

**ATTACHMENT J-1
STATEMENT OF WORK**

**SPECIALIZED ENGINEERING SERVICES TASKS
FOR
SPACE SYSTEMS DEPARTMENT**

1.0 Scope

The Contractor shall provide systems engineering support to the Space Systems Department of the Engineering Directorate. The Contractor shall provide support for, but not limited to, the design and development of launch vehicle systems, space craft systems and system integration tasks and activities for the National Aeronautics and Space Administration (NASA) at the Marshall Space Flight Center (MSFC).

The Contractor shall provide engineering support in the following areas: system engineering, system design, system integration, real-time software development, and engineering modeling, software development, and computer networking expertise in support of distributed computing.

The Contractor shall support the Systems Integration Lab (SIL) design, development, test and evaluation and the overall integration with other launch vehicle elements. The Contractor shall support the design and development of Distributed Space Exploration Simulation (DSES) and Distributed Systems Integration Lab (DSIL). The Contractor shall support the Systems Integration & Test Facility design, development, test and evaluation for Avionics integration of Instrumentation Unit. The Contractor shall provide support to these efforts as the launch vehicle architecture matures and program/project review cycle completes 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 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) 1226 (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 prepare and submit a Monthly Status Report in accordance with DRD 1226MA-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 1226MA-002.
3. The Contractor shall submit a Contractor Employee Clearance Document in accordance with DRD 1226MA-003.
4. The Contractor shall submit a Position Risk Designation for Non-NASA Employees in accordance with DRD 1226MA-004.
5. 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 1226SA-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.
6. The contractor shall report mishaps and safety statistics to the MSFC Industrial Safety Branch in accordance with DRD 1226SA-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 1226SA-002 or electronic equivalent to report mishaps and related information required to produce the safety metrics.

3.0 Technical Requirements

Information Technology Security - The contractor shall develop and implement a comprehensive information technology security program which addresses the management, operational, and technical aspects of protecting the confidentiality, integrity and availability of information and information technology 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 systems, 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 utilize the MSFC system security documentation repository for the development and management of required Certification and Accreditation documents.

The contractor shall develop and submit a Contractor IT Security Program Plan in accordance with DRD 1226CD-001.

The contractor shall report on the IT security work performed under this contract and ensure compliance with NFS 1852.204-76 by submitting annually an IT Security Requirements Compliance Report in accordance with DRD 1226CD-002.

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.

3.1 Specialized Systems - Engineering and Integration Support for Ares System Integration Lab

The Contractor shall provide specialized system engineering and integration services to the SIL including, but not limited to, system engineering, system design, system

integration, real-time software development, and engineering modeling, software development, and computer networking expertise in support of distributed computing.

Systems Engineering SIL Support

The Contractor shall support the MSFC CLV Systems Integrations Lab (SIL) effort in defining functional capabilities and associated development planning activities. The Contractor shall provide guidance on the projected development and integration of these functional capabilities, the need dates, and the associated development plans, as directed by the SIL work package manager. The Contractor shall assess SIL capabilities and plans in conjunction with the CLV project offices and other Engineering Directorate SIL stakeholders. The Contractor shall participate in coordination meetings with identified SIL stakeholders and other members of the SIL development team; identify, coordinate, and participate in key trade studies to feed key decision-making regarding the development of SIL 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 SIL team leads.

The Contractor shall provide expertise in the development of the real-time software for execution within the CLV Systems Integration Lab (SIL). The Contractor shall implement High Level Architecture (HLA) interfaces to run in federation with other HLA compliant federates. The Contractor shall adapt existing software applications middleware for SIL applications.

The Contractor shall provide expertise in M&S management support services to implement the planned M&S management activities for the CLV SIL and its component M&S assets. The Contractor shall brief management on the implementation of the M&S management activities, M&S resources and asset management, M&S accreditation activities and provide continued improvement processes to support the developers in instituting systematic practice in M&S configuration management, M&S verification and validation and M&S accreditation.

