

**Attachment A**

**ENVIRONMENTAL TEST AND INTEGRATION  
SERVICES (ETIS II) CONTRACT**

**STATEMENT OF WORK (SOW)**

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## **I INTRODUCTION**

The mission of the Goddard Space Flight Center (GSFC) is to serve as a national resource for discovery in Earth Science, Space Science, and Technology Development. This mission is carried out through the use of scientific instruments, spacecraft, sounding rockets, balloons, satellite servicing, and supporting ground systems. To fulfill this mission GSFC maintains the onsite capability to function as a full spectrum end-to-end research and development laboratory. Scientific missions can be carried out from concept, through design, manufacture, test, and operations. GSFC is committed through its strategic institutional goals to maintaining and upgrading GSFC's core infrastructure, laboratory facilities, and equipment to preserve the Center's preeminence as a national resource and Center of Excellence.

The GSFC Environmental Test and Integration facilities are managed by the Applied Engineering and Technology Directorate's Mechanical Systems Division to provide environmental test capability that ensures spacecraft and flight experiments will withstand the rigors of launch and will operate properly in the space environment. Other technical facilities managed by a variety of GSFC organizational codes provide a full spectrum of technology and flight mission development capabilities. In addition to operations, these technical facilities have on-going goals of advancing the state-of-the-art in the development of improved space flight systems. The GSFC Environmental Test and Integration Facilities are one of the most complete and comprehensive complexes within the United States Government.

## **II OVERVIEW and SCOPE**

This Statement of Work (SOW) specifies the requirements for on site contractor supplied Environmental Test and Integration and other laboratory operations services to the Goddard Space Flight Center (GSFC). The scope of these services includes the following:

- Operation, maintenance, and upgrade of environmental test equipment and facilities located in the GSFC Building 7/10/15/29 complex, Area 300 Magnetic Test Site and other technical facilities located at various locations within GSFC including the manufacturing and electroplating equipment and facilities primarily located in GSFC Building 5/10/21 shops
- Mechanical and optical integration of spacecraft, flight experiment components, instruments, sub-assemblies and systems
- Design, fabricate, and manufacture custom spacecraft, flight experiment components, instruments, sub-assemblies and systems
- Design, manufacture, and operation of ground handling equipment and fixtures
- Design, manufacture, and operation of optical alignment and calibration systems
- Design, manufacture and installation of space flight thermal blankets

- Design, manufacture and installation of space flight and ground support system cable harnesses
- Design, manufacture, and installation of technical facilities including buildings, building elements, utility systems, and technical equipment and systems
- Define, analyze, and resolve electromagnetic radiation issues relating to facility and satellite ground support equipment operation within the test complex. Support spectrum signature analysis to insure interference-free and safe operation of all facility-located near electromagnetic wave sensing devices.
- Test and Integration Engineering and engineering analysis
- Cleanroom operation and maintenance
- Contamination control services using qualified and experienced personnel
- Maintenance and operation of certain physical plant systems such as processed water, emergency power, LN2/GN2 storage systems, conditioned cleanroom air HVAC and humidity systems
- Recertification (testing and inspection) of lifting devices and equipment (LDE), and (inspection) of pressure vessels and pressurized systems (PVS) at GSFC, Greenbelt, Wallops, and other offsite locations. Maintenance of LDE at Greenbelt site only, not at other sites; Non-destructive examination testing of LDE and PVS
- Facility and operations safety
- Data acquisition and analysis system development and management.

**The SOW includes the following management functions required to support on-site operation and administration of the required services**

- Executive and supervisory management
- Management for facility improvements and Environmental Project Engineering
- Cost control and contract administration
- Human resources
- Equipment and property control
- Configuration control

This Statement of Work (SOW) defines the technical scope of the contract. Task Orders issued under the contract shall define the quantity of work in terms of numbers of tests or operations that will be required, the applicable period of performance, and the identification of facilities and equipment. Together the SOW and Task Order establish the basis for the contractor to respond with a Task Order proposal. The proposal shall include organization, skill mix, and staffing level proposed to meet the contract requirements.

