

## **Statement of Work For Launch Vehicle and Spacecraft Operations Support**

### **1.0 Scope**

The Contractor shall provide systems engineering and operations support to Marshall Space Flight Center (MSFC) Engineering Directorate, Mission Operations Lab. This includes tasks to support the planning, design, development and integration of the operations and ground support systems of launch vehicles, spacecraft and associated elements.

The Contractor shall provide operations engineering and integration support to the launch vehicle, spacecraft and associated elements. The support provided will include both flight and ground operations activities. The operations activities will include support to the following functions; Ground Operations integration and implementation; Flight Operations integration and implementation; Ground Support Equipment integration and implementation; Ground Support Systems development; and test integration and implementation.

### **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) 1180 (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 1180MA-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 contract 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 1180MA-001.
3. The Contractor shall submit a Contractor Employee Clearance Document in accordance with DRD 1180MA-002.
4. The Contractor shall submit a Position Risk Designation for Non-NASA Employees in accordance with DRD 1180MA-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 1180CD-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 1180SA-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 1180SA-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 1180SA-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.

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 Vehicle Integration and Operations, Ground Operations – Close June 2010**

Ground Operations tasks cover the effort from the manufacturing facility to the launch pad to effectively test, transport and process the Ares during the design, development, test, evaluation and operational phases. The efforts in this task consist of ground operations considerations for concept development; planning; training; Ground Operations Working Group (GOWG) support; IPT support; requirements formulation; process assessment and analysis; input to Earned Value Management (EVM) activities; availability modeling inputs, and cost modeling inputs. This activity also includes support for Ares test activities, test control center development, and operations. Additional support will be provided for inputs to Operability Design Analysis (ODA) studies; Design Analysis Cycle (DAC) efforts; active participation in Ares IPTs; Constellation Systems ground operations integration; trade studies; and various other review boards, meetings, and working groups.

The contractor shall perform Project Management Support for this task under the following areas: Status and track schedule/cost and monthly deliverables for this contract, coordination between contract and NASA/MSFC personnel, and Task Management and oversight to ensure the required procedures and supporting processing data is accurate and complete.

### **3.2 Vehicle Integration and Operations, Integrated Operations**

Integrated operations tasks encompass operations engineering support to perform operations concept definition, planning, and related system requirements definition and verification from flight and integrated operations perspectives. This includes participation in integrated operations planning, training, concept definition, scenario development, integrated operations flow development, trade studies, operations requirements development, and related system requirements definition, with emphasis on the integrated operations and associated interfaces. Additionally, this task includes avionics system trade study support, design analysis for flight avionics systems, system operational sequence development, data flow analysis, data flow planning, end to end data system architecture studies, system command and control analysis, vehicle system test plans and procedures, engineering support plan and function development, and development of Flight Operations Data handbooks, procedures, and processes. These efforts will require active participation in the Ares IPTs and working groups as appropriate to the task.

The contractor shall perform Project Management Support for this task under the following areas: Status and track schedule/cost and monthly deliverables for this contract, coordination between contract and NASA/MSFC personnel, and Task Management and oversight to ensure the required procedures and supporting processing data is accurate and complete.

### **3.3 Upper Stage Ground Support Equipment**

GSE tasks include: support to the development and operation of the Component Development Team (CDT), formulation of GSE requirements, GSE design specification development, training support, EVM input, participation in the LSI IPT and supporting analysis and working actions related to GSE. This will include researching the capabilities and

characteristics of existing candidate GSE and incorporation of this data into the analysis process for trade studies.

GSE tasks shall include planning, design, requirements definition, development, manufacturing, assembly and qualification of ground support equipment of the US. GSE support should address existing GSE, interface to launch site, GSE interfaces with other Ares elements, GSE nomenclature definition, identifying unique GSE, GSE Modeling Requirements Development and Implementation, GSE Stage commonality/differences, GSE site commonality/differences, Human Factors, capabilities and characteristics of existing GSE, and the handling and transport of large structures. This will include researching the capabilities and characteristics of existing candidate GSE and incorporation of this data into the Logistics Support Analysis for trade studies.

This task is planned in three categories consisting of US GSE Systems Engineering, US GSE Design, and Project Management Support

The contractor shall support development of the ILS Plan. The contractor shall support the development of the US GSE Plan as an appendix to the ILS Plan.

The contractor shall support the design and development of lifting and handling hardware which:

- Prevents damage during handling and mating operations.
- Mitigates risk and programmatic impacts.
- Aids in development of Program Handling Hardware handling procedures.