Distributed Space Exploration Simulation Design and Development

The Contractor shall provide engineering modeling, software development, and computer networking expertise to support the Distributed Space Exploration Simulation (DSES) by performing the following tasks:

- Develop and maintain the CLV HLA federate
Continue to upgrade and maintain the ARTEMIS CLV federate software to incorporate new interfaces and functionality as required supporting DSES federation objectives. Upgrade federate software to maintain consistency with latest ARTEMIS releases. Develop interfaces and integrate with KSC Ground Operations federate in support of DSES end-to end federation simulation. Continue to maintain the MAVERIC CLV federate as required to support demonstrations.
- Perform federate and federation testing

Perform comparisons of HLA federate to baseline ARTEMIS to insure proper implementation. Perform comparisons of CLV federate with other DSES federates to insure consistency of implementation of basic dynamics and environments. Support testing of end-to-end DSES federation as new capabilities, interfaces, and upgrades are incorporated. Continue to maintain the MAVERIC CLV federate as required to support testing.

- Perform analysis to develop NASA Distributed Simulation Network (DSNet) requirements. Participate in network requirements development to support near-term and long-term DSES project milestones.

Distributed System Integration Lab Support

The Contractor shall provide planning, design and development expertise to support CxP in the buildup of the DSIL. The Contractor shall perform trade studies to define simulation standards, requirements, interfaces, software middlewares, and architectures to support DSIL design and development. The Contractor shall coordinate with CxP to define the content and schedule for simulators and emulators to be exchanged among the CxP Elements and for the DSIL buildup. The Contractor shall define the M&S content required to support integrated testing activities. The Contractor shall participate in the M&S Working Group to coordinate the needed M&S content and the availability and need dates for testing. The Contractor shall assist work to provide definition of modeling and simulation standards and the model and data repository requirements for the elements SIL.

System Design and Development

The Contractor shall provide planning, design and development expertise to support the buildup of the SIL and associated emulators. The Contractor shall perform studies to define hardware requirements, interfaces, and architectures to support SIL design and development. The Contractor shall provide expertise in the area of avionics integration. The Contractor shall provide expertise in the area of emulator design, development, and integration. The Contractor shall provide support for delivery of emulators to other elements within Constellation Program.

3.2 Flight & Ground Software Support – Closed September 2008

The Contractor shall support the development of the flight software for the Crew Launch Vehicle (CLV), particularly in the formulation and coordination of the flight software requirements. This task also requires participation in various project reviews including progress reviews, requirements reviews, avionics reviews and various Technical Interchange Meetings (TIMs) and lifecycle design reviews such as but not limited to PDR, CDR.

3.3 Upper Stage Instrumentation Unit

The Contractor shall perform thermal, structural/stress and mechanism/mechanical design engineering, modeling and analysis that would include defining, analyzing, selecting hardware elements needed to thermally condition avionics test hardware in

the Ares System Integration Laboratory and mount within the IU. Perform thermal engineering and analysis required to oversee the functionality, compatibility, safety and interfaces of Ares 1 First Stage hardware items. Perform thermal , structural/stress and mechanism/mechanical design engineering, modeling and analysis required to oversee the functionality, compatibility, safety and interfaces of Ares 1 Upper Stage avionics hardware items located throughout the volumes. Included also are the determination of environments on ground and during vehicle ascent. Sensors/instrumentation needed for vehicle health and status and verification/validation.

3.4 ICD Development Support – Closed April 2008

3.5 First Stage Avionics Support

Perform thermal engineering and analysis required to oversee the functionality, compatibility, safety and interfaces of Ares I First Stage hardware items.

3.6 Upper Stage Thermal Support – RESERVED

3.7 VI SE&I Support for Avionics Integration

The contractor shall provide System Design, engineering and integration services via specialized technical expertise in the area of avionics/software integration to all levels of customers including program managers and chief engineers in the Exploration Launch System Office including, but not limited to, Level 2 Constellation (CxP), Ares (alias Crew Launch Vehicle) and associated elements, Orion {alias Crew Exploration Vehicle (CEV)} and Cargo Launch Vehicle (CaLV). This task shall include all aspects of integrated avionics/software functions including, but not limited to, Instrumentation Program and Command List (IP&CL) development, coordination and maintenance, electrical power, Electromagnetic Compatibility/Electromagnetic Interference (EMC/EMI) analyses, Command, Control, Communications, and Information (C3I) analyses, Electrical, Electronic, and Electromechanical (EEE) analyses, software development assessments and coordination related to data bus traffic and sensor information and verification-related task coupled with the avionics/software vehicle integration effort.