### **III WORK BREAKDOWN STRUCTURE OVERVIEW**

Contractor requirements are organized in a Work Breakdown Structure (WBS) and are identified in WBS element descriptions. The contractor is required to provide goods and services in accordance with the GSFC Management System as described in the GSFC Quality Manual GPR 1280.1<sup>1</sup>. Information concerning the GSFC quality management system can be found at the Goddard Directives Management System site<sup>2</sup>. Specific, applicable GSFC ISO documents are referenced throughout this statement of work and can be found at the GSFC Code 549 Internet Web Site<sup>3</sup>. The contractor shall comply with the referenced and supporting documents in accordance with this SOW.

### **IV WORK BREAKDOWN STRUCTURE ELEMENT DESCRIPTIONS**

#### **1.0 Environmental Test and Integration Support Services**

WBS elements are organized by the services, goods (products), functional support, and management provided by the contractor. The integrated whole of the goods and services provided by the contract is represented by WBS Element 1.0.

#### **1.1 Services**

The services specified in this statement of work are those services that are provided by the contractor to customers of the GSFC Mechanical Systems Division. Customers may be NASA flight projects managed by GSFC, or other government or non-government organizations; or from other organizations within GSFC such as Optics support to the Instrument Systems and Technology Division Code 550. The role of the contractor in providing these services is defined in the following WBS element descriptions. For those services that utilize the Environmental Test and Integration Facilities a description of the facilities can be found in the GSFC Environmental Test and Integration Facilities Handbook<sup>4</sup>.

##### **1.1.1 Structural Test**

The contractor shall provide structural testing services for space flight program hardware, atmospheric flight (balloon and aircraft), and ground support hardware. This element includes the supporting tasks necessary for test set up and execution. Examples of these tasks are: design, engineering analysis and fabrication of test fixturing and other mechanical ground support equipment (MGSE), and analysis and modification of project supplied test fixturing and MGSE.

#### 1.1.1.1 Steady State Acceleration

The contractor shall provide testing services associated with steady state acceleration testing of hardware using the GSFC High Capacity Centrifuge (HCC). The contractor shall provide services in accordance with the Steady State Acceleration Testing Process Operating Procedure (POP) 09PC-PP01<sup>5</sup>. GSFC shall provide the test plan, and HCC test facility, and also fulfill the roles of Product Design Lead, Process Owner and Test Engineer.

#### 1.1.1.2 Vibration Testing

The contractor shall provide data processing and testing services associated with sinusoidal, random, sine burst, and shock testing of hardware using the GSFC Vibration Test Facility. The Vibration Test Facility consists of four electrodynamic vibration exciters and their associated amplifiers and control systems. Also provided is a small machine shop for fixture modification and maintenance support. The contractor shall provide services in accordance with the Vibration Testing Process Operating Procedure 549-PG-8071.1.1<sup>6</sup>. GSFC shall provide the test plan, and Vibration Test Facility, and also fulfill the roles of Product Design Lead, Process Owner and Test Engineer.

#### 1.1.1.3 Modal Survey

The contractor shall provide testing services associated with performing modal survey testing and data reduction for mechanical structures using the GSFC Modal Survey Test Facility. The Modal Survey Test Facility is housed in the payload assembly area of GSFC Building 15 and consists of a concrete seismic block including a set of stanchion assemblies that simulate a payload bay, a steel T-slot plate for quick rigid mounting of test items and a steel plate for rigid mounting of test items, dedicated facility cranes for hanging shakers, small and large impact hammers, 220 and 20 lbf electrodynamic shakers, power amplifiers to operate shakers, data acquisition system, and an instrumentation trailer that provides data acquisition, signal conditioning and shaker control.

The contractor shall provide services in accordance with the Modal Survey Testing Process Operating Procedure (POP) 09PC-PP03<sup>7</sup>. GSFC shall provide the test plan, and Modal Survey Test Facility, and also fulfill the roles of Product Design Lead, Process Owner and Test Engineer.

