ATTACHMENT J-1
Statement of Work
For
Spacecraft and Vehicle Structures Design and Analysis

1.0 Scope

The Contractor shall provide specialized engineering support to the Marshall Space Flight Center (MSFC) Engineering Directorate including, but not limited to, the Structures Design and Analysis Branch. The Contractor shall provide structural and mechanical design support including, but not limited to, specialized engineering expertise, technical expertise, program support, and leadership expertise for structural/mechanical component systems design and development for spacecraft and vehicle systems. The Contractor shall provide dynamics, loads, and strength analysis for spacecraft and vehicle systems enabling design, development, structural integration, production, and operation.

2.0 Task Order Management and Reporting

A. Contractor Management

The Contractor shall provide the planning, coordination, technical direction, and surveillance of the activities necessary to assure disciplined performance of work and timely application of resources for the accomplishment of all tasks issued under the order. The Contractor shall be responsible for maintaining communication with each supported organization and alerting the Contracting Specialist immediately of any problems that would prevent meeting established milestones.

B. Data Deliverables

The Contractor shall report and document this work and fulfill the requirements of associated Data Requirement Descriptions (DRD's) as outlined in Data Procurement Document (DPD) 1179 (Attachment J-2). The Contractor shall determine the data restriction that applies to each data deliverable and mark or transmit the data restriction in accordance with section 2.3.3 of the Data Procurement Document.

1. The Contractor shall submit a Monthly Status Report in accordance with DRD 1179MA-003. Any presentation, reports, analyses or technical memorandum that is developed during the execution shall be pre-coordinated with the Task Order Monitor and final copies provided to the Task Order Monitor.

   The Contractor shall provide NASA with necessary information on project progress to allow the Government to monitor product assurance, identify significant problems, and implement corrective action as applicable based on the Contractor's performance.

   The Contractor shall develop and maintain a Work Breakdown Structure (WBS) defining all task elements contained in this Task Order and in accordance with established GSA rates per hours worked.

2. The Contractor shall submit a Badged Employee and Remote IT User Listing in accordance with DRD 1179MA-001.

3. The Contractor shall submit a Contractor Employee Clearance Document in accordance with DRD 1179MA-002.

4. The Contractor shall submit a Position Risk Designation for Non-NASA Employee in accordance with DRD 1179MA-004.

5. The contractor shall submit a Contract Information Technology Security Program Plan (CITSPP) that documents how the contractor will be responsible for information and IT security in accordance with DRD 1179CD-001.

6. The Contractor shall establish and implement an industrial safety, occupational health, and environmental program that (1) prevent employee fatalities, (2) reduce the number of incidents, (3) reduce the severity of employee injuries and illnesses, and (4) protects the environment through the ongoing planning, implementation, integration and management control of these programs in accordance with DRD 1179SA-001. The SHE Plan shall address each of the following MSFC SHE core program requirements in detail that are applicable to the contracted effort:

   a. Management leadership and employee involvement.
   b. System and worksite analysis.
   c. Hazard prevention and control.
   d. Safety, health and environmental training.
   e. Environmental compliance.

7. The Contractor shall report mishaps and safety statistics to the MSFC Industrial Safety Office in accordance with DRD 1179SA-002. The contractor shall submit direct to the NASA Incident Reporting Information System (IRIS) or shall use the forms listed in section 15.4 of DRD 1179SA-002 or electronic equivalent to report mishaps and related information required to produce the safety metrics.

3.0 Technical Requirements

The contractor shall be responsible for information and information technology (IT) security when physical or electronic access to NASA's computer systems, networks, or IT infrastructure is required or when NASA information is stored, processed, generated or exchanged with NASA or on behalf of NASA, regardless of where the information resides.

All data files and reports electronically delivered shall comply with Technical Standard 1194.21 of the Rehabilitation Act of 1973, Section 508.

Tasks shall be defined as follows:

3.1 Integrated Structural Assembly Support

Project Management
The contractor shall provide support to the USO Structures and Thermal Subsystem Manager.

Specific minimum PM Support functions applicable to USO Structures and Thermal Project Office consist of supporting the Subsystem Manager in carrying out the following responsibilities:

- Planning, preparing, conducting, and publishing minutes and action items for team meetings, technical interchange meetings, telecons, design reviews, safety reviews, monthly status reviews, and quarterly status reviews to management.

- Preparing, presenting, and submitting progress reports as required by the Order.

- Tracking actions related to the project and providing assistance toward their closure.

