Panels.

c. Provide written technical recommendations for safety products (e.g., SDPs, HRs, FMEA/CILs, NCRs) that are submitted to the S&MA Panels for approval or resolution.

d. Perform launch vehicle manifest assessments to identify unresolved safety and certification issues and provide recommendations on resolution.

e. Perform integration analyses for HRs, SDPs, and FMEA/CILs to verify that all hazards identified have been analyzed, tested, or controlled.

f. Perform assessments of verification data [e.g., Verification Closure Notices / Verification Tracking Logs (VCN/VTLs)] for evidence of requirements compliance (e.g., verification mapping to HRs).

g. Perform and document reassessments of safety requirements/certifications to ensure the validity of the requirements/certifications for the next mission and planned flight.

h. Evaluate modifications to systems and payloads that affect critical systems or create a potential hazard and provide results to the appropriate panels.

i. Develop Safety of Flight Certification Letters for S&MA Panel approval.

j. Maintain cognizance of flight safety status to identify and address safety issues in various technical and safety forums.

k. Provide technical coordination with other NASA Centers, Contractors, Programs, Projects, and International Partners / Participants (IP/P) S&MA organizations to facilitate a clear and consistent understanding of topics, issues, and actions.

l. Provide technical expertise to the various S&MA Panel working groups (e.g., Joint American-Russian Safety Working Group (JARSWG), Safety Working Group (SWG), and Quality Working Group (QWG)) for investigation, analysis, and proposed resolutions to issues/actions.

Performance Standard – S&MA Panels Technical Tasks:

1. Customer Satisfaction – Content and thoroughness of technical assessments effectiveness of pre-board meetings and Board/Panel receives an overall minimum rating of "good."

3.4 Quality Management System

3.4.1 The Contractor shall establish and maintain an internal Quality Management System (QMS) for services and tasks performed under this SOW. The Contractor's QMS shall comply with the ANSI/ISO/ASQ Q9001-2000, Quality Management System Requirements, and JPD 5335.1, JSC Policy Directive - Quality

Policy. The Contractor's QMS will be audited by NASA or a NASA-provided third party to confirm compliance. The Contractor shall comply with the JSC QMS for the products and services provided to the Government under this contract. The Contractor shall provide a Quality Manual per DRD 06, Quality Manual, and supporting metrics per DRD 07, Contractor Quality Metrics, including the assessment and implementation of internal continuous improvement initiatives in order to provide better products and services to S&MA customers.

3.4.2 Should the Contractor be or become International Standards Organization (ISO) Certified, copies of the certification audit report and correspondence confirming certification shall be supplied to the CO.

3.4.3 The Contractor shall provide technical and engineering products to S&MA Directorate QMS activities that include:

a. Conducting assessments and assisting in S&MA QMS continuous improvements efforts.

b. Preparing system level procedures and detailed work instructions of S&MA processes for JSC approval.

c. Training for S&MA personnel (both Government and Contractor).

d. Generation, periodic review, and maintenance of all S&MA work instructions.

Performance Standards - Quality Management System:

1. No major findings during Center ISO audits.

2. Effective ongoing demonstration by the Contractor of quality performance and defect prevention.

3. Quality Metrics – Positive trending on metrics that indicate Contractor’s QMS is effective.

4. Customer Satisfaction – Contractor support to S&MA Directorate QMS activities receive an overall minimum rating of “good.”

3.5 Property Management

The Contractor shall develop and implement a Property Management Plan in accordance with DRD 08, Property Management Plan. The Contractor shall perform on-site property management and administration of all property acquired by or in possession of the Contractor and subcontractors associated with the execution of this contract in accordance with contract terms and conditions.

Performance Standards - Property Management:

1. 100% of Property Reports submitted on time.

2. Minimum of 98% of accountable property accounted for.

3.6 Safety and Health

The Contractor shall ensure the protection of personnel, property, equipment, and the environment by complying with NASA policies and requirements (see Section J, Applicable Documents, Safety and Environment Health subsection) and federal, state, and local regulations for safety, health, environmental protection, and fire protection. The Contractor shall develop and implement a Safety and Health Plan in accordance with DRD 09, Safety and Health Plan. Health and safety reporting requirements shall include an annual Safety and Health Program Self-Evaluation, and Monthly Safety and Health Metrics Report in accordance with DRD 10, Safety and Health Program Self Evaluation and DRD 11, Monthly Safety and Health Metrics.

Performance Standards - Safety and Health:

1. 100% of required reports and metrics delivered on schedule.

2. Injury/illness rates below industry average.

3. Participation in or accomplishment of at least two Safety Leadership / Safety Risk Mitigation activities per Award Fee Period.

3.7 Information Technology (IT)

3.7.1 The Contractor shall provide Information Technology (IT) products and services to the JSC S&MA Directorate in accordance with JPD 2800.1, JSC IT Program, and JPD 2800.4, JSC IT Program Management. These products and services consist of tools, data systems, and web-sites that support S&MA activities.

3.7.2 The Contractor shall establish and maintain an IT Plan in accordance with DRD 12, Information Technology Plan.

3.7.3 The Contractor shall implement and maintain configuration control of hardware, software, and existing data systems per the approved IT Plan.

3.7.4 The Contractor shall establish and implement Data Management Plan per DRD 13, Data Management Plan. The Data Management Plan shall describe the management, preparation, control, and dissemination of data and documentation required and produced under this contract in order to provide NASA with direct, on-going access to all data and documentation required to accomplish S&MA responsibilities. The plan shall include an assessment of existing S&MA data and documents, methods for identifying and acquiring Safety, Reliability, and Quality Assurance (SR&QA) data and documents, requirements for storage, equipment and methods of accessing data and documents, and data management philosophy. All documents and data produced in performance of this contract shall be organized, controlled, and stored on NASA IT equipment.

3.7.5 The Contractor shall prepare and provide user instructions and training to S&MA personnel on the use of hardware, software, and data systems used by the organization to accomplish its responsibilities, tasks, and activities.

3.7.6 The Contractor shall acquire and maintain analytical tools and databases to augment or accomplish work defined in this SOW and the accomplishment of the S&MA Directorate mission. The Contractor shall maintain existing tools, databases, and websites as well as those developed in performance of this contract utilizing software and applications recognized as JSC standards. Proprietary or non-JSC-standard applications, protocols, or IT systems shall not be utilized without prior NASA contractual authorization.

3.7.7 The Contractor shall administer the S&MA laptop computer loan pool and maintain information on the use of the laptops which includes a tracking log (user and due date). The Contractor shall check out current copies of software available for home use as provided by the Information Resources Directorate (IRD). The Contractor shall maintain and assure the accuracy of the Customer Service System (CSS) database. The Contractor shall receive all requirements for new IT or telephone equipment and for moves of existing equipment. The Contractor shall write all Service Requests (SRs) required to obtain or move the IT or telephone equipment. The Contractor shall also write or assist in writing all SRs within the S&MA Directorate.

3.7.8 The Contractor shall participate in the JSC IRD led Information Technology Steering Council (ITSC) and Customer Forum meetings for the purpose of coordinating planned IT activities that affect JSC systems, and sharing information on current IT topics that affect S&MA systems. The ITSC, established under the authority of JPD 2800.4, JSC IT Program Management, acts as the Center IT Program control board. For planning purposes, the ITSC meets twice monthly and the Customer Forum meets approximately monthly. The Contractor shall provide technical expertise at IRD boards and meetings, such as the Network Access Control Board

(NACP) which typically meets once each week for one to three hours.

Performance Standards - Information Technology:

1. 100% of data and documentation required to support S&MA tasks and activities is posted in a timely manner and the completeness, accuracy, and security of the data and documentation is maintained in accordance with the Data Management Plan.

2. Customer Satisfaction – Data system development and modification receive an overall minimum rating of “good.”

3. 100% of ITSC and IRD Customer Forum scheduled meetings are supported in accordance with SOW requirements.

4.0 S&MA PERSONNEL QUALIFICATION PROGRAM (Completion Form)

4.1 The S&MA Contractor shall develop, implement, and maintain a comprehensive S&MA Personnel Qualification Program, in accordance with DRD 14, S&MA Personnel Qualification Program Plan, to include management of an existing training database. This Program shall provide training to qualify S&MA personnel for the positions they are assigned. The Contractor shall develop and maintain a plan for the administrative tasks that support this Program.

4.2 Specific skills, such as welding and Non-Destructive Evaluation (NDE), require formal certification. When certification is required, the S&MA Contractor shall arrange the required training associated with certification and develop courses as needed for the Personnel Qualification Program.

Skills currently identified as requiring certification are:

- Pressure Systems
- Certified Welding Inspector (CWI)
- Nondestructive Evaluation (NDE)
    - Level II and III
        - Magnetic Particle
        - Liquid Penetrant
        - Radiographic
        - Ultrasonic
        - Visual Testing
        - Industrial Radiography
        - Radiation Safety
- ISO Quality Systems Auditor
- Mechanical Inspector
- Calibration Technician
- Safety Engineer
- Reliability Engineer
- Quality Auditor
- Quality Technician
- Quality Engineer
- Quality Manager
- Software Quality Engineer

<u>Performance Standards - S&MA Personnel Qualification Program</u>:

1. 100% of periodic reports submitted on schedule.

2. 100% employees with up to date training plans.

3. Customer Satisfaction – Course attendees opinion surveys indicate satisfaction with course content and level of detail.

