STATEMENT OF WORK
FOR
MARSHALL SPACE FLIGHT CENTER (MSFC)
REAL-TIME SIMULATION SYSTEM DEVELOPMENT AND
AVIONICS SYSTEMS TESTING

1.0 Scope

The contractor shall provide specialized engineering support to the Flight & Ground Software Division, the Systems Development, Integration & Test Division, and the Systems Development, Integration, and Test Division of the Engineering Directorate, Space Systems Department. The contractor shall provide support for, but not limited to, the Constellation Program, Ares Project, and other program and project products, tasks, and activities for the National Aeronautics and Space Administration (NASA) at the Marshall Space Flight Center (MSFC). In addition, the contractor shall provide support for any MSFC activity that leverages the capabilities developed in support of NASA space exploration launch systems.

The MSFC avionics simulation capabilities, developed in support of Avionics System Integration Labs and Test Facilities (ASLTF), provide for sophisticated real-time all-digital simulations and real-time Hardware-in-the-Loop (HWIL) simulations. These capabilities support the development and test of experiments, subsystems; spacecraft control systems, element vehicle systems, and complete launch vehicle systems. These capabilities test and evaluate integrated flight vehicle control systems (flight computer, Ground, Navigation and Control (GN&C) components, actuator control systems, etc.), vehicle GN&C algorithms, flight software, sensors, and effectors.

The contractor shall support the design and development of real-time HWIL systems and their components to be used to verify the integrated avionics systems. The contractor shall provide expertise in the area of real-time computer capabilities, real-time inter-system communication architectures, real-time input/output interfaces, and integrated real-time system performance. The contractor shall provide support to these efforts to meet development review cycles in accordance with respective schedule milestones.

The contractor shall support the design and development of test architectures, test plans, and test procedures for avionics system testing in the ASLTF. The contractor shall provide support to these efforts to meet development review cycles in accordance with respective schedule milestones.

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. The contractor shall support the MSFC Engineering Directorate in providing data, documentation and information to meet program reviews and schedules as required.

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 will 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) 1310 (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 provide technical information concerning any invention, discovery, improvement, or innovation made by the contractor in the performance of work under this contract. Technology Reports shall be prepared in accordance with DRD 1310 CD-OOL

2. The contractor shall prepare and submit a Monthly Progress Report in accordance with DRD 131OMA-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 General Services Administration (GSA) rates per hours worked.

3. The contractor shall prepare and deliver a Badged Employee and Remote IT User Listing in accordance with DRD 1310MA-00l.

4. The contractor shall prepare and deliver a Contractor Employee Clearance Document in accordance with DRD 1310MA-002.

5. The contractor shall prepare and deliver a Position Risk Designation for Non-NASA Employees in accordance with DRD 131 OMA-004.

6. The contractor shall prepare and deliver an Organizational Conflicts of Interest (OCI) Avoidance Plan in accordance with DRD 1310MA-005.

7. 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. The contractor shall comply with all MSFC SHE Core Program requirements in MPR 8715.1 , "Marshall Safety, Health and Environmental (SHE) Program" while working on site at MSFC and provide a signed Safety, Health, and Environmental (SHE) Work Agreement in accordance with ORO 131OSA-OO 1.

8. The contractor shall report mishaps and safety statistics to the MSFC Industrial Safety Branch in accordance with ORD 1310SA-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 DRO 131OSA-002 or electronic equivalent to report mishaps and related information required to produce the safety metrics.

3.0 Technical Requirements

Information Technology (IT) Security - The contractor shall develop and implement a comprehensive IT security program in accordance with NFS 1852.204-76, *Security Requirements for Unclassified Information Technology Resources (May 2007)* which addresses the management, operational, and technical aspects of protecting the confidentiality, integrity and availability of information and IT systems. The IT security program shall ensure the contractor is responsible for information and IT security when physical or electronic access to NASA's computer system s, networks, or IT infrastructure is required or when information systems are used to store , generate, process or exchange information with NASA or on behalf of NASA, regardless of where the information resides.

The contractor shall comply with NASA's Information Technology security program requirements following the NPR 2810.1A, *Security of Information Technology.* The contractor shall support security life-cycle development planning and security certification and accreditation. The contractor shall implement management, operational and technical security controls for all IT systems, applications and components managed and administered under this contract. The contractor shall utilization the MSFC system security documentation repository for the development and management of required Certification and Accreditation documents.
The contractor shall be responsible tor information and 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 tiles and reports electronically delivered shall comply with Technical Standard 1194.21 of the Rehabilitation Act of 1973, Section 508. Contractor format is acceptable.

3.1 Real-time System Engineering and Integration Support

The contractor shall support the MSFC ASLTF efforts in defining real-time capabilities and associated development-planning activities. The contractor shall provide guidance on the projected development and integration of these real-time system functional capabilities, the need dates, and the associated development plans, as directed by work package manager. The contractor shall assess real-time system capabilities and plans in conjunction with the MSFC project offices and other Engineering Directorate stakeholders.