- Provide management support to the Structures and Thermal Integrated Product Team by:
  1. Documenting IPT and component development team meeting minutes.
  2. Tracking IPT action items and deliverables including gathering action item status prior to weekly IPT meetings.
  3. Structures and Thermal IPT gatekeeper for WindChill document reviews by keeping track of what documents need to be reviewed, by when, and by whom. May be required to integrate comments from multiple IPT members for submittal of document reviews.
  4. Integration of a variety of Structures and Thermal documents and inputs to documents, including design, databooks, and development plans, etc.
  5. Work with engineering lead to develop test plans for structures and thermal test articles.
  6. Ensure project risks are documented including risk assessments, definition of risk mitigation plans, and tracking of mitigation plans.

System Engineering
Provide engineering support on Functional Flow Diagrams, Requirements Documents, and System Modeling for Exploration Launch Systems. Provide systems engineering management, maintenance and training in systems engineering tools used to support SE tasks. Provide support on requirements and verification writing and traceability between requirements and integration efforts.

Specific activities may include (but are not limited to) the following:

<u>SE Support for Ares-US Structures and Thermal Group</u>
Document, apply, and manage the Exploration program SE&I processes for the Upper Stage Structures and Thermal Group.

Utilize Cradle SE Tool

a. Coordination with the Exploration SE Team
Coordinate with the Exploration SE team (as a representative of the Ares-US SM group) to effectively utilize the 3SL Cradle database to facilitate the Ares SE process.

b. Utilize Cradle to Support Requirements Development
Use 3SL Cradle to facilitate the comprehensive decomposition and allocation of Ares-US SM requirements.

i. *Review new EXPL Cradle Database* - Initiate familiarization with the Cradle EXPL database (schema, current data status, etc.).

ii. *Update Requirements* - Support Ares-US SM team's use of Cradle to develop, manage and cross-reference (link) Ares-US requirements using Cradle.

iii. *Trade Study, Analysis and Issues Addition and Cross-Referencing* - Support addition/update of Trade Study, Analysis and Issue items in Cradle and cross-reference these items to applicable Ares-US SM requirements.

iv. *Physical & Functional Modeling* - Support functional and physical modeling using Cradle Toolset to facilitate the comprehensive decomposition, allocation and interface definition of Ares-US requirements.

v. *Output Data* - Utilize Cradle Document Publisher capabilities and Cradle Workbench table export capabilities to output the desired data (complete requirements, a subset of desired requirements, comparison tables, physical and function models, and other products as needed) from the EXPL Cradle database into Word or Excel files.

The contactor shall provide specialized engineering support for all aspects of S&T IPT development, qualification, demonstration, and acceptance testing including structural strength, thermal, vibration and acoustic, purge/venting/hazardous gas, dynamic and pyrotechnic testing. Specific activities may include (but are not limited to) the following activities:

1. Consolidate and maintain a complete list of all testing required for S&T hardware.
2. Maintain schedules to assure design drawings are available to support necessary testing. Coordinate the creation of test drawings (including strain gage installation drawings and development test article drawings) and analysis. Track the procurement of material for, and fabrication of, development test hardware as required.
3. Write, or aid in the creation of, Test Data Sheets, qualification and development test plans and reports. Files should be maintained for all test documentation.
4. Research testing accomplished for the Saturn V and the Shuttle External tank qualification to aid in the identification of Ares testing deficiencies or alternate testing techniques. Identify areas of difficulty experienced in previous programs. Research may also include gathering available information with regard to testing of Ariane, Delta, and Atlas launch vehicles.

5. Assure a test is associated with each requirement identified as "verified by test". Ensure objectives are justified, practical, can be achieved, is warranted, and clearly identified. Identify tests that may be combined to achieve objectives while minimizing cost and schedule impacts. Understand succession plan for each piece of S&T hardware to determine how many test articles will be required.
6. Verify interfaces with test hardware and simulators.
7. Act as the primary S&T point of contact for the Upper Stage Test IPT and represent the IPT in the planning and execution of integrated testing that contains S&T hardware. Integrated testing is anticipated to include Separation testing, Acoustic testing, Ground Vibration Testing (GVT), and the Integrated Stage Test Article (ISTA).

Ordnance and Separation Systems Project Management
The contractor shall provide support to the USO Structures and Thermal Subsystem Manager and the Ordnance and Separation Systems Technical Lead. Project Integration and Ordnance and Separation systems day to day programmatic management including: planning, preparing, conducting, and team meetings, technical interchange meetings, vendor activities, design, manufacturing, test and integration reviews.