5.0 PROGRAM SUPPORT

a. The Contractor shall provide services and products for Program S&MA engineering tasks. Services and products consist of assisting in the development of Program requirements, performing analyses, assessments, audits, reviews, and evaluations; preparing and presenting reports and briefings; and participating in meetings and review boards and panels. The Contractor shall verify that Program design and operations meet S&MA requirements and identify issues and non-conformances. The Contractor shall evaluate the design, manufacturing, testing, and refurbishment of spaceflight hardware and software to ensure delivery of products in accordance with functional, performance, and design requirements. The Contractor shall perform S&MA activities throughout the Program life-cycle as described in this section in order to assure systems meet requirements. Life-cycle phases may overlap and tasks may be worked or revisited in more than one phase.

b. The Contractor shall provide engineering assessments for software intensive ground systems residing at JSC that support the design, development, and test of flight systems. The Contractor shall also provide engineering assessments for JSC facility software.

c. The Contractor shall identify and assess risks to Programs consistent with Program risk management plans. This includes the identification and evaluation of risks, reporting of risks, tracking the resolution of identified risks, and the development and evaluation of proposed risk mitigation strategies throughout the Program life-cycle.

d. The Contractor shall develop and review human factors considerations for each phase of the Programs' life-cycle. The Contractor shall assess the effectiveness of mitigations for human factors related hazards.

e. The Contractor shall integrate and coordinate S&MA products and services across Programs that are relevant to multiple Programs or Projects.

5.1 Concepts and Requirements Phase

This phase includes Program feasibility assessments, Program definition and approval, and requirements definition and approval. The Contractor shall develop and review Program requirements documents to ensure that S&MA requirements are included. The task includes assisting in the development of top-level Program policies and requirements, research to define and develop workmanship standards and specifications, the development of software assurance guides and standards, and the development of implementation plans, processes and work instructions. The Contractor shall assess software and hardware assurance plans, quality plans, safety plans, procedures, processes, and reports for compliance with NASA and JSC policies, procedures and standards.

5.1.1 Safety, Reliability, and Maintainability Goals and Requirements

The Contractor shall assist in developing and refining safety goals and requirements such as overall probability of a catastrophic event, probability of a catastrophic event during launch/boost phase requiring separation/abort, probability of a catastrophic event during other mission phases (e.g., on-orbit, Extravehicular Activity (EVA), rendezvous and docking, reentry and landing), or probability of a specific catastrophic event (e.g., fire, loss of a specific system or sub-system). These requirements shall meet or exceed the standards set forth in the NASA-STD-8729.1, Planning, Developing, and Maintaining an Effective Reliability and Maintainability (R&M) Program. The Contractor shall also assist in developing and refining reliability goals and requirements, such as availability, maintainability, and Mean-Time Between Failure (MTBF). Once developed, these goals and requirements will be used to establish Program safety requirements such as redundancy, fault tolerance, Micro-Meteoroid and Orbital Debris (MMOD) protection, and launch abort capabilities.

5.1.2 Quality Assurance Goals and Requirements

The Contractor shall assist in developing and refining quality assurance goals and requirements. The Contractor shall participate in the preparation, review, and assurance of proper implementation of procedures, processes, inspection planning, and quality assurance requirements.

5.1.3 Requirements Reviews

The Contractor shall support formal Program Requirements Reviews to ensure that S&MA principles and practices are incorporated into Program policies and requirements. The Contractor shall coordinate and document all proposed inputs on formal documents such as Review Item Discrepancies (RIDs), and track and ensure proper closure of RIDs that impact S&MA.

5.1.4 Trade Studies

The Contractor shall perform and support trade studies to assist JSC S&MA in assuring that risk-based decision making processes are used to select among competing design and operational concepts, in order to minimize technical and Program risk, and meet S&MA goals and requirements.

5.1.5 Feasibility Assessments

The Contractor shall participate in feasibility assessments to ensure that Program design and operational concepts are achievable and meet S&MA requirements.

5.1.6 Technical Assessments

The Contractor shall perform qualitative and quantitative assessments. The technical subjects are determined real-time and require the Contractor to develop or perform analyses such as, reliability, Probabilistic Risk Assessment (PRA), fault-tree analysis, trend analysis, statistical analysis, or engineering analysis.

5.2 Design and Development Phase

This phase includes preliminary and detailed design, and system design validation. Design validation is generally accomplished through a combination of test, analysis, and inspection of a flight-like unit to prove the design meets the requirements.

5.2.1 Program Design Milestone Reviews

5.2.1.1 The Contractor shall perform S&MA evaluations of proposed designs to ensure compliance with Program S&MA requirements, to identify areas where design modifications could reduce or eliminate risk, and to identify areas of non-compliance. The Contractor shall also ensure that S&MA products (such as safety assessment reports, failure modes and effects analyses, and critical items lists) required to be delivered in support of each milestone have been provided. The Contractor shall document any findings, comments, or recommendations, and shall track the closure of all items that impact S&MA.

5.2.1.2 The Contractor shall develop S&MA design criteria and requirements; tasks and activities to be performed; and verification and assessment methods. The Contractor shall assess these items when developed by other entities. The Contractor shall provide input in establishing the verification method success criteria for each requirement in the verification plans.

5.2.2 Integrated Teams

Programs form teams to assure that all relevant organizations (such as Engineering, Mission Operations, Space Life Sciences, and S&MA) are properly represented and have an opportunity to interactively discuss Program concepts and requirements. The Contractor shall participate on such teams to ensure that S&MA requirements are met and that S&MA concerns are properly addressed.

5.2.3 Requirements and Design Changes

The Contractor shall assess all change requests for compliance to S&MA requirements and identify areas of risks, non-compliances, and impacts of accepting non-compliances. The Contractor shall continue this support throughout the Program life-cycle.

5.2.4 Safety

5.2.4.1 The Contractor shall ensure the application of a process for the systematic identification and control of hazards during the design phase. The Contractor shall identify the risk inherent in a system's design and operation by quantifying both the likelihood of various possible risk sequences and their consequences, using various tools such as fault trees, event trees, and reliability block diagrams.

5.2.4.2 In performing Safety Analyses, the Contractor shall:

a. Evaluate Safety Assessment Reports (SARs) and Hazard Reports (HRs) per NSTS 22254, Methodology for Conduct of Space Shuttle Program Hazard Analyses, and SSP 30309, Safety Analysis and Risk Assessment Requirements Document, to ensure the design meets safety requirements.

b. Evaluate SARs and HRs and all supporting data to identify areas of non-compliance with technical and data submittal requirements.

c. Perform hazard analyses as required to ensure that the developer has adequately identified hazards and hazard controls.

d. Assess Hazardous Command Lists (HCLs), Restricted Command Lists (RCLs) and Critical Command Lists (CCLs) to ensure that commands are correctly classified as defined by the ISS Computer Safety Working Group (CSWG).

e. Ensure that all applicable safety requirements have been identified and met. If requirements have not been met, make recommendations regarding possible corrective actions that should be taken; alternatively, identifying impacts to accepting a noncompliance.

f. Document and coordinate all comments and recommendations with NASA S&MA personnel, safety panels, the developer, and other NASA technical organizations (e.g., Engineering, Mission Operations, Space Life Sciences).

g. Track the closure and resolution of all comments and recommendations.

5.2.4.3 As the evaluator of HRs, associated Non-Compliance Reports (NCRs), or Accepted Risk (AR) Hazard Reports, the Contractor shall:

a. Evaluate all NCR or AR Hazard Report data to ensure completeness. Ensure that all applicable safety requirements have been properly identified.

b. Determine whether rationale is sufficient to recommend approval of the NCR or AR Hazard Report. Perform risk trades to determine whether more risk is accepted by approving or denying the NCR or AR Hazard Report.

c. Evaluate associated S&MA data, such as Critical Items Lists (CILs) and problem reports.

d. Assess that the NCR or AR Hazard Report will not add unacceptable risk to a system or procedure.

e. Make a formal recommendation to the Program regarding the acceptance of the NCR or AR Hazard Report. Define alternative approaches to risk mitigation.

f. Verify the appropriate disposition of all NCRs or AR Hazard Reports.

5.2.5 Reliability and Maintainability

a. The Contractor shall predict system or function reliability, maintainability, and availability characteristics (e.g., failure rates and probabilities or availability rates) based on available design, analysis, or data. The predictions shall be provided to the Programs for logistical planning.

b. The Contractor shall make use of reliability modeling and simulation tools to evaluate system design. The results of this evaluation along with recommendations associated with the system design shall be provided to NASA.

c. In evaluating the Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL), the Contractor shall:

1. Evaluate FMEA/CIL and all supporting data per SSP 30234, Instructions for Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL) for

Space Station, and NSTS 22206, Instructions for Preparation of Failure Modes and Effects Analysis and Critical Items List, to identify areas of noncompliance with technical and data submittal requirements.

2. Document and coordinate all comments and recommendations with NASA S&MA personnel, Reliability and Maintainability (R&M) panel, the developer, and other NASA technical organizations (e.g., Engineering, Mission Operations, Space Life Sciences). Track the acceptable closure and resolution of all comments and recommendations.

3. Brief panel chairmen before reviews on the evaluation results. Identify areas of concern and issues raised during the review. Identify FMEA/CILs that may be dispositioned by the chairman before the meeting, and identify FMEA/CILs requiring the support of particular specialists, or that require separate meetings. Identify actions that will be required and propose an agenda for the review.