Contractor support shall include:

- Defining ground support equipment and developing a ground support equipment list.
- Certification of handling and lifting hardware in accordance with NASA Standards.
- Design of transporters and structures; hydraulics and pneumatic; mechanical engineering analysis; component testing and qualification; and electrical controls.
- Designing and developing mechanical and electrical systems to support launch processing activities.
- Developing, qualifying, and implementing systems and equipment to meet the unique requirements of US processes.
- Developing systems and equipment which meet US unique requirements which reduce the cost of processing, checkout, launch, and landing operations.
- Developing technical specifications for GSE.
- Developing plans for GSE maintenance and spares.

The contractor shall support design and development of US simulators in support of ground support equipment development.

The contractor shall support the GSE activities by participating in the US IPT, and developing documentation. The contractor shall participate in other IPTs as appropriate. The contractor shall support trade studies relevant to US development and definition. The Contractor shall

support the development, review, and assessment of the Ground Support Systems Development and Design Review Plans.

The contractor shall attend and participate in relevant US Design and Program Reviews. Project Support includes Major Milestone reviews, Technical Interchange Meetings, Boards, Oversight/Insight, and Sustaining Engineering as necessary. The contractor shall perform Project Management Support for this task under the following areas: Status and track schedule/cost and monthly deliverables for this contract, coordination between contract and NASA/MSFC personnel, and Task Management and oversight to ensure the required procedures and supporting processing data is accurate and complete.

### **3.4 Upper Stage Ground Operations**

Ground Operations tasks include the effort from the manufacturing facility to the launch pad to effectively test, transport and process the US during the design, development, test, evaluation and operational phases. The efforts in this task consist of ground operations considerations for concept development; planning; training; Ground Operations Working Group (GOWG) support, IPT support; requirements formulation; process assessment and analysis; input to Earned Value Management (EVM) activities; availability modeling inputs, and cost modeling inputs. This activity also includes support for US test activities, test control center development, and operations. Additional support will be provided for inputs to Operability Design Analysis (ODA) studies; Design Analysis Cycle (DAC) efforts; active participation in US IPTs; Constellation Systems ground operations integration; trade studies; and various other review boards, meetings, and working groups. The contractor shall perform Project Management Support for this task under the following areas: Status and track schedule/cost and monthly deliverables for this contract, coordination between contract and NASA/MSFC personnel, and Task Management and oversight to ensure the required procedures and supporting processing data is accurate and complete.

### **3.5 Upper Stage Flight Operations – Closed June 2010**

Flight operations tasks encompass operations engineering support to perform operations concept definition, planning, and related system requirements definition and verification from flight and integrated operations perspectives. This includes participation in integrated operations planning, training, concept definition, scenario development, integrated operations flow development, trade studies, operations requirements development, and related system requirements definition, with emphasis on the integrated operations and associated interfaces. Additionally, this task includes avionics system trade study support, design analysis for flight avionics systems, system operational sequence development, data flow analysis, data flow planning, end to end data system architecture studies, system command and control analysis, vehicle system test plans and procedures, engineering support plan and function development, and development of Flight Operations Data handbooks, procedures, and processes. These efforts will require active participation in the Ares IPTs and working groups as appropriate to the task.

The contractor shall perform Project Management Support for this task under the following areas: Status and track schedule/cost and monthly deliverables for this contract, coordination

between contract and NASA/MSFC personnel, and Task Management and oversight to ensure the required procedures and supporting processing data is accurate and complete.

### **3.6 First Stage Systems Engineering & Integration**

This task is broken into four categories consisting of Ground Operations, Ground Support Equipment Systems Engineering, Flight Operations and Project Management each described below:

Ground Operations tasks include the effort from the manufacturing facility to the launch pad to effectively test, transport and process the FS during the design, development, test, evaluation and operational phases. The efforts in this task consist of ground operations considerations for concept development; planning; training; Ground Operations Working Group (GOWG) support, IPT support; requirements formulation; process assessment and analysis; input to Earned Value Management (EVM) activities; availability modeling inputs, and cost modeling inputs. This activity also includes support for FS test activities, test control center development, and operations. Additional support will be provided for inputs to Operability Design Analysis (ODA) studies; Design Analysis Cycle (DAC) efforts; active participation in FS IPTs; Constellation Systems ground operations integration; trade studies; and various other review boards, meetings, and working groups.

GSE tasks include: support to the operation of the Component Development Team (CDT), formulation of GSE requirements, GSE Systems Engineering, GSE design specification development, training support, EVM input, participation in the FSIWG and supporting analysis and working actions related to GSE of the FS. This will include researching the capabilities and characteristics of existing candidate GSE and incorporation of this data into the analysis process for trade studies.