#### 1.1.1.4 Mass Properties Testing

The contractor shall provide testing services associated with performing mass properties measurement, spin balance, and static balance of structural assemblies and components using the GSFC Mass Properties Measurement Facilities. These facilities consist of a measurement unit, control console and personal computer system used for mass properties measurement of payloads from 50 – 10,000 pounds. A Tridyne machine is used for items less than 20 pounds. Both systems are located in the high bay area of GSFC Building 15. The contractor shall provide services in accordance with the Mass Properties Measurement System Process Operating Procedure (POP) 09PC-PP04<sup>8</sup>. GSFC shall provide the test plan, and Mass Properties Measurement System, and also fulfill the roles of Product Design Lead, Process Owner and Test Engineer.

#### 1.1.1.5 Static Loads Testing

The contractor shall provide testing services associated with performing static load testing of mechanical structures using the GSFC Universal Static Test Facility (USTF), the Portable Static Test Facility (PSTF), and two Tinius Olsen Tensile Test Machines. The USTF and PSTF consist of steel beam structures for reacting loads that are applied to the test article by hydraulic pressure cylinders. The facilities include a data acquisition system for measuring and controlling induced loads. The contractor shall provide services in accordance with the Static Load Testing Process Operating Procedure (POP) 09PC-PP05<sup>9</sup>. GSFC shall provide the test plan, and Static Loads Facilities, and also fulfill the roles of Product Design Lead, Process Owner, and Test Engineer.

#### 1.1.1.6 Acoustic Testing

The contractor shall provide testing services associated with performing acoustic testing of system, sub-systems and components using the GSFC Acoustic Test Facility. The Acoustic Test Facility consists of a 40,000 cubic foot reverberation chamber, acoustic horns, noise generators, control console, and data handling system. The contractor shall provide services in accordance with the Acoustic Testing Process Operating Procedure (POP) 09PC-PP06<sup>10</sup>. GSFC shall provide the test plan, and Acoustic Test Facilities, and also fulfill the roles of Product Design Lead, Process Owner, and Test Engineer.

### **1.1.2 Electromagnetic Test**

The contractor shall provide the following electromagnetic testing services for space flight, atmospheric flight (balloon and aircraft) and ground support hardware.

#### 1.1.2.1 Electromagnetic Compatibility (EMC) Testing

The contractor shall provide testing services associated with performing electromagnetic emissions and susceptibility testing using the GSFC Large EMC Facility and Small EMC Facility. The Large EMC Facility consists of a 21' x 21' x 20'H semi-anechoic shielded enclosure that can be operated as a Class 10k cleanroom; and two shielded anterooms that house test equipment and support equipment for the test article. The Small EMC test facility consists of an anechoic-shielded 16' x 16' x 10' test enclosure and two contiguous shielded enclosures; an operational control room; and an experimenters test equipment area. The facilities include associated electric and magnetic field antennas, line conductance transducers, signal generators, amplifiers, spectrum analyzers, control computers, and data acquisition and analysis systems.

The contractor shall provide services in accordance with the Standard EMC Test Facility Process Operating Procedure 549-PG-8080.0.1<sup>11</sup>. GSFC shall provide the test plan, and EMC Test Facilities, and also fulfill the roles of Product Design Lead, Process Owner and Test Engineer.

#### 1.1.2.2 Magnetic Testing

The contractor shall provide testing services associated with magnetic properties testing and magnetic field simulation testing at the GSFC Spacecraft Magnetic Test Facility. The facility includes a three axis Braunbek coil system consisting of 12 loops, 4 loops on each of the three

orthogonal axes; a remote Earth field sensing magnetometer and servo controller; a remote power control and instrumentation building; and auxiliary equipment such as degaussing coils and power supplies. The inner coils of the Braubek system are 42-foot in diameter with a 10-foot by 10-foot opening through the outer coils to accommodate spacecraft access into the test volume.