4. Support the panel as they conduct their review.

d. The Contractor shall analyze system and component failure modes identifying 'scheduled' or 'on-condition' tasks, as well as maintenance frequency required at assigned maintenance levels.

e. The Contractor shall review maintenance and repair plans to verify:

1. Proposed procedures meet safety requirements.

2. Proper priority has been assigned to maintenance activities.

3. Maintenance intervals support the availability of safety-critical equipment.

4. Hardware taken out of service for maintenance will not compromise system safety.

5. Consistency with sound maintenance and repair practices

f. The Contractor shall analyze the functions of Mechanical and Electrical, Electronic, and Electromechanical (EEE) Parts for consistency with intended design rules to ensure reliable operation under expected environments. The Contractor shall recommend parts that operate in the most effective, reliable, and cost-efficient manner for the planned application.

g. The Contractor shall assist in the development of certification plans, including the definition of all usage environments.

h. The Contractor shall analyze items designated as having a limited useful life. The analysis shall include shelf life, operating life, and life expended during testing.

5.2.6 Quality Assurance

The Contractor shall assist in defining and reviewing quality management systems and quality assurance plans and processes. The Contractor shall verify that designs meet quality requirements.

a. The Contractor shall perform Procurement Quality Assurance (PQA) by conducting Program supplier evaluations, conducting quality management system audits at Program prime contractor facilities, drafting Letters of Delegation (LODs) for Government approval, and defining quality requirements for Program contractor and subcontractor purchases in accordance with NPR 8735.2, Management of Government Safety and Mission Assurance Surveillance Functions for NASA Contracts.

b. The Contractor shall provide facility assessments which include product and process surveillance and software assurance support for ground simulators, mission control centers, development integration laboratories, and integrated training facilities. Current facilities supported are the Shuttle Avionics and Integration Laboratory (SAIL), Sonny Carter Training Facility (SCTF), JSC Avionics Engineering Laboratory (JAEL), Instrumentation Systems Laboratory (ISL). Other facilities shall be included as they are established by new Programs.

c. The Contractor shall provide JSC with facility integration software safety analysis technologies and methodologies expertise. This includes the development of software tools to aid in software safety analyses. Software safety analysis tools shall be in accordance with NASA-STD-8719.13, NASA Software Safety Standard.

5.3 Manufacturing, Test, Acceptance, and Delivery Phase

5.3.1 Quality Assurance

The Contractor shall perform inspection and surveillance activities during production, testing, and operations to reduce the overall risk to cost, schedule, and mission success. The Contractor shall provide inspectors that are trained in quality assurance and engineering methods for assembly, testing, inspection, and surveillance.

5.3.2 Non-Conformance Reports (NCRs) and Waivers

The Contractor shall analyze non-conformances and waivers per NSTS 08126, Space Shuttle Problem Reporting and Corrective Action (PRACA) System Requirements, SSP 30223, Problem Reporting and Corrective Action for the Space Station, and SSP 30524, PRACA Data System Requirements Definition Document. The Contractor shall participate in Problem Resolution Teams (PRTs) to analyze non-conformances, determine root cause and recommend corrective actions to prevent recurrence. The Contractor shall communicate across Programs and Projects to assure that S&MA has an integrated and coordinated position.

5.3.3 Software Verification and Validation

The Contractor shall support software code walkthroughs, review test plans, procedures, and test results to verify that the software meets safety and quality requirements. The Contractor shall ensure adequate testing coverage based on the changes made to the software code.

5.3.4 Certification

The Contractor shall verify the as-built system meets all applicable certification requirements. The Contractor shall verify that the hardware will function properly in all applicable use environments. The Contractor shall document the certification and maintain certification records as required.

5.3.5 Test Support

The Contractor shall support Test Readiness Reviews (TRRs) and observe testing conducted on Program flight hardware, software, and equipment to ensure that Program S&MA requirements for the flight items are being appropriately tested and documented. The Contractor shall ensure that test procedures are complete and meet Program system requirements. The Contractor shall ensure that test plans support test objectives. The Contractor shall review test articles and assess readiness to perform testing. The Contractor shall review system test results to ensure that test objectives have been demonstrated and meet system certification requirements.

5.3.6 Inspection Requirements

The Contractor shall identify characteristics requiring independent verification, establish sampling plans, identify special process inspection needs [e.g., Non-Destructive Evaluation (NDE)], and verify implementation of FMEA screens and hazard control verifications.

5.3.7 Manufacturing and Fabrication Plans and Processes

The Contractor shall ensure work authorizing documents, drawings, and engineering changes have pass/fail criteria and appropriate tolerances. The Contractor shall ensure documentation is complete and accurate.

5.3.8 Surveillance and Audits

5.3.8.1 The Contractor shall conduct product and process surveillances. The Contractor shall also conduct technical and quality audits. The Contractor shall support the development of audit plans and maintain the Master Audit Schedule for the Programs. Surveillance and audit activities shall be conducted in accordance with NPR 8735.2, Management of Government Safety and Mission Assurance Surveillance Functions for NASA Contracts.

5.3.8.2 The Contractor shall perform special process verification audits identifying areas needing corrective or preventive action (examples include quality management systems, contamination control, welding, brazing, soldering, and conformal coating).

5.3.9 Procurement Quality Assurance (PQA)

5.3.9.1 The Contractor shall assist the Government in assessing quality plans for production controls and in conducting contract surveillance throughout the procurement process in accordance with NPR 8735.2, Management of Government Safety and Mission Assurance Surveillance Functions for NASA Contracts. This includes the review of purchase orders and contracts to:

a. Verify proper inclusion of quality requirements and supplier qualifications.

b. Determine if Government source inspection is required.

c. Determine and recommend quality instructions to be included in the LODs.

5.3.9.2 The Contractor shall assist the Government in performing PQA functions at remote site facilities in support of Program development activities in the following areas:

a. Assessment of and participation in supplier qualification audits for flight hardware.

b. Inclusion of necessary quality requirements flow down to suppliers through purchase order and contract review.

c. Development of Defense Contract Management Association (DCMA) LODs, development of DCMA site-specific Risk Assessment Management Plan (RAMPs), and monitoring of subcontractor performance.

d. Material review disposition and approval requiring NASA participation.

e. Manufacturing, assembly, and test operations assessments.

f. Review of quality requirements at Technical Interchange Meetings (TIMs), Preliminary Design Reviews (PDRs), and Critical Design Reviews (CDRs).

5.4 Operations and Maintenance Phase

The Contractor shall review flight products such as flight rules and crew procedures to identify safety issues, to ensure that operational hazard controls are properly implemented, and to ensure the safety of pre-defined responses to contingency situations.

5.4.1 Mission Planning

5.4.1.1 The Contractor shall provide technical expertise in operational meetings such as Flight Techniques Working Groups, Mission Integration and Operations Control Boards, Joint Operations Panels, Flight Operations Reviews, Increment Operations Reviews, and Mission Management Team meetings to ensure that flight products meet safety requirements. Participation includes technical evaluation of items to be presented prior to the meetings.

5.4.1.2 The Contractor shall participate in PRTs to analyze non-conformances, determine root cause and corrective actions to prevent recurrence. The Contractor shall communicate across Programs and Projects to ensure that S&MA has an integrated and coordinated position.

5.4.1.3 The Contractor shall support mission planning activities to ensure that operational planning does not conflict with safety requirements. Activities include the review of flight objectives, plans, manifests, equipment transfer priorities, and crew activity plans for compliance with requirements.

5.4.1.4 The Contractor shall review proposed manifests to ensure the safe continued operation of the on-orbit vehicle, planned maintenance activities, and that transfer priorities support safety requirements. The Contractor shall ensure planned crew activities are properly coordinated and safety related objectives are accomplished in a timely manner.

5.4.1.5 The Contractor shall perform mission readiness assessments and prepare briefings per DRD 15, S&MA Prelaunch Assessment Presentations, to support Prelaunch Assessment Reviews (PARs), S&MA Readiness Reviews (SMARRs), Software Readiness Reviews (SRR), EVA Readiness Reviews, Stage Operations Readiness Reviews (SORRs), and Flight Readiness Reviews (FRRs). The Contractor shall provide pre and post-flight assessments and briefings. Readiness review activities shall include review and reporting of:

a. Status of S&MA products such as hazard reports, non-compliances, FMEA/CILs, and problem reports.

b. Open work, including schedules for completion.

c. S&MA issues and risks, flight constraints, or exceptions to flight readiness.

d. Status of readiness to provide S&MA operational support, including training and certification of personnel and availability of required supporting data.

e. Status of the on-orbit vehicle.

f. Status of previously identified anomalies and their resolution.

5.4.2 Mission Support

5.4.2.1 The Contractor shall provide real-time S&MA support to the Mission Management Team (MMT) and shall staff the Mission Evaluation Room (MER) to:

a. Review requirements changes and waivers.

b. Serve as the repository of S&MA data such as hazard reports, noncompliances, FMEA/CILs, Problem Reports, and retrieving such data in support of the evaluation and resolution of in-flight anomalies.

c. Provide responses to in-flight hardware and software anomalies to identify any changes in risk resulting from

associated hardware changes or software patches or workarounds.

d. Resolve questions and providing engineering assessments regarding on-orbit S&MA issues.

e. Evaluate and provide technical expertise in the resolution of In-Flight Anomalies (IFAs), Mission Action Requests, Flight Rules and Crew Procedure changes.

f. Provide S&MA representation on Flight Investigation Teams (FITs), and Anomaly Resolution Teams (ARTs) to identify risk impacts.

g. Develop and assess Fault Trees and Root Cause analyses of anomalies.

h. Ensure integration of International Partners / Participants (IP/P), Government-Furnished Equipment (GFE), Contractor-Furnished Equipment (CFE), Software, Payload and Visiting Vehicle assessments for MER responses.