The Contractor shall provide the technical systems engineering expertise with emphasis in vehicle systems timing to develop and address the system integration aspect of all timing, both hardware and software, for the entire vehicle. The Contractor shall ensure that overall vehicle and subsystem timing and latency analysis (not limited only to avionics and software) is established to derive the correct requirements or verify that existing requirements are complete. This activity may involve trade studies, including but not limited to: time correlation requirements, time drift requirements, flight control latency, box-to-box operations, integrated data bus architecture, internal flight computer (FC) and command & telemetry computer (CTC) operation overlay, data stamping, abnormal over-voltage or under-voltage

surge of the power bus, etc. Requirements and verification activities, including those related to this timing analysis and in general, shall also be reviewed/updated by the Contractor as part of this task. The Contractor shall coordinate daily activities of this task with the Avionics Lead System Engineer (ALSE) in the Avionics Systems Integration Branch (ES12).

3.8 US SE&I Support for Avionics

The contractor shall support the development of trade studies, analyses, requirements, standards, development plans, test plans, integration plans, risk management assessment, technical performance measures, and reports to ensure that the US avionics system will satisfy system level requirements, plans, and procedures, and integrate with all other elements as defined in the Interface Requirements Documents, (IRDs) and the Interface Control Documents, (ICDs). (Note: The term “avionics” refers to avionics hardware and firmware including health management components. Ensuring that the avionics integrates with the software is within the scope of this WBS. The contractor shall facilitate the planning and implementation of avionics integration between the US subsystems and IPTs (both internal to US as well as external to US) and oversee associated working groups as needed. The contractor shall coordinate with US software integration task team to ensure the avionics integrate with the software, support the US avionics system Verification and Validation (V&V) tasks as defined in the vehicle V&V Plan, and facilitate all resources required to perform this task. The contractor shall coordinate task risks and facilitate mitigation activities as directed by US project management, and provide written and oral status reports as requested by US project management. The contractor shall support panels and working groups (schedule, quarterly reports, project plans, etc.), and other US, Ares I, Orion, LMS, or vehicle tasks, panels and working groups as needed. The contractor shall support development of US project management products (e.g., project plan, project schedules, quarterly reports), support special studies or tasks as assigned by the US project, commonality/interoperability standards definition, and vehicle US risk management (identification, mitigation planning, etc.).

3.9 Ares 1-1 MSFC Avionics & SW Insight – Closed March 2009

3.10 VI Ares Avionics Test Support

Provide detailed technical support for avionics test planning as it relates to the Avionics Test Events to be performed at the Ares I System Integration Laboratory (SIL), which includes both avionics hardware and flight software, with an emphasis on software development and test for verification. Provide input to and actively support the primary developer of the Ares I Level III Integrated Avionics System Test Plan, specifically in the area of Test Case Development. Experience in complex simulation-based test beds and a background in verification testing of flight hardware necessary, and will be called upon to independently produce planning documentation and test procedures to ensure proper coverage of requirements closure through test

activities. Perform the above mentioned tasks for all follow-on plans to be implemented in the Ares I SIL. Coordinate and communicate regularly with the element-led avionics function test groups to ensure that the combination of test efforts made by each of these independent groups will eventually lead to a properly tested and verified Integrated Avionics Systems (IAS).