The contractor shall provide services in accordance with the Standard Magnetic Test Facility Process Operating Procedure (POP) 09PC-PP09<sup>12</sup>. GSFC shall provide the test plan, and Magnetic Test Facilities, and also fulfill the roles of Product Design Lead, Process Owner and Test Engineer.

### **1.1.3 Space Simulation Test**

The contractor shall provide testing services associated with performing thermal vacuum testing using the GSFC thermal vacuum test laboratory. This laboratory consists of 10 thermal vacuum chambers, 2 temperature and humidity chambers, and related support equipment. The test volumes of the thermal vacuum chambers range in size from 2' diameter by 2' deep, to 27' diameter by 40' high. The operating pressure is from atmospheric to  $1.0 \times 10^{-8}$  torr with a temperature range from  $-190^{\circ}$  C to  $+150^{\circ}$  C. A helium skid is available that can provide a  $20^{\circ}$  K environment to test articles in the large thermal vacuum chamber.

The contractor shall provide services in accordance with the Product Testing in a Vacuum Chamber Process Operating Procedure 549-PG-8071.0.1<sup>13</sup>. GSFC shall provide the test plan, and thermal vacuum test facility, and also fulfill the roles of Product Design Lead, Process Owner and Test Engineer.

### **1.1.4 Mechanical Integration**

The WBS for Mechanical Integration Services is divided between those services that are provided to the Mechanical Systems Division Advanced Manufacturing Branch Code 547, and those services that are provided to the Environmental Test Engineering and Integration Branch Code 549. Although the capabilities that the contractor needs in order to provide mechanical integration services for both Branches are similar, there are sufficient differences in facilities and the nature of the work between the Branches to warrant separate WBS elements.

#### **1.1.4.1 Mechanical Integration Services for the Environmental Test Engineering and Integration Branch Code 549**

The contractor shall provide mechanical integration services necessary to mechanically integrate space flight components into a finished spacecraft or space flight experiment that is ready to launch. These services include integration operations in the GSFC Building 7/10/15/29 complex, transportation to the launch site, and pre-flight and post-flight operations at the launch site. The contractor shall provide the following mechanical services for space flight, atmospheric flight (balloon and aircraft) and Mechanical Ground Support Equipment (MGSE). MGSE includes payload transporters and transporter environmental control systems. Mechanical integration services shall be provided in accordance with the Mechanical Integration Function Level Procedure 09PC-FP05<sup>14</sup>. Work is performed via Work Order Authorizations (WOA's) that are provided to the contractor, or that are developed by the contractor as required. Work Order Authorizations provide the technical data that is required to accomplish a task such as drawings,

specifications, and step-by-step procedures. WOA's are a formal part of the GSFC Quality Management System.

#### 1.1.4.1.1 Assembly

The contractor shall provide assembly services for payload components and structures, and Mechanical Ground Support Equipment (MGSE). Assembly services shall be performed in accordance with Work Order Authorizations and 540 policies.

#### 1.1.4.1.2 Integration

The contractor shall provide integration services for installation and mechanical fit verification of components and subassemblies into completed spacecraft, flight experiments, or Ground Support Mechanical Equipment. Integration services shall be performed in accordance with Work Order Authorizations and 540 policies.

#### 1.1.4.1.3 Payload Handling

The contractor shall provide lifting and handling services for instruments, spacecraft, spacecraft related subassemblies and components, and Ground Support Equipment. Lifting and handling shall be performed in accordance with Work Order Authorizations and 540 policies.

#### 1.1.4.1.4 Engineering Design and Analysis

The Contractor shall perform mechanical designs studies, and provide designs and drawings of, but not limited to spacecraft, aircraft instruments, balloon, instrument, and mechanical ground support equipment (including launchers and instrumentation trailers). These services involve the translation of a system (or subsystem, program, project, or activity) concept into a preliminary and detailed design (engineering plans and specifications), and then integrating the various components to produce a working prototype or model of the system. Typical associated tasks include, but are not limited to computer-aided design and engineering design and analysis. Also included are fabrication, assembly, modeling, training, outsourcing and integration activities.