5.4.2.2 The Contractor shall support MMT meetings by providing problem investigation support consisting of administrative and technical personnel. As scheduled, technical personnel for Shuttle support shall be on duty 24 hours, 7 days a week (24/7) at the MER Safety Console beginning at tanking and continuing through landing. The administrative personnel shall support 24/7 beginning at launch and continuing through landing. As scheduled, , technical personnel for ISS support shall be on duty 24/7 at the MER Safety Console during high activity periods (e.g. launch, docking, EVA, assembly operations). On weekends and periods of low activity technical personnel shall be on call 24/7. All personnel shall support mission simulations and shall demonstrate knowledge of mission, vehicle, and payload hazard controls and an ability to cope with high stress situations prior to supporting a mission.

5.4.2.3 The MMT support shall ensure that:

a. S&MA MMT representatives are properly briefed on ongoing investigations, issues, anomalies, and operations.

b. S&MA positions on Mission Action Requests, IFAs and other in-flight issues are clearly defined and communicated to Program management.

c. S&MA data are provided in support of MMT

discussions and activities.

5.4.2.4 The Contractor shall develop and review Contingency Action Plans (CAPs) to assist in the development of predefined responses to accidents, incidents and mishaps. The Contractor shall assist in developing notification trees, obtaining contact information, defining data to be locked down, and defining how investigation boards will be established and operated, in accordance with SSP 50190, ISS Contingency Action Plan, and NSTS 07700 Volume VIII, Operations, Appendix R.

5.4.2.5 The Contractor shall support accident, incident, and mishap investigations in accordance with NPR 8621.1, NASA Procedural Requirements for Mishap Reporting, Investigation, and Recordkeeping. The Contractor shall retrieve and supply relevant S&MA data to investigatory boards. Contractor personnel shall perform analyses, such as the development of fault trees in support of accident investigation activities. The Contractor shall review relevant S&MA data to identify contributing and root causes of the accident, and the Contractor shall assist in the development of preventive and corrective actions to prevent recurrence.

5.4.2.6 The Contractor shall maintain the Safety Observation and Variance Assessment Report (SOVAR) database to ensure that real-time changes made to vehicle design and operation which conflict with baselined HRs are identified, reviewed by the appropriate safety panel, and resolved.

5.4.2.7 The Contractor shall maintain the S&MA Operations Console Handbook.

6.0 JOHNSON SPACE CENTER (JSC) PROJECTS SUPPORT

a. This section describes the requirements for S&MA support to hardware and software development Projects managed by JSC in support of major NASA Programs and initiatives. Projects include new, modifications or redesigns of existing items. The Contractor shall provide technical services related to Government-Furnished Equipment (GFE), Payloads, and other hardware, software, and firmware processed on site. The Contractor shall manage and provide NASA access to information on work being performed, products produced, and documentation tracked for other organizations.

b. The Contractor shall perform S&MA support throughout the Project life-cycle as described in this section in order to ensure systems meet requirements. Life-cycle phases may overlap and tasks may be worked or revisited in more than one phase. Support includes engineering services and the use of technical experts in the areas of design, development, fabrication, test and integration, and performance and evaluation of S&MA analyses.

c. Specific requirements for life-cycle support, project management processes and products for the definition, planning and implementation of GFE Flight Development Projects are defined in EA-WI-023, Project Management for GFE Flight Projects.

d. The Contractor shall develop or assess documentation including but not limited to:

1. Program plans
2. system hazard analyses
3. safety trade studies
4. design drawings
5. interface control drawings and documents
6. failure modes and effects analyses and critical items lists
7. system qualification and certification plans
8. EEE parts usage
9. manufacturing plans and processes
10. configuration control plans and procedures
11. software development folders
12. test plans and procedures

13. inspection requirements

14. work authorizing documentation

e. The following outlines the life-cycle roles of personnel. Specific skills and proven capabilities are required for each role.

1. Safety and Reliability personnel assist the Government in determining the S&MA requirements for the project

2. Quality Engineering personnel assist the Government in establishing the design and workmanship requirements

3. PQA personnel assist in ensuring that S&MA requirements are included in contracts

4. Quality Assurance personnel witness and verify inspections and tests

5. Safety and Quality personnel provide products to aid in the certification of the equipment for flight.

6. Safety and Reliability personnel verify controls are in place for operations

7. Safety, Quality, and Test Engineers investigate anomalies, quality escapes, and perform failure analysis

8. Data Management personnel provide proper configuration management of records

f. The Contractor shall document activities and rationales for decisions to provide traceability, and shall prepare and present status of actions and activities in periodic meetings such as weekly staff and monthly status per DRD 16, Activity Reports and quarterly technical reviews with the Programs.

g. The Contractor shall provide engineering and technical expertise to process improvement, incident review, mishap investigation teams, and boards where S&MA related topics are addressed. Activities include evaluation of flight readiness, certification record generation and management, and participation in forums including design reviews and Program Boards and Panels.

6.1 Software Assurance

The Contractor shall provide quality engineering services for software intensive ground systems residing at JSC that support the design, development, and test of flight systems. The Contractor shall provide quality engineering services for JSC facility software. This effort requires expertise in both hardware and software engineering as well as expertise in

the assurance disciplines of safety, reliability, maintainability and quality. The Contractor shall:

a. Provide software assurance support for the SAIL, SCTF, JAEL, ISL, ground simulators, mission control centers, and integrated training facilities.

b. Assess software assurance plans, quality plans, safety plans, procedures, processes, and reports for compliance to NASA and JSC policies and standards (Section J, Applicable Documents, Software Requirements and Policies subsection).

c. Support the preparation, review, and assurance of proper implementation of procedures, processes, inspection planning, and quality assurance requirements for JSC ground software.

d. Provide JSC with facility software safety analysis technologies and methodologies expertise.

e. Develop software tools, methodologies and techniques to support facility software safety analyses.

6.2 Concept and Requirements

This phase includes Project feasibility assessment, Project requirements definition and approval.

6.2.1 Feasibility Assessments

The Contractor shall assist with feasibility assessments by providing input in areas such as constraints, technical validity, facility capability, schedule and other associated risks.

6.2.2 Procurement Quality Assurance (PQA)

6.2.2.1 The Contractor shall assist in the review of proposed quality provisions and clauses to ensure project procurements are consistent with the Federal Acquisition Regulation (FAR), NASA FAR Supplements (NFS), and JSC Procurement Instruction. The Contractor shall recommend Government Source Inspection (GSI) in accordance with the requirements of FAR 46.402, applicable NASA and the JSC Procurement Instruction, draft Letters of Delegation (LOD), and NPR 8735.2, Management of Government Safety and Mission Assurance Surveillance Functions for NASA Contracts. The Contractor shall submit the GSI recommendations and draft LODs to NASA S&MA for concurrence prior to obtaining Contracting Officer approval.

6.2.2.2 The Contractor shall perform safety, reliability, and quality assurance surveillance on selected JSC and contractors' processes to monitor contractor performance to safety, product, and technical requirements. The Contractor shall assist in defining surveillance programs that assure method, manpower, material, equipment, and environment satisfy contract requirements.

6.2.2.3 The Contractor shall perform quality assessment audits on vendors and suppliers to determine their manufacturing and testing capability. Audits include process audits to verify specified levels of control by the vendor or supplier on their internal processes, determination of problems or potential problems, identification of corrective and preventive actions, and verification of corrective and preventive action implementation and effectiveness. The Contractor shall perform inspections and monitor clean room laboratory services on-site at JSC and at other local or remote locations to ensure compliance with JPR 5322.1, Contamination Control Requirements Manual. Audits and inspections shall be performed during the development and manufacturing phases.

6.2.2.4 In order to ensure that safety, reliability, and quality assurance surveillances, audits, and inspection activities are performed in accordance with safety, product and technical requirements, the Contractor shall provide qualified Quality Assurance Specialists (QAS). The QAS shall be pre-qualified with a minimum of 2 years of experience in the quality assurance disciplines with skills encompassing problem solving, analyzing, facilitating, researching, coordinating, articulating, negotiating, communicating, and evaluating issues, concerns and actions relative to meeting S&MA requirements.

6.2.2.5 On-The-Job Training of Contractor personnel shall be restricted to acquiring the necessary experience of working within the JSC and S&MA systems and processes and shall not be used to qualify a QAS in the quality assurance disciplines.

6.2.3 S&MA Requirements

6.2.3.1 The Contractor shall assist in defining hardware and software S&MA requirements for NASA Projects.

6.2.3.2 The Contractor shall support project requirements reviews and ensure appropriate requirements for intended use, planned environments, and established criticality based on operational use are included in the project requirements documents and Project Management Plans. The

Contractor shall ensure traceability between the system level requirements and the project requirements.