Preparing, presenting, and submitting budget data (planning and actuals), contract formulation documents, technical and progress reports as required by the Order.

Incorporation into the Ares US S&T IMS and tracking of vendor and USPC schedule activities related to the project and providing assistance toward their closure.

Provide management support to the Structures and Thermal Integrated Product Team by:

A. Integration of a variety of Structures and Thermal documents and inputs to documents, including design, databooks, and development plans, etc.
B. Work with engineering lead to develop ordnance and separation related test plans for Structures and Thermal test articles.
C. Ensure project risks are documented including risk assessments, definition of risk mitigation plans, and tracking of mitigation plans.

3.2 Dynamics, Loads, and Strength- Closed June 2008

The contactor shall provide specialized engineering support for the development and design of dynamic computer models, dynamic strength analyses, dynamic load generation, technical reports, and other miscellaneous products associated with day-to-day team activities for the various Ares Upper Stage Structures & Thermal Components.

The contactor shall provide specialized engineering support for the development and design of static computer models, static load generation, static strength analyses, technical reports, and other miscellaneous products associated with day-to-day team activities for the various Ares elements. Specialized analyses may include strength, buckling and fracture mechanics analyses.

The contractor shall support the development and design of specialized conceptual and high level requirement definition and analysis by developing operational concepts, integration methodologies, component descriptions and specifications, schematics, preliminary component designs, development and verification test plans, test procedures, and technical reports for the various Ares Upper Stage Structures & Thermal Components.

The contractor shall assist the project and IPT leaders with specialized engineering and testing tasks, milestones and product planning to meet the project overall schedules and planning. The contractor shall provide specialized support at test planning and test readiness reviews. The contractor shall support test data reviews and test analysis for the various Ares Upper Stage - Structures & Thermal Components.

The contractor shall use prior program experience to identify necessary tasks and products required for successful development and certification of dynamics, loads, and strength components of the various ARES elements. The contractor shall assist the government in the formulation and planning of specialized development, verification and certification plans for human-rated systems and by performing trade studies inapplicable areas for the various Ares Upper Stage Structures & Thermal Components.

3.3 US Integrated Test- Closed January 2010

3.4 CLV Upper Stage Structures and Thermal IPT

The contractor shall provide structural, mechanical and thermal design support for spacecraft and vehicle systems using design package systems such as, but not limited to, Pro-E.

3.5 US Structures and Thermal IPT – Closed January 2009

3.6 Ares V ED Study Pro-E Support – Closed November 2008

3.7 EDO-US Structures & Thermal IPT – Closed November 2008

3.8 MSFC – Structural Test Articles (SA) Support – Closed June 2010

3.9 S&T SE&I and Analysis Support

Provide engineering support on Functional Flow Diagrams, Requirements Documents, and System Modeling for Exploration Launch Systems. Provide systems engineering management, maintenance and training in systems engineering tools used to support SE tasks. Provide support on requirements and verification writing and traceability between requirements and integration efforts.

3.10 Spacecraft and Launch Vehicle Structural & Mechanical Design Support

(Authorization to proceed with this subtask will be provided by the Contracting Officer in written direction.)

The contractor will provide structural and mechanical design support for MSFC, and departments, divisions and branches within the Engineering Directorate, including, but not limited to, the Structural and Mechanical Branch. This support will include, but not limited to, design of flight and test hardware for spacecraft and launch vehicles. Leadership and support for integrated product type teams shall be included, but not limited to, participating in monthly reviews and / or telecons to collect the required information for this effort.

4.0 Travel

The contractor shall travel as requested to accomplish each technical requirement. Any travel must be approved by the Contractor Officer‘s Technical Representative (COTR) or task order technical monitor, prior to travel.

The contractor’s monthly report shall contain travel detail to include travel destination, dates of travel, number of people who traveled, and purpose of the travel.

5.0 Materials

No materials are currently required for this order. However, this may change based on the customer’s requirements as directed by the Contractor Officer‘s Technical Representative (COTR) or task order technical monitor. Any materials being purchased must be approved by the Contracting Officer prior to purchase.

6.0 Reserved

7.0 Personnel Skill Levels

The Contractor shall provide skills at a level to perform the subtasks in this order.

8.0 Technical Milestones and Deliverables

Specified under Section 2.B of the SOW; any additional deliverables for specific subtasks are specified under Section 3.0.