J – 1

STATEMENT OF WORK
FOR
ARES I SYSTEM ENGINEERING AND INTEGRATION TASKS SUPPORT
FOR THE
MSFC SPACECRAFT & VEHICLE SYSTEMS DEPARTMENT

1.0 Scope

This statement of work defines the requirements to be accomplished by the contractor for the National Aeronautics and Space Administration (NASA) at the Marshall Space Flight Center (MSFC). The Contractor shall provide systems engineering support to the branches within the Spacecraft & Vehicle Systems Department of the Engineering Directorate at MSFC for the new Crew Launch Vehicle (CLV) and Cargo Launch Vehicle (CaLV) as part of the NASA Constellation Program (CxP). This includes, but is not limited to, the development of and support to the Ares Program Element products, tasks, activities, and risk management.

The specific task areas shall include, but are not limited to, resolving testing and developmental issues for the propulsion systems, upper stage segments and other vehicle stages as required; planning and coordinating for design, manufacturing, hardware assembly and checkout of test article subsystems; providing support and coordinating the development of change packages for the Upper Stage design and development; and other systems engineering and integration tasks as required. The Contractor shall participate, as directed, in various Technical Working Group (TWG) meetings, interface with the System Integration Groups (SIGs), and participate in monthly reviews and / or telecons to collect the required information for supporting these task processes.

2.0 Reporting and Management

The Contractor shall report and document this work and fulfill the requirements of associated Data Requirements Descriptions (DRDs) as outlined in Data Procurement Document (DPD) 1255 (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.

A. In accordance with DRD 1255MA-001, the Contractor shall generate a single Monthly Status Report to include the following:

- **Financial Reporting**
  NASA will provide to the Contractor the applicable Work Breakdown Structure (WBS) charge code(s) for each subtask. (There may be multiple charge codes for each subtask.) The Contractor shall maintain the WBS defining all task elements contained in this Task Order and in accordance with established GSA rates per hours worked.

- **Technical Reporting**
  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. See section 3.0 for specific deliverables per subtask. Any presentation, reports, analyses or technical memorandum that is developed during the execution shall be pre-coordinated with the task order lead and final copies provided to the task order lead.

- **Contractor Management Reporting**
  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 Officer's Technical Representative (COTR) immediately of any problems that would prevent meeting established milestones.

B. In accordance with DRD 1255SA-001, the contractor shall report mishaps and safety statistics to the MSFC Industrial Safety Branch. 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 1255SA-001 or electronic equivalent to report mishaps and related information required to produce the safety metrics.

3.0 Technical Requirements

Subtask 1 – Upper Stage and J-2X Engine Integration
The contractor shall provide support for the Integration of the Upper Stage and J-2X engine. Specific tasks shall include, but are not limited to, resolution of issues (technical and non-technical) related to testing and development of liquid oxygen, liquid hydrogen, pneumatic, electrical and other interfaces by working with engine, upper stage and other applicable parties.

Specific deliverables for this task shall include, but are not limited to, initiation or review of interface control document changes, development plans, test plans, and other documentation as required.

Subtask 2 - MPTA Assembly and Checkout Integration
The contractor shall provide support for the development of the MPTA to assure verification of the ARES I main propulsion system design. Specific tasks shall include planning and coordination for design, manufacturing, hardware assembly and checkout of each MPTA subsystem.

Specific deliverables for this task shall include input for and review of, MPT Master Test Plan, MPT requirements Document, MPT Verification Plan, Test Matrix, Test facility requirements and others.

Subtask 3 – Constellation Program Vehicles Design Support
The contractor shall perform Constellation Program Vehicles Design Support including creation of a vehicle level assembly model. This task will also include the development and maintenance of a configuration of the vehicle assembly in Pro-E and the Design Data Management System (DDMS) Windchill Product Data Management System (PDMS). This task will also include interfacing with the Pro Engineer process developers to establish methods and standards to integrate I-DEAS files from the first stage contractor. The goal is to have an acceptable process utilizing DDMS to provide reference models which will replace current activities utilizing NXCAD and Teamcenter PDM system. This activity must be closely coordinated with First Stage, Upper Stage, Crew Exploration Vehicle, Launch Abort System, and others as directed by the Government.