6.3 Design and Development

a. This phase includes preliminary and detailed design, and system design, verification, and validation. Design validation is generally accomplished through a combination of test, analysis and inspection of a flight-like unit to prove the design meets the requirements. For JSC Projects, primary design reviews during this phase are the Preliminary Design Review (PDR) and the Critical Design Review (CDR) though other reviews may be identified that are specific to the needs of the Project. For payload reliability and maintainability, development phase reviews are held by responsible JSC organizations.

b. The Contractor shall provide support to all Project design activities, development activities, verification, and validation activities, and technical working groups. This includes the development of milestone schedules, milestone reviews and a list of hardware and software deliverables. The Contractor shall perform in-depth analysis of data and documentation to identify and document problems. Quality engineering and technical services includes preparation of documentation, review of prepared documentation, recommendations for approval of design documentation, EEE parts analysis, approval of drawings for release, verification that software development folders are maintained, attendance and participation in formal reviews, and follow-up activities including responding to actions and review of changes to documentation resulting from review discussions and actions.

c. The Contractor shall ensure appropriate closure criteria of all issues are identified and verify that action closures have been accomplished. The Contractor shall verify that documentation is maintained under Project established configuration control processes. For software development support activities, the Contractor shall use applicable quality assurance tools such as requirements traceability tools, code map coverage and software complexity studies as part of their evaluations.

6.3.1 Projects

6.3.1.1 The Contractor shall perform and evaluate assessments of the design and identify areas of risk. Examples of products utilized for assessment and analysis are:

1. FMEAs and CILs developed to the requirements of NSTS 22206, Instructions for Preparation of Failure Modes and Effects Analysis and Critical Items Lists, and SSP 30234, Instructions for Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL) for Space Station.

2. HRs developed and processed to the requirements of NSTS 22254, Methodology for Conduct of Space Shuttle Program Hazard Analyses, SSP 50021, Safety Requirements Document, SSP 30309, Safety Analysis and Risk Assessment Requirements Document, SSP 50146 (Attachment D), NASA/RSA Bilateral S&MA Processes, JSC 17773, Instruction for Preparation of Hazard Analysis for JSC Ground Operations, KHB 1700.7, Space Shuttle Payload Ground Safety Handbook, and KHB 1710.2, KSC Safety Practices Handbook, to identify hazards associated with the ground processing and operational use of the hardware and software, define controls for those hazards, and verify implementation of the hazard controls.

3. Fault Tree Analyses to identify critical hardware, software, and procedural failure paths.

4. Statistical or probabilistic analyses to support reliability assessments.

5. Sneak circuit analyses to identify latent circuit conditions, design concerns, and drawing errors.

6. Test and analysis of high risk candidate EEE and mechanical parts.

6.3.1.2 Other products or analysis techniques shall be utilized or developed by the Contractor as necessary to meet specific requirements and to assess functions/complexity of the hardware and software items.

6.3.1.3 The Contractor shall review technical documents, changes to technical documents, and deviations and waivers to ensure inclusion of quality assurance requirements and adequacy of design criteria necessary for procurement, fabrication, inspection, and test operations. The Contractor shall identify areas of noncompliance with technical and data submittal requirements. The Contractor shall ensure hazards are identified and controlled, and verify implementation of the hazard controls. Hazards may be associated with ground processing and operational use of the hardware and software during all phases of flight (installation, launch, on-orbit usage, stowing and destowing, landing, post-landing removal and post-mission processing). The Contactor shall ensure the development of inspection and test processes and techniques in accordance with JSC policies and procedures.

6.3.1.4 Milestone design reviews such as PDR and CDR are conducted to review and approve documentation

associated with the design phase and provide formal control of the design and development process.

6.3.1.5 For PDR, the Contractor shall evaluate the design based on the following considerations:

a. Compliance with statement of work, end item specifications, specific design criteria, and other applicable documents.

b. Compatibility with interface and operational requirements.

c. Feasibility of proposed schedule.

d. Consideration of induced and natural environmental criteria.

e. Requirements for transporting, storing, handling.

f. Requirements for support equipment.

g. Inclusion of S&MA requirements.

h. Adequacy of design to satisfy S&MA-related requirements in the areas of thermal, electrical, materials, mechanical, stress, software, performance, and interface.

i. Inspectability and testability including traceability to requirements.

j. Completeness of verification matrix, adequacy of verification methods selected, and appropriateness of success criteria.

6.3.1.6 For CDR the Contractor shall evaluate the design and documentation for:

a. Detailed environmental, thermal, electrical, and mechanical analyses.

b. Development test data.

c. Design decisions and trade-offs.

d. Requirements which have been added or changed since the PDR.

e. Parts and materials selections including participation in establishment of parts reliability requirements, parts

specifications and applications, as well as requirements for selection, screening, qualification, derating, handling, destructive physical analysis, failure trending and potential NASA Advisories and Government-Industry Data Exchange Program (GIDEP) / Acute Launch Emergency Reliability Tip (ALERT) impacts, and review of non-standard parts approval requests.

f. Hardware manufacturing and software development test plans and procedures, which shall include provisions for inspections and tests.

g. Traceability in accordance with Program/Project requirements.

h. Completeness of verification matrix, adequacy of verification methods selected, and appropriateness of success criteria.

i. Closure of actions generated at the PDR.

6.3.1.7 For design validation the Contractor shall verify that the hardware and software design and implementation meets the Project requirement for life, environments, interfaces, and performance and that the method of verification (test, analysis, or inspection) is appropriate, adequate and documented in applicable Work Authorization Documents. The Contractor shall review all design validation documentation and participate in organizational and formal certification reviews.

6.3.2 Payloads

The Contractor shall provide evaluation of the implementation of JSC and NASA payload reliability and maintainability requirements. The Contractor shall participate in working group meetings and formal and informational reviews of payload documentation and data as described in NSTS 13830, Payload Safety Review and Data Submittal Requirements, NSTS 1700.7, Safety Policy and Requirements for Payloads Using the Space Transportation System (STS), and NSTS 1700.7, ISS Addendum, Safety Policy and Requirements for Payloads Using the International Space Station, to assess payload hardware and software compliance with applicable payload requirements. The Contractor shall identify problems, deficiencies, or concerns and present their findings along with recommendations for corrective and preventive actions to the responsible organization.

6.4 Manufacturing, Test, Acceptance, and Delivery

This phase includes materials procurements and receiving, fabrication and manufacturing, subassembly testing and assembly acceptance testing, formal acceptance by NASA, software code development, software verification testing, shipment, and physical delivery of the finished products and requires engineering, inspection, and recordkeeping functions. The Contractor shall audit manufacturing processes, inspect manufactured items, support testing, and provide inspection and processing services for storage, handling, shipping, and receiving. The manufacturing processes include metallurgical, chemical, metal-joining, bonding, plating and coating, surface-treating, EEE, welding, machining, and plastics-working processes, and designing and implementing manufacturing inspection attribute sampling plans.

6.4.1 Readiness Reviews

The Contractor shall conduct documentation and drawing reviews, coordinate work requests, and participate in formal reviews such as Manufacturing Readiness Reviews (MRRs) and Test Readiness Reviews (TRRs). The Contractor shall participate in Acceptance Reviews (ARs) to assess the readiness of hardware and software for acceptance by NASA.

6.4.2 Manufacturing and Test Assurance

6.4.2.1 The Contractor shall provide in-line technical assessments by use of inspection, verification, and the witnessing of work and processes used in the development and manufacturing of space flight hardware, software, and associated ground support equipment. Technical assessments are performed to verify work is accomplished according to applicable requirements. Inspection and verification tasks are associated with receiving, handling, storage, packaging, preservation, fabrication, assembly, test, processing, and shipping of hardware and software. The Contractor shall maintain all the Contractor-provided and Government-provided precision measurement mechanical and electronic tools and equipment required for performance of manufacturing and test assessment responsibilities contained in this SOW. The Contractor shall provide surveillance of hardware and software processes and hardware fabrication where in-line inspection is being accomplished by other than this Contractor’s provided inspectors.

6.4.2.2 The Contractor shall support simulation or integrated ground system testing both pre- and post-acceptance to assess compliance of planned simulations or integrated system testing with NASA approved plans, procedures and applicable standards for the simulator or facility involved.

6.4.2.3 The Contractor shall provide engineering and technical services for the development, testing, acceptance, and delivery of software and associated tools. The Contractor shall perform software code walkthroughs to evaluate testability. The Contractor shall analyze test plans, procedures and results to ensure that the software meets S&MA requirements.

6.4.3 Non-Conformances

6.4.3.1 The Contractor shall document problems and anomalies by using a Non-Conformance Report (NCR) or Discrepancy Report (DR). The Contractor shall be responsible for trend coding of all NCRs and DRs and the preparation of trend reports and analyses based on trend coding data. This task includes conducting investigation and corrective action activities, documenting problems and anomalies, tagging and segregating discrepant hardware or software during investigation. The Contractor shall ensure that acceptable problem resolutions or explanations are documented and implemented.

6.4.3.2 The Contractor shall review failures and discrepancies that occur in JSC facilities supported by S&MA. The Contractor shall analyze the failure and discrepancy information and provide trend reports per DRD 17, Trend Analysis (JSC Systems) Report.

6.4.3.3 The Contractor shall maintain a system for reporting and tracking of Problem Reporting and Corrective Action (PRACA) items. The Contractor shall input problem data received from other contractors into the system, use and analyze the data for reporting and supporting other problem discussion activities, and output data from the system into Program systems that collect both Program and Project problem data. The Contractor shall participate in PRTs and similar investigation teams to ensure proper classification and disposition of problems, and support Project and Program level boards to provide status, closure, and disposition information. The PRACA process tracks problems that occur during manufacturing, assembly, test, maintenance, and operations. The PRACA process is described in NSTS 08126, Space Shuttle Problem Reporting and Corrective Action (PRACA) System Requirements, for the Shuttle Program, and in JSC 28035, JSC Government Furnished Equipment (GFE) Problem Reporting and Corrective Action (PRACA) Requirements, for GFE Projects, and SSP 30524, PRACA Data System Requirements Definition Document, and SSP 30223, Problem Reporting and Corrective Action for the

International Space Station, for the Space Station Program.

