

ATTACHMENT J-1
Statement of Work
For
Systems Engineering Division Support

1.0 Scope

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

The Contractor shall provide specialized systems engineering services and expertise in the following areas for spacecraft and launch vehicle elements such as, but not limited to, integrated systems and subsystems technical hardware / software requirements, design, test and verification; vehicle and subsystems development and analyses; systems engineering and integration; identify vehicle hardware / software systems requirements, verification and interface issues; systems engineering tools / database support configuration/data management and data architecture; and coordination / support to engineering planning and the technical review processes.

The Contractor shall participate 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 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) 1177 (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 1177MA-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 1177-001.
3. The Contractor shall submit a Contractor Employee Clearance Document in accordance with DRD 1177-002.
4. The Contractor shall submit a Position Risk Designation for Non-NASA Employee in accordance with DRD 1177-004.
5. 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 1177CD-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 1172SA-001. The SHE Plan shall address each of the following MSFC SHE core program requirements in detail that are applicable to the contracted effort:
 - i. Management leadership and employee involvement.
 - ii. System and worksite analysis.
 - iii. Hazard prevention and control.
 - iv. Safety, health and environmental training.
 - v. Environmental compliance.
7. The contractor shall report mishaps and safety statistics to the MSFC Industrial Safety Office in accordance with DRD 1172SA-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 1172SA-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, generated or exchanged with NASA or on behalf of NASA, regardless of where the information resides.

The Contractor shall provide specialized systems engineering services in requirements generation and analyses, systems engineering and integration, verification processes and system performance requirements verification, interface requirements development, test and verification planning, systems engineering tools support and support to the technical review process for all spacecraft and vehicle system elements.

The Contractor shall provide strategic and engineering planning for spacecraft and vehicle system elements. The Contractor shall be responsible for technical inputs to risk management, configuration and data management, review planning, trade study planning and general SE process definition management and SE functions.

Tasks shall be defined as follows:

3.1 Systems Requirements, Verification, and SE Tool Support – Closed September 2009

The Contractor shall provide inputs to the development of review products such as, but not limited to, Ares Upper Stage (US) Element Requirements Document (ERD), Systems Requirements Documents (SRD), Ares First Stage ERD, and Ares to Ground Systems (GS) IRD. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 3 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products.

The Contractor shall provide inputs to the development of review products such as, but no limited to, CxP Master Integrated Verification Plan and Ares to US Verification Requirements. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 4 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products. The Contractor shall review CxP Architecture.

The Contractor shall provide expertise in the use of Cradle Toolset for capturing database inputs, documents management, requirements and verification linking and tracking, and functional flow block diagram generation. The Contractor shall provide general expertise in the operation and administration of the Cradle application and assist book managers and other Systems Engineering personnel in the use of Cradle to support generation of data products for CxP Office / Project reviews.

3.2 Interface Requirements, Verification, and SE Tool Support

The Contractor shall provide inputs to the development of review products such as, but not limited to, Ares Upper Stage (US) Element Requirements Document (ERD), Systems Requirements Documents (SRD), Ares First Stage ERD, and Ares to Ground Systems (GS) IRD. The Contractor shall participate in technical reviews of the documents and disposition

any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 3 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products.

The Contractor shall provide inputs to the development of review products such as, but no limited to, CxP Master Integrated Verification Plan and Ares to US Verification Requirements. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 4 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products. The Contractor shall review CxP Architecture.

The Contractor shall provide expertise in the use of Cradle Toolset for capturing database inputs, documents management, requirements and verification linking and tracking, and functional flow block diagram generation. The Contractor shall provide general expertise in the operation and administration of the Cradle application and assist book managers and other Systems Engineering personnel in the use of Cradle to support generation of data products for CxP Office / Project reviews.

3.3 Test Requirements, Test & Verification, and SE Tool Support – Closed November 2009

The Contractor shall provide inputs to the development of review products such as, but not limited to, Ares Upper Stage (US) Element Requirements Document (ERD), Systems Requirements Documents (SRD), Ares First Stage ERD, and Ares to Ground Systems (GS) IRD. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 3 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products.