- 3.11 US Integrated Avionics and Software SITF – Closed October 2009**
- 3.12 US Integrated Test SD19 Thermal Support – Closed June 2010**
- 3.13 GN&C-Flight Control System (FCS) Design Support – Closed August 2009**
- 3.14 MAF Integration Documentation Support – Closed March 2010**
- 3.15 (DC)-Avionics Box Isolation CDT – Closed May 2010**
- 3.16 SE&I Functions – LAS**
(This subtask begins November 1, 2010)

Perform independent technical analyses of the Launch Abort System (LAS) integrated system (including internal and external interfaces) and subsystem requirements and verification development, allocation and management;

Perform independent technical analyses of the LAS integrated system (including internal and external interfaces) and subsystem motor design specification development, allocation and management;

Perform independent technical analyses of the LAS integrated system (including internal and external interfaces) and subsystem motor test and verification development, allocation and management;

Evaluation of LAS motor testing plans (both developmental and qualification);

Perform pre and post test analyses of LAS system and subsystem motor performance tests;

Perform risk assessments and development of associated mitigation plans;

Review of all associated Orion Project Review documentation such as the System Engineering Management Plan (SEMP), Project Plan, System Requirements Document (SRD), System Definition Review (SDR) Process Plan, Master Verification Plan (MVP), Operations Concept (Ops Con) Document, Constellation Architecture Requirements Document (CARD);

Development and review of all LAS-level documentation that mirrors the Orion SEM, Project Plan, SRD, SDR Process Plan, MVP, Ops Con;

Develop and maintain LAS Requirements and Verification database, which includes continuous evolution of the CARD-to-Orion SRD, SRD-to-LAS and LAS to subsystem requirements, including requirement derivation and decomposition;

Review of all relevant NASA policies, processes, and procedures as they apply to LAS with recommendations for inclusion in project implementation;

Participation in all Orion Project and lower level LAS Reviews, including but not limited to, System Requirements Review (SRR), System Design Review (SDR), Preliminary Design Review (PDR), Critical Design Review (CDR), Flight Readiness Review (FRR);

Participation in and critique of all required NASA and Prime Contractor Technical Interchange Meetings (TIMs), Integrated Product Team (IPT) meetings, Table Top Reviews (TTRs), and Engineering Review Boards (ERBs), as directed by the SE&I lead or designee;

Surveillance of the Prime Contractor activities, including site visits;

Assist LAS management in tracking, projecting, coordinating, and allocating resources available to achieve LAS goals and objectives;

Prepare and provide informal reports that include, but are not limited to, requirements and verification cross-reference matrices, requirements validation reports, system and motor analyses reports, LAS contractor assessment reports, risk mitigation plans, weekly notes, monthly status reports, etc.

3.17 Assembly, Integration & Production Support – LAS *(This subtask begins November 1, 2010)*

Review of and respond to various propulsion concepts as they are generated and providing the necessary technical analyses in support of NASA's Space Programs.

Perform risk assessments and development of associated mitigation plans for propulsion systems and associated structures as required.

Submission of quarterly formal feedback via the Award Fee Process and informal feedback, as assessed necessary, via a "one-pager" to NASA LAS Office management of any problems/concerns that may warrant further Government engagement/action.

Technical analysis and assessment of the contractors' engineering work, hardware products and associate documentation related to the design, manufacture, test, evaluation, and integration of the CEV LAS and all its precursor subsystems and components into Flight Test Vehicle Configurations and Production Launch Vehicle Configurations. Subsystems to be assessed include the Abort Motor, Jettison Motor,

Attitude Control Motor, Structures & Mechanisms, Avionics & Power, and all associated component level hardware. Assessment to be documented within the NASA CEV review procedure and/or via submission of a Technical Assessment Report of length appropriate to the situation. This work shall include familiarization and critiques of contractors' LAS plans and related documents including but not limited to those covering:

- i. Sourcing, manufacturing, inspection, transportation, and test/launch site integration, final assembly and checkout
- ii. Development, qualification and acceptance tests

Participation and/or insight into all LAS propulsion related Materials and Processes non-conformance resolution efforts lead by the contractor and as requested by the CEV LAS Module Project Office. Provide Technical Assessment Trip Reports assessing the resolution plans and progress to the NASA LAS project office management including definition of issues and potential mitigation action(s).