6.4.4 Documentation Tracking and Retention

The Contractor shall provide tracking, control, maintenance and indices of documents and the actual or controlled electronic versions of documentation produced during this phase. Documentation includes but is not limited to Task Performance Sheets (TPSs), Virtual Work Authorization Records (VWARs), Work Order Packages, Interim DRs, DRs, MRRs, shipping documents, Acceptance Data Packages (ADPs), documentation on inactive hardware and equipment, and vendor data submittals.

6.4.5 Acceptance

The Contractor shall verify system requirements and specifications for safety, reliability and performance are met. The Contractor shall participate in Software Acceptance Reviews, System Acceptance Reviews, Functional Configuration Audits (FCAs), and Physical Configuration Audits (PCAs) to present and discuss their findings and recommendations. The Contractor shall ensure the completeness and accuracy of ADPs per SSP 30695, Acceptance Data Package Requirements Specification, and SN-D-0007, Acceptance Data Package Requirements.

6.5 Operations

This phase includes system certification or recertification to new or revised operational usage requirements, assessment of readiness for shipment, evaluation of readiness for operational use, and support to operations that include ground handling and flight.

6.5.1 Certification

The Contractor shall establish and maintain a process for the certification or recertification of hardware and software for flight that includes obtaining, producing, and reviewing objective evidence that design, production, safety and acceptance processes provide products that meet or exceed the minimum requirements identified for the hardware or software. The certification process for hardware includes tracking manifested items and assessing certification status, assembling, summarizing, and presenting certification data packages to a NASA Certifying Official, and logging, storing and controlling the signed certification documentation. The certification process includes the processing of the Government Certification Acceptance Record (GCAR).

6.5.2 Shipment of Flight Equipment

The Contractor shall ensure flight equipment being shipped for flight is ready for shipment and follow-on flight processing and integration. The Contractor shall verify that the equipment is certified for the mission, open issues have been resolved, pre and post flight ground processing open work has been scheduled, and there is sufficient life usage remaining to support the identified mission. The Contractor shall present their assessment of readiness for shipment to NASA.

6.5.3 Prelaunch Assessments

6.5.3.1 The Contractor shall perform evaluations of flight worthiness and readiness, and generate flight assessment documentation to support discussions and Flight Readiness Reviews (FRRs).

6.5.3.2 The Contractor shall prepare and present S&MA prelaunch assessment presentations for each flight per DRD 15, S&MA Prelaunch Assessment Presentations. The overall Program-level requirements for this activity are contained in NSTS 08117, Requirements and Procedures for Certification of Flight Readiness.

6.5.3.3 The Contractor shall support EVA mission crew training and verify EVA Assessment Team (EVAAT) crew training. EVA payloads and hardware reviews shall be supported by the Contractor to verify compliance with S&MA and EVA requirements. EVA related Integrated hazard reports shall also be reviewed to verify compliance to EVA requirements. The Contractor shall perform, document, baseline and maintain EVA operations risk assessments for Space Shuttle and ISS EVAs. The Space Shuttle Program-level requirement for this task is identified in NSTS 22254, Methodology for Conduct of Space Shuttle Program Hazard Analyses, and more specific requirements for operational and hazard assessments are contained in JSC 17481, Safety Requirements Document for JSC Space Shuttle Flight Equipment. The ISS Program-level requirement for this task is in SSP 30309, Safety Analysis and Risk Assessment Requirements Document.

6.5.3.4 The Contractor shall prepare S&MA Certification of Flight Readiness (CoFR) and Certification of EVA Readiness presentations for both S&MA internal and Program flight readiness reviews for each flight in accordance with the requirements of SSP 50108, Certification of Flight Readiness Process Document, ISS Program, Space Shuttle Program Directive 52, for the ISS Program, NSTS 08117, Requirements and Procedures for Certification of Flight Readiness, for the Shuttle Program, and JSC 28222, EVA Project Certification of Flight Readiness

Requirements and Implementation Plan, for EVA-related items.

6.5.4 Flight Planning and Real-Time Flight Support

6.5.4.1 The Contractor shall provide real-time flight support to monitor system use and performance and serve as the flight support data resource for S&MA data as well as Project specific data and documentation.

6.5.4.2 The Contractor shall participate in flight planning, mission simulation training and operations to identify potential safety issues to ground support systems, payloads, or mission operations and provide an independent assessment including recommendations for resolution, for discussion, or presentation to the responsible JSC forums or organizations.

6.5.4.3 In addition, the Contractor shall participate in investigations of in-flight anomalies and failures, and in the implementation of resolutions and preventive or corrective actions.

6.6 Sustaining Engineering and Maintenance

This phase includes engineering activities supporting the continuing usage of Project hardware and software. The Contractor shall support flight operations planning and assessments, performance and problem trending, hardware life assessments and maintenance requirements tracking, and engineering and inspection support to required maintenance and repair activities.

7.0 INDEPENDENT ASSESSMENT AND ASSURANCE ACTIVITIES

7.1 Independent Assessment (IA)

7.1.1 The Contractor shall provide Programmatic, technical, and process expertise within each S&MA discipline for conducting Independent Assessments (IAs) to enhance the success of Programs and Projects and the effectiveness of S&MA processes implemented in Programs and Projects. Assessments and evaluations shall be proposed by the Contractor. The Contractor shall report the results of assessments and evaluations per DRD 18, Evaluation Reports and DRD 19, Assessment Plans and Reports.

7.1.2 The Contractor shall:

a. Identify status, issues, and concerns regarding safety and mission assurance and communicate this information to the JSC Independent Assessment Office (IAO) via informational reports (verbal or written) regarding meetings attended, Program and Project activities, and internal IA planning activities.

b. Provide technical and administrative services to the JSC IAO to facilitate the Prelaunch Assessment Review (PAR) process of the JSC S&MA Directorate for unmanned International Partner (IP) launches to the ISS.

c. Provide technical and administrative support to the NASA Headquarters Office of Safety and Mission Assurance (OSMA) SMARR process for Shuttle and Russian Soyuz launches.

d. Provide expertise on audit teams to:

1. Research and compile documentation needed in the audit

2. Verify requirements traceability

3. Identify requirements gaps

4. Assess areas such as processes, staffing, skill mix, software tools, and funding

5. Document findings and supporting objective evidence

e. Maintain and administer the JSC IA website for use by IA personnel.

f. Provide the JSC IAO Quarterly Activity Report in a mutually agreed format for redistribution to other IA locations and NASA management per DRD 16, Activity Reports.

7.2 Integrated Supplier Assurance Management Program (ISAMP)

7.2.1 NASA has implemented a program for evaluating, gathering, and disseminating information on Government suppliers' performance under the authority of the NPR 8735.2, Management of Government Safety and Mission Assurance Surveillance Functions for NASA Contracts.

7.2.2 The Contractor shall participate in the implementation of NASA quality assurance of Government suppliers. The assurance activities include consideration of hardware complexity, supplier experience, state of hardware development, unit cost, and hardware use. The Contractor shall also participate in Supplier Assurance Studies, Working Groups, and Headquarters Support. This support includes the preparation of meeting minutes and assistance in the development of Agency quality related procedures.

7.2.3 The Contractor shall provide project administration of the Integrated Supplier Assurance Management Program (ISAMP), which includes cost tracking and cost and Project reporting. The services shall also include services to and coordination with Headquarters and NASA Centers, Projects, and Programs.

7.2.4 In support of the Supplier Assessment System (SAS), the Contractor shall:

a. Maintain, enhance and train personnel in the use of the SAS data repository for the agency. The SAS provides the user with:

1. a complete listing with supporting information of suppliers used by NASA with emphasis on performance and risk;

2. Agency-wide supplier metrics, providing performance insight and targets of opportunity for supplier base improvements;

3. detailed schedule information of audits;

4. detailed repository of audit history information;

5. provision of standardized tools (e.g. audit checklists, flow down audit formats for incorporation into DCMA LOD);

6. resource links throughout the Agency for access to product data and best practices.

b. Coordinate activities with the Naval Sea Systems Command (NAVSEA), and the Missile Defense Agency, and Army Material Command as directed.

7.3 Software Continuous Process Improvement

7.3.1 The Contractor shall manage and provide services to the development and implementation of all NASA software continuous improvement initiatives in accordance with NPR 7150.2, Software Engineering Requirements. The primary goal is the release of safe and high quality software products and processes. Specifically, the Contractor shall perform the following:

a. Establish comprehensive company goals for continuous improvement in the area of software development and assurance.
b. Provide metrics which quantify the effectiveness of continuous improvement goals.

c. Maintain a record of continuous improvement activities and associated results.

7.3.2 The Contractor shall provide technical and engineering services to the S&MA Software Assurance Technology Team (SWATT) in developing and maintaining continuous process improvement in the area of software development and assurance. This includes the periodic review and recommended revision to Agency and Center software policies, procedures and standards.

7.3.3 The Contractor shall maintain and ensure uniformity in the implementation of software quality and safety requirements for JSC Programs and Projects. This includes developing and implementing JSC approved procedures and controls that are consistent with software process and product continuous improvement models. The Contractor shall assist S&MA to ensure that JSC procedures and controls are compliant with the Capability Maturity Model Integrated (CMMI).