The Contractor shall provide inputs to the development of review products such as, but no limited to, CxP Master Integrated Verification Plan and Ares to US Verification Requirements. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 4 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products. The Contractor shall review CxP Architecture.

The Contractor shall provide expertise in the use of Cradle Toolset for capturing database inputs, documents management, requirements and verification linking and tracking, and functional flow block diagram generation. The Contractor shall provide general expertise in the operation and administration of the Cradle application and assist book managers and other Systems Engineering personnel in the use of Cradle to support generation of data products for CxP Office / Project reviews.

3.4 Flight Integrated Test Requirements, Verification, and SE Tool Support – Closed August 2007

The Contractor shall provide inputs to the development of review products such as, but not limited to, Ares Upper Stage (US) Element Requirements Document (ERD), Systems Requirements Documents (SRD), Ares First Stage ERD, and Ares to Ground Systems (GS) IRD. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 3 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products.

The Contractor shall provide inputs to the development of review products such as, but no limited to, CxP Master Integrated Verification Plan and Ares to US Verification Requirements. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 4 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products. The Contractor shall review CxP Architecture.

The Contractor shall provide expertise in the use of Cradle Toolset for capturing database inputs, documents management, requirements and verification linking and tracking, and functional flow block diagram generation. The Contractor shall provide general expertise in the operation and administration of the Cradle application and assist book managers and other Systems Engineering personnel in the use of Cradle to support generation of data products for CxP Office / Project reviews.

3.5 Ground Vibration Test Requirements, Verification, Interfaces and SE Tool Support – Closed October 2007

The Contractor shall provide inputs to the development of review products such as, but not limited to, Ares Upper Stage (US) Element Requirements Document (ERD), Systems Requirements Documents (SRD), Ares First Stage ERD, and Ares to Ground Systems (GS) IRD. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 3 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products.

The Contractor shall provide inputs to the development of review products such as, but no limited to, CxP Master Integrated Verification Plan and Ares to US Verification Requirements. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 4 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products. The Contractor shall review CxP Architecture.

The Contractor shall provide expertise in the use of Cradle Toolset for capturing database inputs, documents management, requirements and verification linking and tracking, and functional flow block diagram generation. The Contractor shall provide general expertise

in the operation and administration of the Cradle application and assist book managers and other Systems Engineering personnel in the use of Cradle to support generation of data products for CxP Office / Project reviews.

3.6 US Requirements, Verification, and SE Tool Support – Closed January 2008

The Contractor shall provide inputs to the development of review products such as, but not limited to, Ares Upper Stage (US) Element Requirements Document (ERD), Systems Requirements Documents (SRD), Ares First Stage ERD, and Ares to Ground Systems (GS) IRD. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 3 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products.

The Contractor shall provide inputs to the development of review products such as, but no limited to, CxP Master Integrated Verification Plan and Ares to US Verification Requirements. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 4 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products. The Contractor shall review CxP Architecture.

The Contractor shall provide expertise in the use of Cradle Toolset for capturing database inputs, documents management, requirements and verification linking and tracking, and functional flow block diagram generation. The Contractor shall provide general expertise in the operation and administration of the Cradle application and assist book managers and other Systems Engineering personnel in the use of Cradle to support generation of data products for CxP Office / Project reviews.

3.7 CxP Test & Verification, and SE Tool Support – Closed September 2007

The Contractor shall provide inputs to the development of review products such as, but not limited to, Ares Upper Stage (US) Element Requirements Document (ERD), Systems Requirements Documents (SRD), Ares First Stage ERD, and Ares to Ground Systems (GS) IRD. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 3 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products.

The Contractor shall provide inputs to the development of review products such as, but no limited to, CxP Master Integrated Verification Plan and Ares to US Verification Requirements. The Contractor shall participate in technical reviews of the documents and disposition any comments received from the reviews. The Contractor shall interface with the SIGs, the CxP Office and complete Section 4 in preparation for major reviews. The Contractor shall support the Cradle inputs, linking and publishing of the data products. The Contractor shall review CxP Architecture.