Subtask 4 – Thermal Design and Analysis
The contractor shall support the MSFC Advanced Concepts Office (ED04) by performing structural and thermal design and analysis of conceptual spacecraft applicable to a broad range of potential future NASA missions. The structural analysis shall include analysis of Earth-to-orbit launch vehicles and orbital spacecraft concepts designed to perform low-Earth orbit, lunar, and planetary missions. Analysis shall include structural design, loads analysis and mass estimation of spacecraft and payload concepts. Structural analyses shall include all aspects of launch vehicle and spacecraft structural analyses, including primary structure, propellant tank sizing, crew habitat analysis, and secondary structures for metallic and composite structural materials. The contractor shall also assist with the analysis and sizing of spacecraft and payload thermal subsystems. Thermal analysis shall include supporting design team members to assist in the development of thermal system models, analysis of thermal environments and design of spacecraft and payload thermal control systems. Conceptual design analyses will consist of quick-turn around studies, preliminary design trades, vehicle conceptual development as well as detailed analyses to define system requirements and vehicle operational concepts. The contractor shall perform the design analyses utilizing the Advanced Concepts Branch collaborative engineering computer tools, including NASTRAN, FEMAP, Hypersizer, Thermal Desktop, Thermica, SINDA-G as well as a number of specialized in-house structural and thermal analysis tools.

Subtask 5 – Constellation Project Vehicles System Integration

The contractor shall provide Constellation Project Vehicles system integration activities including system engineering and integration, concept of operations development, schedule and project management, program integration, configuration management, risk management, and vehicle analysis support. The contractor shall review and analyze requirements and interface control documents for their hierarchy and implementation schedule for completeness, maturity, feasibility and other characteristics that would impact the Constellation Team's capability. The contractor shall identify long lead procurement items and establish rough schedule for implementation. This activity shall > be closely coordinated with Constellation Project Offices and Vehicle Product Teams as directed by the Government.

4.0 Staffing Requirements

A. Staffing Requirements for Subtask 1 and 2

The contractor shall provide personnel with the following experience/knowledge base:

(b)(4)

[redacted]

B. Staffing Requirements for Subtask 3

(b)(4)

[redacted]

C. Staffing Requirements for Subtask 4

There are no specific staffing requirements for Subtask 4.

D. Staffing Requirements for Subtask 5

There are no specific staffing requirements for Subtask 5.

5.0 Travel

The Contractor shall travel as requested to accomplish each technical requirement contained in this SOW. The government will authorize this travel as required during the period of performance.

- **Planned Travel for Subtask 2 per year:**
  - Two (2) trips to Pratt-Whitney Rocketdyne Facilities in Chatsworth, CA, for one (1) week each trip
  - Two (2) trips to Stennis Space Center, MS, for one (1) week each trip

- **Estimated Potential Travel for all Subtasks per year:**
  - One (1) trip to Pratt-Whitney Rocketdyne Facilities in Chatsworth, CA, for five (5) days each trip
  - One (1) trip to Stennis Space Center, MS, for five (5) days each trip
  - One (1) trip to any location determined to be necessary by EV management for five (5) days each trip

6.0 Period of Performance

ATP to **09/30/2011**.

In the event the Government elects to exercise its option(s) pursuant to the terms of this task order, the period of performance for each option shall be as set forth below:

Option 2 - 05/1/2010 to 09/30/2010 (exercised by Modification 18)

Option 3 – 10/01/2010 to **09/30/2011** (exercised by Modification 21)

7.0 Materials:

N/A

8.0 Work Location:

All tasks shall be performed offsite at Contractor's facilities.