Flight Operations tasks encompass operations engineering support to perform operations concept definition, planning, and related system requirements definition and verification from flight and integrated operations perspectives. This includes participation in integrated operations planning, training, concept definition, scenario development, integrated operations flow development, trade studies, operations requirements development, and related system requirements definition, with emphasis on the integrated operations and associated interfaces. Additionally, this task includes avionics system trade study support, design analysis for flight avionics systems, system operational sequence development, data flow analysis, data flow planning, end to end data system architecture studies, system command and control analysis, vehicle system test plans and procedures, engineering support plan and function development, and development of Flight Operations Data handbooks, procedures, and processes. These efforts will require active participation in the FS identified IPTs and working groups as appropriate to the task.

The contractor shall attend and participate in relevant US Design and Program Reviews. Project Support includes Major Milestone reviews, Technical Interchange Meetings, Boards, Oversight/Insight, and Sustaining Engineering as necessary.

The Project Management Support for this task includes the following: Status and track schedule/cost and monthly deliverables for this contract, coordination between contract and

NASA/MSFC personnel, and Task Management and oversight to ensure the required procedures and supporting processing data is accurate and complete.

### **3.7 Ground Vibration Test, Crew Launch Vehicle Operations Support**

GVT tasks encompass operations engineering support to perform operations concept definition, planning, and related system requirements definition and verification. This includes participation in integrated operations planning, training, concept definition, scenario development, integrated operations flow development, trade studies, operations requirements development, and related system requirements definition, with emphasis on the integrated operations and associated interfaces. Additionally, this task includes system operational sequence development, vehicle system test plans and procedures. These efforts will require active participation in the GVT identified IPTs and working groups as appropriate to the task.

The Project Management Support for this task includes the following: Status and track schedule/cost and monthly deliverables for this contract, coordination between contract and NASA/MSFC personnel, and Task Management and oversight to ensure the required procedures and supporting processing data is accurate and complete.

### **3.8 Upper Stage Test Control Vehicle Operations Support – Closed April 2009**

### **3.9 FITO Vehicle Systems & Integration Testing**

This task shall support the test objects of the MSFC Flight Integration and Test Office for the Ares vehicle stack by providing the interface and support between the MSFC FITO and the KSC Level 2/3 Ground Operations. The task will also support FITO activities related to coordination between FITO and the Constellation Level 2 vehicle integration and test office, located at JSC and FITO and MAF/SSC, This support shall include but not be limited to requirements and interface definitions, vehicle integration and testing, facility and ground support equipment preparation, This task will support the weekly Systems Integration & Test Working Group and will support the resolution of actions assigned by the working group lead. This task will support the integration, test objectives and collection of data associated with the Ares 1-Y, ORION 1, 2, 3 and 4 vehicles.

### **3.10 Vehicle Integration & Operations Flight Operations**

Flight operations tasks encompass operations engineering support to perform operations concept definition, planning, and related system requirements definition and verification from flight operations perspectives. This includes participation in flight operations planning, training, concept definition, scenario development, operations flow development, trade studies, operations requirements development, and related system requirements definition, with emphasis on the flight operations and associated interfaces. Additionally, this task includes avionics system trade study support, design analysis for flight avionics systems, system operational sequence development, data flow analysis, data flow planning, end to end data system architecture studies, system command and control analysis, vehicle system test plans and procedures, engineering support plan and function development, and development of Flight Operations Data handbooks,

procedures, and processes. These efforts will require active participation in the IPTs and working groups as appropriate to the task.

The contractor shall perform Project Management Support for this task under the following areas: Status and track schedule/cost and monthly deliverables for this contract, coordination between contract and NASA/MSFC personnel, and Task Management and oversight to ensure the required procedures and supporting processing data is accurate and complete.

### **3.11 CEV Flight & Ground Ops - Operations Analysis Support - RESERVED**

### **3.12 Ares V ED Study Core Stage Assessment – Closed August 2008**

### **3.13 Launch Vehicle/Spacecraft Operations Engineering Support**

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

The Contractor will provide experienced operations expertise in support of ground and flight operations and integration activities related to the development and operations of the Launch Vehicle/Spacecraft and its associated elements during the DDT&E phase. The tasks required of the contractor will include but not be limited to: Integrated Operations, Ground Operations, Flight Operations, Ground Support Equipment Development and Integration, Control Center Development and Integration, Training Development and Integration, and Test Planning and Integration.

## **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 required for this order. However, this can change based on the Task Order Monitor requirements. Any materials being purchased must be approved by 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.