8.0 ADVANCED PROGRAMS, ASSURANCE METHODOLOGIES, AND SPECIAL PROCESSES

The Contractor shall ensure that S&MA disciplines are included in advanced programs and projects. Emphasis shall be placed on early involvement, responsiveness, and providing added value. This includes new, modified, and exploration-related programs and projects. Services shall also be provided to advance the state of the art in assurance practices and to maintaining cognizance of advanced technologies and their implications to the assurance function.

8.1 Advanced Programs and Projects

The Contractor shall provide early involvement to assigned advanced programs and projects to increase the likelihood of mission success, reduce the risk of injury to personnel, and improve the overall system safety, reliability, and mission assurance.

8.1.1 Risk Analyses

8.1.1.1 The Contractor shall perform qualitative and quantitative assessments of risk. The Contractor shall assist in the identification, assessment, reporting, tracking, and mitigation of risks throughout the program life-cycle. Examples of risk assessments include hazards analyses, FMEA, PRAs, reliability, maintainability, supportability and availability analyses.

8.1.1.2 The Contractor shall participate in requirements development and design trade studies to determine the most effective means of achieving safe and reliable space systems. The Contractor shall also utilize lessons learned, as well as research and analyze other data and methodologies to provide and defend recommendations.

8.1.2 Requirements Development

8.1.2.1 The Contractor shall assist the Government with the development and assessment of top-level S&MA requirements for proposed space flight programs and their associated support systems. This includes the development and evaluation of rationale and traceability for recommended requirements.

8.1.2.2 The Contractor shall assist with the development and assessment of Project- and subsystem-level S&MA requirements derived from higher level requirements. This includes the development and evaluation of rationale and traceability for recommended requirements.

8.1.3 Vehicle S&MA Engineering

8.1.3.1 The Contractor shall evaluate design concepts proposed by NASA and contractors against S&MA requirements and provide feedback to design processes with supporting data for recommendations.

8.1.3.2 The Contractor shall perform integrated system-level S&MA assessments of designs, specifications, and other Program documentation such as hazards analyses, safety plans, and reliability analyses and provide inputs to milestone reviews with supporting data for any findings.

8.1.3.3 The Contractor shall perform detailed evaluations of spacecraft subsystems through the review of subsystems specifications, design documents, operations plans, and the use of safety and reliability analysis tools. The Contractor shall also develop or evaluate subsystem safety and reliability analyses such as preliminary hazard analyses, hazard analyses, FMEAs, fault trees, and reliability block diagrams. The Contractor shall provide inputs to subsystem design specifications and operations documents at milestone reviews or as needed and present and defend these inputs. The Contractor shall assess planned flight operations concepts to ensure S&MA requirements are met and provide input to NASA.

8.1.3.4 The Contractor shall determine applicability of human rating requirements to space flight systems and incorporate such requirements in appropriate Program documents. The Contractor shall also generate and evaluate human rating plans and requirements and evaluate Program and Project compliance to human rating requirements and provide recommendations to correct deficiencies.

8.1.4 Procurement Quality Assurance (PQA)

8.1.4.1 The Contractor shall assist the Government in the development of procurement documentation in order to describe S&MA processes and products delivered by the spaceflight systems contractors.

8.1.4.2 The Contractor shall assist the Government in determining quality requirements to be incorporated into spaceflight systems contracts and assist in instituting processes to ensure that delivered products meet NASA requirements. The Contractor shall assist the Government in drafting LODs for government approval, to authorize DCMA or other Government agencies to accept spaceflight hardware and software deliverables.

8.2 Assurance Methodologies and Technologies

8.2.1 Assurance Methodologies

The Contractor shall participate in activities to advance state of the art assurance methodologies in support of NASA initiatives such as Research Technology Objectives and Plans (RTOPs) NASA Electronic Parts Packaging (NEPP) Program. The Contractor shall conduct or participate in research efforts in new technologies for the purpose of identifying assurance techniques required upon deployment of advanced technologies. The Contractor shall also propose RTOPs and plans for innovative methodologies and technologies for conducting risk assessments and providing product assurance. The Contractor shall support the NEPP by identifying and suggesting approaches for EEE parts database management, identifying and collecting data sources for EEE parts obsolescence, and identifying and comparing tools and techniques for predicting obsolescence.

8.2.2 Assurance Technologies

The Contractor shall carry out activities to advance S&MA capabilities in performing assurance functions. These activities include evolving or improving existing assurance and analysis techniques, and proposing and developing new assurance concepts.

The Contractor shall:

a. Research and develop techniques to quantitatively assess the risks of software failures.

b. Assess and develop new assurance tools in multiple areas such as: reliability, maintainability, and supportability analyses; probabilistic risk assessment; nondestructive evaluation and other inspection techniques; and risk management.

c. Research advanced technologies with emphasis on assurance. Examples of such technologies are Micro-Electromechanical Systems (MEMS), nano-technology, advanced materials, and advanced computing and processing systems.

d. Facilitate technology transfer through demonstrations to JSC Programs and Projects.

8.3 Special Processes

8.3.1 The Contractor shall provide expertise to assess new and emerging technologies and apply to programs and projects. Current designated areas are metals, welding, soldering, brazing, nonmetallic materials (composites and adhesives), Surface Mount Technology (SMT), lubrication, seals, contamination, fasteners, contamination-related environmental technology, fluids, NDE, and Statistical Process Control (SPC).

8.3.2 The Contractor shall:

a. Evaluate data provided by hardware contractors and subcontractors on equipment to verify compliance with contract requirements and appropriate specifications.

b. Provide materials and process engineering expertise for review of flight and flight-related system problems and recommend corrective actions to prevent problem reoccurrence.

c. Support special problem investigations as required, review process-oriented hardware failure analyses and investigations, and provide findings and recommendations.

d. Review Government and contractor drawings and specifications as directed. Present findings on adequacy and compliance, with emphasis on process technology.

e. Review process specifications and procedures for fabrication, assembly, and testing; and prepare comments and findings.

f. Review nondestructive test procedures and NDE of pressure vessels and fracture control of structural components. Provide findings on adequacy and compliance.

g. Provide expertise in the development and maintenance of workmanship standards for manufacturing and process technologies at the Center and Agency levels.

h. Recommend requirements for the JSC procurement of clean rooms, tools, related equipment, and services. The Contractor shall review JSC clean room facilities and operations and provide comments and findings.

i. Provide expertise for the preparation and maintenance of cleanliness specifications and procedures for Program hardware testing, preflight checkout, and functional operations.

j. Review JSC contamination control activities and provide recommendations concerning compliance to requirements.

k. Establish and evaluate process technologies for ground-based and on-orbit applications.

8.4 Electrical, Electronic, Electromechanical (EEE) Parts

8.4.1 The Contractor shall provide services to JSC organizations that are responsible for internal or contracted efforts involving EEE parts in space flight hardware and mission-essential or critical ground support equipment for new designs, Programs, and Projects.

8.4.2 The Contractor shall:

a. Provide verification during requirements definition phase to ensure that the parts screening, qualification and vendor selection process is compliant with requirements.

b. Participate in audits of existing and proposed suppliers to verify compliance to NASA standards.

c. Perform verification of the data submittal during hardware development for parts qualification, screening, EEE parts problem resolution and corrective action, risk assessment, and recurrence control.

d. Assist in preparation, analysis and distribution of NASA Advisories and GIDEP ALERTS. Verify as-built configuration parts are not included in the GIDEP database and coordinate with JSC Engineering to resolve any nonconformances.

e. Provide technical expertise to the Receiving Inspection and Test Facility (RITF) for EEE part failure analysis and screening.

f. Evaluate electrical stress derating analysis and MTBF reliability analysis for flight hardware in conjunction with S&MA flight hardware certification process.

g. Provide reliability analysis tools and manpower to perform MTBF analyses. The analysis shall be performed in two phases. In the early design phase, the analysis shall ensure the design is consistent with the hardware failure rate goal. The final design phase shall use the appropriate stress analysis model to verify the MTBF for the delivered hardware.

h. Compare “as-built” configuration to the “as-designed” EEE parts lists and identify risk implications for any non-compliances to the Program and Project managers.

i. Support JSC Engineering by verifying the test facilities meet Program requirements.

8.5 NASA Advisories and Government-Industry Data Exchange Program (GIDEP)/Acute Launch Emergency Reliability Tip (ALERT) System

8.5.1 The Contractor shall use the GIDEP/ALERT system to exchange information both internal and external to NASA.

8.5.2 The Contractor shall maintain the GIDEP/ALERT files and related information, and the ALERT distribution list. The Contractor shall review ALERTs for applicability to JSC contracts, distribute ALERTs, and determine adequacy of responses.

8.5.3 The Contractor shall provide a controlled method to evaluate, initiate, investigate, distribute and respond to ALERTs which apply to JSC and other NASA Centers per the process and requirements of NPR 8735.1, Procedure for Exchanging Parts, Materials, and Safety Problem Data Utilizing the Government Industry Data Exchange.

9.0 INSTITUTIONAL SAFETY AND QUALITY

9.1 Pressure Systems

9.1.1 The Contractor shall provide engineering and technical expertise for the JSC pressure systems certification Program as outlined in JPR 1710.13, Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems. The Contractor shall:

a. Review and certify compliance of Pressure Vessel System (PV/S) designs.

b. Review and certify compliance of PV/S certification inspection and testing procedures.

c. Perform pressure vessel inspections per JPR 1710.13.

d. Track and record inspections and assessments per DRD 20, Facilities System Certification Report.

e. Monitor PV/S tests for conformance to test requirements.

f. Maintain a computerized inventory and recall system to document, track, and schedule all PV/S tests and inspections.