The Contractor shall provide expertise in the use of Cradle Toolset for capturing database inputs, documents management, requirements and verification linking and tracking, and functional flow block diagram generation. The Contractor shall provide general expertise in the operation and administration of the Cradle application and assist book managers and other Systems Engineering personnel in the use of Cradle to support generation of data products for CxP Office / Project reviews.

3.8 Systems Management Support – Closed May 2008

The Contractor shall provide Systems Management services / expertise to facilitate the activities of systems engineering and systems management responsible for the configuration and data management, records management, risk management, knowledge management, review planning, trade study planning and general SE process definition through the Systems Engineering Management Plan (SEMP) and management of project CDM, risk management and systems engineering and integration (SE&I) functions. The Contractor shall provide inputs on SE process planning, definition, development and maintenance of SE, vehicle integration and systems management products.

3.9 SEG Support – Closed May 2008

3.10 Modeling & Simulation Support – Closed May 2008

3.11 Systems Management Support – Closed January 2008

3.12 L2 Primo Book Manager – Closed October 2009

3.13 Operability Design and Analysis Reliability – Closed January 2009

3.14 VI Configuration and Data Management Support – Closed October 2009

3.15 Vehicle Integration Development Support - Closed June 2008

3.16 Analytic Integration Support – RESERVED

3.17 Specialized SE&I Support for ID&A – Closed December 2008

3.18 US Configuration and Data Management Support – Closed October 2009

3.19 Specialized SE&I Support for VI Ares LSI & Assembly Analysis & Plan – Closed June 2008

3.20 Specialized SE&I Support for Avionics/SW Integration – Closed June 2008

3.21 Operability Design and Analysis – Safety – Closed January 2009

3.22 Program/Systems Analyst – Closed June 2010

3.23 Vehicle Systems Integration (VSI) - SE Support

The contractor shall provide Systems Engineering and Integration technical to support the NASA/MSFC Spacecraft and Vehicle Systems Engineering and Integration Division (VSI), Vehicle System Design and Integration Branch (EV91) organization by performing the following tasks:

1. 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 of the Ares 1 system.
2. 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.
3. Assist in the development of system definition, concepts, interfaces, and specifications.
4. Provide support for the planning and implementation of fabrication, assembly, integration, and testing.
5. Support the development of Level III multi-year roadmaps with internal and external organization entities for future milestone-based planning and implementation.
6. Support the development of Project Plans, Implementation Plans and the Level III Ares 1 organizational implementation against those plans.
7. Support the integration of the Elements into a functional Crew Launch Vehicle
8. Support systems engineering implementation through participation in panels, boards and working group discussions.
9. Support trade studies and perform an Analysis of Alternatives (AoA) as required.
10. Provide support to planning and implementation of the Ares 1 approach for DDT&E.
11. Support and participation in preparing for and execution of technical reviews such as SRR, SDR, PDR, CDR, DCR, etc.

3.24 FITO - Vehicle Systems Integration (VSI) - Sys Engineering

The contractor shall provide engineering technical expertise (SE, Propulsion, Avionics, Software, Verification, Integration, Test, Planning; with an emphasis on Test Integration and planning) to support to the NASA/MSFC Vehicle Systems Integration, (VSI) Systems Engineering and Integration (SE&I) organization, and the Flight Integration and Test Organization (FITO) and in particular the System Test Integration Group (SyTIG) and other joint FITO/VI working groups by participating as a member of the VSI team. This systems engineering expertise will facilitate, coordinate and expedite the work package tasks activities with the SyTIG/VSI and associated Elements/IPTs and other working groups (Level IV, Level III and Level II) , during the design process for the Ares vehicle. Also included is support/participation in technical reviews such as SRR, SDR, DCR, PDR, CDR, etc. Also the contractor shall perform evaluate the implementation plan/process for horizontal integration which cross cuts all WBS managers, Work Package managers, elements (and associated IPTs), disciplines and external organizations (external to NASA/MSFC) focusing on the required technical coordination for efficient and effective product development.