Provide expert analysis on controllability of solid rocket control motors by evaluating the Solid Rocket Motor's (SRM) performance – propellant burn rate and thrust response as a function of throttling the Attitude Control Systems (ACM) valves for Orion's Launch Abort System.

Perform additional propulsion system analysis, and design on an as needed basis as the LAS design matures and evolves into the Qualification, Production and Flight Programs. The LAS subsystems include motors, structures & mechanisms, and avionics & power, development and operational flight instrumentation, with emphasis on propulsion systems.

Participation in all CEV/Orion Project and lower level LAS Reviews, including but not limited to System Requirements Reviews (SRR), System Design Reviews (SDR), Sub-system Design Reviews (SSDR), Preliminary Design Reviews (PDR), Critical Design Review (CDR) and Flight Readiness Reviews (FRR).

Participation in and critique of all required NASA and Prime Contractor Technical Interchange Meetings (TIMs), Integrated Product Team (IPT) meetings, Table-Top Reviews (TTRs), Test Readiness Reviews (TRR), Chief Engineers Technical Review Board (TRB), Engineering Review Boards (ERB), Hardware Acceptance Reviews (HAR) and Hardware Inspection Reviews pre and post-test hardware at the contractor's facilities as directed by the Program Manager, Chief Engineer, Propulsion Team Lead and/or SE&I Lead.

Support all planned and unplanned meetings with MSFC, LaRC, DFRC, WSMR, GRC, JSC and KSC as directed by the Program Manager, Chief Engineer, Propulsion Team Lead and/or SE&I Lead.

Establish working relationships and technical dialogue with the LaRC LAS Project Office, the JSC Orion Project Office, the Dryden Flight Research Center (DFRC) Flight Test Office (FTO), the KSC Ground Operations Office, and the Prime Contractor (Lockheed Martin) and the LAS's Solid Rocket Motors - Abort Motor, Jettison Motor and Attitude Control Motor subcontractors – (b)(4)
(b)(4)

Technical oversight of the Prime Contractor and Sub-contractor activities, including site visits and travel as required by the NASA customer.

Prepare and provide informal reports that include, but are not limited to, propulsion analyses, requirements validation reports, system and motor analyses reports, LAS contractor assessment reports, trip reports, weekly notes, monthly status reports, etc.

3.18 Systems Engineering Support for on-Orbit Systems/Subsystems
(Authorization to proceed with this subtask will be provided by the Contracting Officer in written direction.)

The contractor shall support and maintain the following : System/Subsystem Requirements documents/databases, System/Subsystem Requirement Allocation Matrix and Requirements Traceability, System/Subsystem Requirement/Spec Trees, System/Subsystem Architecture and functional decomposition documents, Interface Requirements documentation, Stakeholder high level definition and operational concept development, Verification/Validation Requirements, Planning, and Compliance Tracking documents/databases, System/Subsystem Trade Study Reports/Presentations, Technical Risk Assessment and Tracking databases, System/Subsystem Analysis & Modeling and reports. Support will be provided on negotiated reviews.

The contractor shall support the on-orbit/flight vehicle spares in the area of general systems engineering and provide support to the DLE. Duties may include: coordinating scheduling, coordinating design and fabrication activities, supporting technical reviews, supporting verification activity, and providing periodic status inputs to project and ES management.

The contractor shall provide overall support planning, including resource planning and management, task and day-to-day scheduling, cost estimating and planning and periodic task status reporting.

3.19 Systems Engineering Support for Vehicle Avionics Integration - IP&CL

The contractor shall provide System Design, engineering and integration services via specialized technical expertise in the area of avionics/software integration to all levels of customers including program managers and chief engineers in the Exploration Launch System Office including, but not limited to, Level 2 Constellation (CxP), Ares (alias Crew Launch Vehicle) and associated elements, Orion {alias Crew

Exploration Vehicle (CEV)} and Cargo Launch Vehicle (CaLV). This task shall include all aspects of integrated avionics/software functions including, but not limited to, Instrumentation Program and Command List (IP&CL) development, coordination and maintenance.