The contractor shall participate in coordination meetings with identified stakeholders and other members of the development team; identify, coordinate, and participate in key trade

studies and product evaluations to feed key decision-making regarding the development of real-time capabilities and implementation plans. The contractor shall participate in the coordination, communication and documentation of any materials, databases, schedules or other data packages as required by the MSFC team leads. This support shall include, but not limited to, defining the real-time system architecture, defining the real-time hardware interfaces, evaluating real-time systems and components, developing real-time systems and interfaces, and supporting the implementation of the real-time systems within the ASLTF or other real-time hardware-in-the-loop products produced by the MSFC.

3.2 Integrated Avionics Test Support

The contractor shall support the design, development, and implementation of testing of the ASLTF. This support shall include, but not be limited to, work in support of the development of test plans, test procedures, data collection, data reduction, data analysis, and test conduct.

3.3 Solid Rocket Booster Test Support

The Contractor shall support the design, development, and implementation of testing of solid rocket boosters and corresponding avionics system. This support shall include, but not be limited to, work in support of the development of test plans, procedures, data collection, data reduction, data analysis, and test conduct.

3.4 Launch Vehicle Systems Engineering Support

The contractor shall support the concept development and subsequent design, development and implementation of launch vehicles, including the application of a solid booster to the concept. This support shall include, but not limited to, systems engineering trades and evaluations of concepts, and flight test planning in support of the MSFC project office requirements.

3.5 Propulsion Systems HWIL Technology Development Support

The contractor shall support the Propulsion Systems Department by providing HWIL analysis & design, build documentation, and test support. The Contractor shall provide laboratory testing and support at component and system level, provide expert level analysis guidance and support, provide reporting documentation as required including journal papers, conference papers, technical memorandums, and technical reports.

4.0 Staffing Requirements

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

<u>Task 3.1</u>

Subject Matter Expert:

- Bachelors degree in engineering required, advanced degree preferred.

- 25 years experience in the development and analysis of real-time systems and their performance.

- 25 years experience with real-time computing and extensive knowledge of the x86 processor architecture and its real-time implications

- 25 years experience and knowledge of input/output devices and their effect on the performance of real-time simulation systems.

- Expertise and demonstrated competence level in the design and development of real-time avionic system test systems used for Hardware-in-the-loop tests.

Senior Level Engineer:

- Bachelors degree in engineering required, advanced degree preferred

- 15 years experience in the development and analysis of real-time systems and their performance.

- 15 years experience with real-time computing and extensive knowledge of the x86 processor architecture and its real-time implications

- 15 years experience and knowledge of input/output devices and their effect on the performance of real-time simulation systems.

- Expertise and demonstrated competence level in the design and development of real-time avionic system test systems used for Hardware-in-the-loop tests.

Tasks 3.2 , 3.3 and 3.5

Subject Matter Expert:

- Bachelors degree in engineering required, advanced degree preferred.

- 25 years experience in the design and development of system test plans and procedures.

- 25 years experience the design and development of test requirements, methodologies, task definition, schedules, facilities, test design

- Expertise and demonstrated competence level in the generation of test reports and analysis of test results.

Senior Level Engineer:

- Bachelors degree in engineering required, advanced degree preferred.

- 15 years experience in the design and development of system test plans and procedures.

- 15 years experience the design and development of test requirements, methodologies, task definition, schedules, facilities, test design

- Expertise and demonstrated competence level in the generation of test reports and analysis of test results.

Task 3.4

Subject Matter Expert:

- Bachelors degree in engineering required, advanced degree preferred.

- 25 years experience in the design and development of system test plans and procedures.

- 25 years experience the design and development of test requirements, methodologies, task definition, schedules, facilities, test design

5.0 Travel

The contractor shall travel as requested to accomplish each technical requirement. Travel projections are planned below for the period of performance. Travel projections are assumed to be one (1) person and five (5) days per trip. The government will authorize this travel as required during the period of performance.

For Subtask 3.2:
- Two (2) trips to NASA JSC in Houston, TX per fiscal year.
- Two (2) trips to NASA KSC in Cocoa Beach FL per fiscal year.

For Subtask 3.3:
- Two (2) trips to NASA JSC in Houston, TX per fiscal year.
- Two (2) trips to NASA KSC in Cocoa Beach FL per fiscal year.

For Subtask 3.4:
- Two (2) trips to NASA JSC in Houston, TX per fiscal year.
- Two (2) trips to NASA KSC in Cocoa Beach FL per fiscal year.

The number of trips, travel locations, number of people and length of stay can change based on the customers' requirements. These are engineering estimates.

The Government will reimburse the Contractor for any necessary travel expense, in accordance with the Federal Travel Regulations. The Government shall not be charged

with travel expenses, unless the travel is coordinated and concurred, in writing by the COTR prior to the beginning of travel.

6.0 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 the Contracting Officer prior to purchase.

7.0 RESERVED

8.0 Technical Milestones and Deliverables

No additional deliverables other than those specified under Section 2.0 (B) of the SOW.