3.25 VIO - Project Management Support Systems Requirement Verification – Closed June 2010

3.26 VI Project Management Support Vehicle Systems Integration – Closed June 2010

3.27 EDO C&DM Support – Closed December 2008

3.28 Ares Project Management - Oscillation Team Support – Closed December 2008

3.29 Ares 1 Integrated Abort Support – Closed April 2009

3.30 Ares 1 Integrated Abort Support – Closed June 2010

3.31 Integrated Design & Analysis - LOX Damper

The contractor shall provide physics based liquid oxygen (LOX) Damper Analysis support for launch vehicle design and integration as directed by EV91. The contractor support shall include, but is not limited to, updating the previously derived, physics based standard model to incorporate the latest analytical and test observations ; modeling different hardware configuration and test setups; work with the group to apply creative thought in the use of this technology to mitigate oscillation in spacecraft and launch vehicles including Ares 1 and Upper Stage.

3.32 Ares V - MSFC Vehicle Integration

The Contractor shall perform a variety of engineering tasks which are broad in nature and are concerned with the project planning, engineering processes, project reviews, and risk management. The Contractor shall perform with some latitude for un-reviewed actions and decisions.

The Contractor shall plan and perform engineering activities associated with design development, and other assignments in conformance with design, engineering and customer specifications. Responsible for the technical/engineering part of a project of lesser complexity and importance than those normally assigned to a higher level engineer.

3.33 Ares V Core Cryogenic Stage Support – Closed January 2010

3.34 Systems and Design Integration Support for Spacecraft & Vehicle Systems
(Authorization to proceed with this subtask will be provided by the Contracting Officer in written direction.)

Requirements Development and Management: The contractor shall provide resources and skills necessary to decompose program needs, goals, and objectives into system requirements and the maintenance of these requirements through the system lifecycle. Additionally, this shall include the management of this requirement space to ensure effective communication and integration into lower level design requirements documents. Products developed under this task shall include, but is not limited to, functional flows, functional requirements, system requirements, system specifications, interface requirements, interface control and interface definitions; or additional requirements documents necessary to support the system, mandated by NASA or MSFC procedural requirements.

Design Integration: The contractor shall provide resources and discipline expertise to support requirements and interface maturation. Products developed under this task shall include, but is not limited to, trade study decision packages, proposed system or interface requirements and definitions, requirements validation and compliance data, or system definitions in support of requirements management. The contractor shall provide technical support to product teams throughout the design definition and maturation lifecycle; and support to the execution of design trade studies or technical issue resolution teams. As necessary, the contractor shall provide design integration support to risk reduction activities such as flight test or development test planning.

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

3.35 Systems Test & Flight Evaluation Support for Spacecraft & Vehicle Systems
(Authorization to proceed with this subtask will be provided by the Contracting Officer in written direction.)

The contractor shall provide engineering technical expertise (SE, Propulsion, Avionics, Software, Verification, Integration, Test, Planning; with an emphasis on test integration and planning) to support the vehicle systems test and flight evaluation Systems Engineering and Integration (SE&I) organization, and the flight test organization and designated working groups by participating as a member of the vehicle integration team. This systems engineering expertise shall facilitate, coordinate and expedite the work package tasks activities with the project(s) and other working groups (Level IV, Level III and Level II), during the design process for the vehicle. Also included is support/participation in technical reviews such as SRR, SDR, DCR, PDR, CDR, etc. The contractor shall perform and evaluate the implementation plan/process for horizontal integration which cross cuts all WBS managers, Work Package managers, elements (and associated IPTs), disciplines and external organizations (external to NASA/MSFC) focusing on the required technical coordination for efficient and effective product development. May perform other systems engineering task related to NASA Systems Engineering Process and Requirements, NPR 7123.1A such as but not limited to test planning, process and risk management duties as assigned. Test planning and integration tasks shall be in compliance with organizational issuance EV01-OWI-001.

3.36 Systems Planning Support for Spacecraft & Vehicle Systems
(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 design development, and other assignments in conformance with design, engineering and customer specifications. Responsible for the technical/engineering part of a project of lesser complexity and importance than those normally assigned to a higher level engineer. May perform other systems engineering tasks related to NASA Systems Engineering Process and Requirements, NPR 7123.1A such as but not limited to systems engineering planning, process development, review planning and execution, and risk management duties as assigned.

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

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.