3.20 Specialized Engineering Support for Space Systems, Spacecraft and Launch Vehicle Systems

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

The Contractor shall provide engineering support in the following areas for existing and new launch vehicles, systems, sub-systems and support equipment: system engineering, system design, system integration, mechanical design, mechanisms, structural analysis, thermal modeling/analyses, modeling, software development, and computer expertise. The contractor shall support other tasks as designated by the department which support the needs, goals and objectives of the department.

The Contractor shall assist/support the translation of a system (or subsystem, program, project, activity) concept into a preliminary and detailed design products, perform risk identification/analysis/mitigation, traceability, and integration of the various components to produce a working prototype or model of the system. These tasks include, but are not limited to, computer-aided design, design studies and analyses, specification preparation, configuration management and document control, fabrication, assembly and simulation, modeling, and training. Tasking for space transportation vehicles includes performance of engineering tasks; structural/thermal design and analysis; system design and analysis; trajectory/GN&C design and analysis; dynamics analysis; and prototype development. The contractor shall provide services for the planning, budgetary, contract and system/program management functions required to procure and/or produce, render operational and provide life cycle support (maintenance, repair, supplies, and engineering specific logistics) to technology-based systems, activities, subsystems, projects, etc.

The contractor shall perform space systems/launch vehicle avionics and software systems engineering and integration. This includes but is not limited to: Lead, facilitate, and coordinate activities to ensure that avionics subsystem concepts translate properly into standard engineering products needed to successfully meet program/project/element goals and objectives. Provide guidance and technical expertise across subsystem functions to balance objectives between each subsystem to meet overall system requirements. Perform estimation and negotiation of necessary tasks/activities and resources to provide the subsystems required functions commensurate with the program/project life cycle phase. Assess progress toward goals and objectives and communicate to engineering and program/project/element offices and/or recommended changes.

The contractor shall support / perform mechanical, structural (stress, dynamics, fracture, shock), thermal design and analyses of components, structures for launch

vehicle flight, ground support, and test equipment including electrical and mechanical (fluid) integration line routing between components, test articles and breadboard/development units, Mechanisms, mechanical ground support equipment, special test equipment, test fixtures, flight/airborne equipment and non-propulsive fluid systems and components.

The contractor shall perform research, engineering, design, development, technology development, analysis, test, and evaluation of Instrumentation and sensors control and signal conditioning for analog, digital or hybrid electronics, Imaging and video systems, Radio-frequency (RF) systems guidance, navigation and control systems, GSE and Advanced Optics.

The contractor shall perform/support research, engineering, design, development, technology development, analysis, test, and evaluation of guidance, navigation and control analysis including identification of algorithms/software which utilize existing or new control electronics to perform various flight trajectories with dispersions needed to achieve proper orbital insertion for various low earth orbit and earth departure scenarios.

The contractor shall perform research, engineering, design, development, technology development, analysis, test and evaluation of Electrical power systems, power electronics, power supplies, and electronic hardware for launch vehicles and ground support systems.

The contractor shall perform research, engineering, design, development, technology development, analysis, test and evaluation of integration hardware, E3 engineering, development of schematics and interconnect diagrams.

The contractor shall support or perform Software requirements development for flight and ground systems, software architecture definition, preferred system solution, facility development, risk identification/mitigation, and trade studies.

The contractor shall support avionics system simulation and integration facility design/development, requirement analysis, and validation including systems Engineering for avionics system simulation and integration facilities, electrical Integration for avionics system simulation and integration, emulator Requirement Development for avionics system simulation and integration for emulators, simulators, models for use in avionics system simulation and integration and shall provide support to lab automation and system simulation by defining software and hardware requirements, trade studies and risk identification/mitigation.

The contractor shall provide input for launch vehicle requirements, and Test Verification Requirements that include testability consideration, planning for verification test activities associated with avionics, provide resource estimates for development of Test Facilities,

The contractor shall coordinate, manage, and conduct integrated avionics test activities, as needed to support planned program/project milestones.

The contractor shall support test report generation and test data archiving resulting from test activities that support the verification item closure efforts.

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 subtask are specified under Section 3.0..