9.1.2 Inspection personnel shall possess a commission from the National Board of Boiler and Pressure Vessels. Inspectors shall be certified by the American Welding Society to perform weld inspections. The Contractor shall maintain copies of certifications and commissions and shall provide copies to the COTR.

9.2 White Sands Test Facility (WSTF)

9.2.1 The Contractor shall provide the White Sands Test Facility (WSTF) S&MA offices with support in the establishing and implementing policies and Program requirements, engineering and technical expertise in materials and process engineering, system safety, engineering and technical expertise for the JSC pressure systems certification program, inspection support to flight and flight-related systems to ensure that quality assurance requirements are satisfied, and performance of activities related to institutional safety and health.

9.2.2 The Contractor shall provide products and services to the WSTF S&MA in the following areas:

a. Process submitted Corrective/Preventive Action Requests (CPAR), including tracking CPAR resolution and maintaining the WSTF CPAR database.

b. Work with WSTF design groups, technical offices, and S&MA to make and implement quality improvements and changes.

c. Provide field quality assessments and surveillance of WSTF test activities.

d. Provide acceptance test verification.

e. Support cross-functional management system and system safety audits.

f. Generate discrepancy records for observed non-conformances and perform trend analysis.

g. Support the processes required to perform re-certification and modification of existing ground-based pressure systems and certification of new ground-based pressure systems in accordance with facility policies and procedures, applicable industry codes and specifications, and governing NASA standards.

h. Provide expertise to the processes required for the qualification of welding and brazing personnel and review and authorize welding and brazing processes and documentation in accordance with facility policies and procedures, applicable industry codes and specifications, and governing NASA standards.

i. Review WSTF management system documents for sufficiency in addressing and conformity to meeting requirements.

j. Perform vendor surveys and maintain Survey Vendor List (SVL).

k. Develop training Programs for S&MA disciplines for use at WSTF.

l. Train WSTF S&MA personnel and integrate with the JSC S&MA Personnel Qualification Program.

m. Provide record maintenance, data entry, and management system documentation maintenance.

n. Implement and maintain WSTF Hazard Management System. Assess applicable agency requirements implementation. Coordinate NASA customer inputs and communicate system needs to NASA.

o. Plan and execute annual Performance Evaluation Profile (PEP) surveys and coordinate improvement activities performed by NASA and WSTF team contractor personnel.

p. Facilitate contribution to and application of the Lessons Learned Information System (LLIS) per DRD 02, Lessons Learned, for WSTF personnel. Provide monthly assessment of WSTF information for candidate LLIS contributions. Coordinate application of LLIS with WSTF Management Representatives.

q. Assess GIDEP/ALERTS and coordinate applicable information with affected WSTF representatives.

10.0 RECEIVING INSPECTION TEST FACILITY (RITF) (Completion Form)

a. The effort described by this SOW Section provides the JSC S&MA Directorate with the expertise and ability to provide mechanical and electrical part testing, failure analysis and evaluations, and specialized training in NASA workmanship standards in support of NASA programs and projects. The RITF is located at JSC and provides services to contractors and subcontractors, JSC and other NASA Centers, as well as other Government agencies.

b. The Contractor shall provide the engineering and technical services necessary to operate the RITF facility and accomplish the testing, evaluation, and training services.

c. The Contractor shall ensure the existing American Association for Laboratory Accreditation (A2LA) and ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories, accreditation is maintained for all lab disciplines.

10.1 Mechanical and Electrical Testing and Analysis

10.1.1 The Contractor shall perform the following mechanical and electrical testing and analyses within the RITF:

a. Destructive and nondestructive physical, chemical, and metallurgical testing and analyses of raw materials, fasteners, and mechanical hardware and components. Testing includes ultimate load, hardness, and quantitative chemical analysis of fasteners (e.g., bolts and rivets). Fastener testing shall be conducted in accordance with the requirements of JSC 23642, JSC Fastener Integrity Testing Program.

b. Failure analysis of electronic and mechanical components.

c. Burn-in of electronics components.

d. Application research and testing on electronic parts proposed for use in environments not specified by the manufacturer (e.g., vacuum, extremely high or low temperatures, plasma inducing pressure levels).

e. Incoming inspection of electrical assemblies used in critical and life-support hardware.

f. Incoming screening of wire and cable to be used for flight Projects at JSC per the requirements of JSCM 8080 E-24, Manned Spacecraft Criteria and Standards.

10.1.2 In performing RITF services, the Contractor shall establish test and analysis requirements, perform inspections, screen and test, evaluate test and screening results, and prepare documentation to

be returned to the customer. In the case of a failure analysis, the Contractor shall also include determination of failure cause, and process or manufacturing corrective action recommendations.

10.1.3 The Contractor shall perform testing and analyses of manufacturing techniques, processes, and procedures pertaining to welding, soldering, electrical wire certification, surface mount technology and printed wiring boards/circuits, heat treating, EEE and mechanical parts, interconnecting wiring, fiber optics, electrostatic discharge control, conformal coating and encapsulation, staking, bonding, and contamination control.

Performance Standards – RITF Mechanical and Electrical Testing and Analysis:

1. Minimum of 90% of lab services completed on schedule.

2. Customer Satisfaction – Services including testing, analysis, and documentation, receive an overall minimum rating of "good."

10.2 Training

10.2.1 The Contractor shall maintain training courses for the following processes: through hole soldering and inspection; surface mount soldering and inspection, cable and harness crimping and inspection; wire-wrap; lithium battery handling; conformal coating fabrication and inspection; fiber optic termination; electrostatic discharge (ESD) control; and other related courses as identified in the future to support changing and new NASA program and project workmanship standards. This training ensures compliance to NASA and industry standards and demonstrates proficiency to perform the necessary tasks.

10.2.2 The Contractor shall provide a comprehensive training and cross-training program for all RITF personnel that includes both formal and on-the-job training and RITF equipment proficiency training. Training requirements and fulfillment are to be documented in the S&MA Training data system in accordance with DRD 14, S&MA Personal Qualification Program Plan.

10.2.3 The Contractor shall record all training conducted and employees trained. The Contractor shall track certifications resulting from process certification courses conducted and notify the training coordinator or designee when certifications require renewal.

Performance Standards – RITF Training:

1. 100% of periodic reports submitted on schedule

2. 100% employees with up to date training plans.

3. Customer Satisfaction – Course attendees opinion surveys indicate satisfaction with course content and level of detail.

10.3 Quality

10.3.1 The Contractor shall maintain a Quality Management System (QMS) in the RITF compliant with ANSI ASQ Q9001-2000, Quality Management Systems Requirements in accordance with DRD 06, Quality Manual.

10.3.2 The Contractor shall maintain the RITF's procedures, equipment, management, and personnel in compliance with ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories.

10.3.3 Upon receipt, the Contractor shall submit a copy of audit reports generated by internal or external auditors of the RITF to NASA RITF management. The Contractor shall provide written statuses per DRD 16, Activity Reports, of any open work remaining after an audit (such as auditor findings and observations) until the open work is completed and approved by the auditing organization.

Performance Standards – RITF Quality:

1. Maintained compliance to ANSI ASQ Q9001-2000 as verified by NASA-authorized audits and inspections.

2. Maintained certification to ISO/IEC 17025 as verified by NASA-authorized audits and inspections.

10.4 Laboratory Equipment and Facilities

The equipment provided by the Government for performance of RITF activities is listed in Section J. Property shall be managed by the Contractor per the approved Property Management Plan (DRD 08).

Performance Standards – RITF Laboratory Equipment and Facilities:

1. 100% of Property Reports submitted on time.

2. Minimum of 98% of accountable property accounted for.

10.5 Maintenance

The Contractor shall be responsible for the maintenance of RITF equipment. The Contractor shall plan, coordinate, and manage the resources to perform RITF services. The Contractor shall maintain a

prioritized life-cycle replacement and acquisition list of equipment needs that ensures continuity of RITF services and expansion of capacity to accommodate approved Program and Project requirements.

Performance Standards – RITF Maintenance:

1. 100% of equipment maintenance (scheduled maintenance and calibration) completed on schedule.

2. Life-cycle replacement and acquisition list updated and NASA-approved for input to NASA yearly budget planning activity on schedule.

10.6 Shipping and Receiving

The Contractor shall ship and receive all equipment and materials leaving or entering the RITF through the shipping and receiving area. The Contractor shall record and maintain information necessary for tracking incoming and outgoing shipments. For items being shipped or received by commercial package delivery or by the U.S. Postal Service, the Contractor shall coordinate with the JSC shipping and receiving departments.

Performance Standard – RITF Shipping and Receiving:

1. Less than one working day processing time for shipping and receiving processing.

10.7 Laboratory Information Management System (LIMS)

The Contractor shall maintain a Laboratory Information Management System (LIMS) provided by NASA. This system shall be used by the Contractor to track information and costs for all jobs performed by the RITF. The LIMS system shall be accessible by both Contractor and NASA personnel. Maintenance of the LIMS system hardware and software shall be in accordance with DRD 12, Information Technology Plan.

Performance Standards – RITF LIMS:

1. 100% data and system availability during weekdays from 8 a.m. to 6 p.m. and 24/7 during Shuttle flights (launch to landing).

2. Customer Satisfaction – Data system development and modification receive an overall minimum rating of “good.”

RITF Workload Estimates:

- Jobs per year – 1411
  - Test samples per year* – 2683
  - Failure analysis or application analysis - 60

- Number of student seats per year – 1120
- Certifications being tracked – 1221

*Multiple test samples maybe combined to be considered as one job