ATTACHMENT J-1
STATEMENT OF WORK
For
SPECIALIZED ENGINEERING SERVICES FOR SPACECRAFT AND VEHICLE SYSTEMS ANALYSIS AND PERFORMANCE

1.0 Scope

The Contractor shall provide systems engineering, analysis and integration support to the Marshall Space Flight Center (MSFC) Engineering Directorate including, but not limited to, the Spacecraft Systems Engineering and Integration Division. The Contractor shall provide support for, but not limited to, the development of the spacecraft and vehicle systems engineering products.

The Contractor shall provide Modeling and Simulation (M&S) support in the following areas: develop, distribute, collect M&S data surveys, support prioritization of M&S for accreditation, support M&S gap analysis and investment planning, and provide M&S Verification, Validation, and Accreditation (VV&A) services.

The Contractor shall participate in various Technical Working Group (TWG) meetings, interface with the System Integration Groups (SIGs), Integration Groups (IGs), Panels, and Elements, and participate in monthly reviews and/or telecons to collect the required information for supporting these task processes.

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 Requirements Descriptions (DRDs)

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) 1225 (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 1225MA-001. 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 1225MA-002.

3. The Contractor shall submit a Contractor Employee Clearance Document in accordance with DRD 1225MA-003.

4. The Contractor shall submit a Position Risk Designation for Non-NASA Employees in accordance with DRD 1225MA-004.

5. 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, generated or exchanged with NASA or on behalf of NASA, regardless of where the information resides. The contractor shall prepare 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 1225CD-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 1225SA-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 1225SA-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 1225SA-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 M&S Integrated Management – Closed December 2008

The Contractor shall execute the M&S Integrated Management strategy in accordance with the M&S requirements by providing centralized oversight of M&S needs, usage and development with an emphasis on:

- Promoting M&S Standards to ensure validated models and simulations are being used to support the system lifecycle.
- Developing, distributing, and collecting M&S data surveys and compiling the collected M&S data/info into an appropriate database.
- Identifying and prioritizing M&S candidates for accreditation to support critical program decisions.
- Supporting M&S gap analysis and investment planning
- Providing M&S VV&A Brokerage services.

M&S Data Surveys
The Contractor shall:

- Develop an M&S Data Survey process (to be documented in the M&S Support Plan (MSSP))
- Develop an M&S Data Survey form to collect appropriate M&S attributes to support:
  - M&S prioritization for accreditation.
  - Gap analysis, including time-phased needs and capabilities for investment planning.
- Distribute and collect completed Data Survey forms.
- Compile the collected data/info in an appropriate database.

M&S Prioritization for Accreditation

The Contractor shall:

- Support development of a process for identifying and prioritizing M&S for accreditation (to be documented in the M&S Support Plan).
- Support execution of the process for identifying and prioritizing M&S for accreditation.
- Document DAC-specific M&S and associated priorities in the DAC-related Annex of the MSSP.

Ares M&S Investment Analysis Planning

The Contractor shall:

- Conduct M&S needs assessment to plan and manage M&S investments;
- Conduct gap analyses of M&S.
  - Identify capability overlap and redundancies.
  - Support the planning and development of integrated M&S capability to support program analysis and system development.
- Identify and manage M&S capability development risks.
- Assess overall Ares Project risks for associated M&S needs.

Ares M&S VV&A Brokerage Services

The Contractor shall:

- Provide the expertise to support the planning, development and implementation of CxP VV&A processes for the CLV Project.
- Assist the CxP in maturing the VV&A process by capturing feedback to update CxP applicable M&S documentation.
- Provide inputs to a formalized Accreditation Process and M&S Risk Assessment Methodology.
- Identify and assist in planning VV&A Training, Education and Socialization needs for a successful implementation of the CxP VV&A processes at the CLV level.
- Assist in promoting the VV&A concepts, principles and practices through the development of briefings, white papers and other materials to communicate across stakeholder communities by participating in conferences and workshops.
- The Contractor shall provide technical support and input to develop required documentation in the form of briefing materials to support this activity.

3.2 Operability Design & Analysis – Safety – Closed September 2009

3.3 Specialized SE&I Support for ID&A

1) The contractor shall provide program management specialists in the integration of integrated vehicle design and analyses, including, but not limited to, vehicle requirements analysis, modeling and simulation, design analysis cycle planning and execution, and verification methods. The contractor shall support and/or lead, as needed, IDA work

package discipline integration, DAC planning, implementation, and re-integration tasks and work with the Level 3 design and analyses working group and other working groups and integration groups as needed.
2) The contractor shall directly support IDA work package manager for fulfilling IDA work package responsibilities including integration, technical implementation, and the on time delivery of quality products to the VI project office and other customers. Integration responsibilities shall include planning, evaluations, status of technical disciplines, establishing, tracking, coordinating, and addressing technical actions from project and engineering. Responsibilities shall also include supporting and/or providing, as needed, status reviews and project monthly reviews and associated metrics and risk identification, mitigation, and tracking responsibilities for IDA. The contractor shall support SRD, IRD, DRD requirements coordination and technical resolutions as needed. The contractor shall conduct and support trade study planning, Level 2, Level 3, and Level 4 coordination as needed.
3) The contractor shall perform or lead trade study and decision analysis efforts, including technical disciplines, and facilitate decision making for a wide range of Ares I technical issues.
4) The contractor shall evaluate technical quality, status, and provided integration of analyses and design products and documentation in support of vehicle design, development, operational flight tests and flight operations for the Ares program.
5) The contractor shall provide subject matter expert support to verification and validation activities for models and simulations used for IDA work package. The contractor shall review technical reports, requirements documents, engineering memorandums for technical adequacy and content.
6) The contractor shall provide technical subject matter expertise for integration, but not limited to, of the following IDA disciplines for human rated space launch vehicle or similar vehicle:

- Guidance and navigation algorithm development, implementation, and assessment
- Flight control system performance determination through linear stability analyses; and 3-degree of freedom (DOF) and 6-DOF simulation implementation, development, and analyses.
- Static and dynamic structural loads determinations through estimation, analyses, and test, including finite element analyses.
- Aero-elastic analyses
- Trajectory and performance analyses
- Determination of valid ranges for Vehicle/discipline specific Monte Carlo dispersions.
- Aerodynamics, aero-thermal, flight acoustics analyses
- Thermal analyses
- Propulsion and lift-off acoustics
- Solid and cryogenic liquid systems
- Mass properties estimation techniques and CAD integration

7) The contractor shall support Constellation/VI project office with architecture integration activities including architecture development and feasibility analyses,

physical configuration definition, architecture reference documentation, mission modeling and simulation.

8) The contractor shall support analytical integration activities between Ares, Level II and the Ares Level IV elements including Ares Design Analysis Cycle (ADAC) / Constellation Integrated Design Analysis Cycle (IDAC) / Orion Design Analysis Cycle (ODAC) coordination as needed. The contractor shall support identification, preparation and implementation of analyses and trade studies efforts, documentation and presentation of related work to the various working groups and control boards, as well as issues tracking and resolution. The contractor shall support development of the ADAC / IDAC plans, integrated analysis schedules, as well as requirements coverage and design feasibility assessments.
9) The contractor shall provide requirements development and verification support.

3.4 Operability Design & Analysis - Reliability – Closed June 2010

3.5 Ares V – MSFC-Vehicle Integration – Closed October 2009

3.6 Operability Design & Analysis Abort – Closed October 2009

3.7 Ares V MSFC Vehicle Systems Analysis

Provide systems engineering expertise in support of Ares V to develop documents such as the Systems Analysis Plan (SAP) and Design Analysis Cycle (DAC) Plan.

3.8 VI SE&I Support LCRSP Trajectory Working Group – Closed June 2010

3.9 Spacecraft and Launch Vehicle Systems Analytical Integration Support
(Authorization to proceed with this subtask will be provided by the Contracting Officer in written direction.)

The Contractor shall plan and perform engineering activities associated with, but not limited to, design development, and other assignments in conformance with Vehicle Systems Management (VSM) System definition/design engineering and customer specifications. Effort spans the development spectrum to include requirements development and traceability, algorithm design, customer interface and integration, documentation, and testing.

Algorithm development and technical documentation, and communication skills will be employed. The output will be used by the flight software group as a basis of the vehicle flight software. May perform other systems engineering task related to NASA Systems Engineering Process and Requirements, NPR 7123.1A such as but not limited to duties as described above.

Systems Engineering: Contractor shall provide resources and support in the implementation of systems engineering functions. Contractor shall provide support and participation in preparing for and execution of technical reviews.

1. Provide an Interface Lead which is responsible for providing direct technical support to engineering and project working groups, panels and boards as necessary to support Vehicle Integration.
2. Provide a Database Lead which is responsible for providing direct technical support for database and IT expertise related to ICD/SRD Requirements, TBD/TBR resolutions, risk mitigations, etc. using customer defined database tools.
3. Provide inputs and guidance for the development and management of systems engineering processes. These processes shall provide the mechanisms for identifying and evolving the product and process definition such as but not limited to vehicle systems.
4. Assist in developing the policies and processes, which specify the requirements for the planning, implementation, and control of product and process development and human/system interaction.
5. Assist in the development of system definition, concepts, interfaces, and specifications.
6. Provide support for the planning and implementation of fabrication, assembly, integration, and testing.
7. Support the development of multi-year roadmaps with internal and external organization entities for future milestone-based planning and implementation.
8. Support the development of Project Plans, Implementation Plans and the organizational implementation against those plans.
9. Support the integration such as, but not limited to, the Elements into a functional Launch Vehicle, vehicle, spacecraft or technology product.
10. Support systems engineering implementation through participation in panels, boards and working group discussions.
11. Support trade studies and perform an Analysis of Alternatives (AoA) as required.
12. Provide support to planning and implementation of a vehicle approach for DDT&E.
13. Support and participation in preparing for and execution of technical reviews.
14. May perform other systems engineering task related to NASA Systems Engineering Process and Requirements, NPR 7123.1A such as, but not limited to duties as described above.

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.