#### 1.1.4.1.5 Fabrication

The contractor shall provide fabrication services for rapid response to unexpected mechanical integration fabrication requirements. GSFC's on site machine tools include tools such as drill press, lathe, milling machine, band saw, hand power tools, and hand tools.

#### 1.1.4.2 Mechanical Integration Services for the Advanced Manufacturing Branch Code 547

The contractor shall provide mechanical integration services necessary to mechanically integrate space flight components into a finished spacecraft or space flight experiment that is ready to launch. These services include fabrication operations in the GSFC Building 5 Advanced Manufacturing Branch, transportation to the launch site, and pre-flight and post-flight operations at the launch site. The contractor shall perform precision machine assembly by operating a variety of Government-furnished manufacturing tools/equipment that are, both manual and computer numerically controlled. The machines to be used include lathes, vertical computer-numerically

controlled machines, sheet metal tools, turning, milling, grinding, welding equipment and Electrical Discharge Machining (both wire and sinker EDM's). Work is performed via Work Order Authorizations (WOAs) that are provided to the contractor, or are developed by the contractor as noted. Work Order Authorizations provide the technical data that is required to accomplish a task such as drawings, specifications, and step-by-step procedures. WOAs are a formal part of the GSFC Quality Management System. The majority of the effort shall be performed at NASA, GSFC, Bldg. 5 Shop and associated staff shops, Greenbelt, MD 20771.

#### 1.1.4.2.1 Mechanical and Structural Engineering Design, Analysis and Integration

The Contractor shall perform mechanical designs studies, and provide designs and drawings of, but not limited to spacecraft, aircraft instruments, balloon, instrument, and mechanical ground support equipment (including launchers and instrumentation trailers). Assembly services shall be performed in accordance with Work Order Authorizations. These services involve the translation of a system (or subsystem, program, project, or activity) concept into a preliminary and detailed design (engineering plans and specifications), and then integrating the various components to produce a working prototype or model of the system. Typical associated tasks include, but are not limited to computer-aided design, engineering design and analysis, fabrication, assembly, modeling, training and outsourcing.

#### 1.1.4.2.2 Payload Handling

The contractor shall provide lifting and handling services for instruments, spacecraft, spacecraft related subassemblies and components, and Ground Support Equipment. Lifting and handling shall be performed in accordance with Work Order Authorizations and 540 policies.

#### 1.1.4.2.3 Acquisition and Life Cycle Management for Precision Fabrication

The contractor shall provide fabrication services for rapid response to unexpected mechanical integration fabrication requirements. The contractor shall provide fabrication services for Goddard in-house projects and programs. Services also required by the contractor under this element involve planning, budgetary, contract and systems/program/project management execution functions required to procure and or produce, render operational and provide life cycle support (maintenance, repair, supplies, engineering specific logistics) to activities, subsystems, projects, etc. Typical tasks associated include, but are not limited to operation and maintenance, program/project management, configuration management, engineering retrofit improvements and similar functions. These services may include actual manufacturing and fabrication of parts, launch and performance monitoring of spacecraft instrumentation. Work is performed to Work Requests that are provided to the Advanced Manufacturing Branch.

#### 1.1.4.2.4 Mechanical Equipment and Logistics Support

The Contractor shall provide mechanical equipment support to include the installation, repair, maintenance, assembly modification, setup, operation, and testing of a variety of Government-owned Computer Numerical Control (CNC) and conventional machinery and equipment. Associated tasks include inventory planning, standards/procedures development, training of civil service trainees and technicians when applicable, operation and maintenance requirements, and replacement procedures.

Logistics support includes the following:

- a) Maintain, calibrate, and control storage of all tools in the Code 547 tool crib located in GSFC Building 5;
- b) Inspect tools to determine which tools require rework or sharpening, and preparation of cutting tools for shipment to a tool grinding facility for routine sharpening as necessary;
- c) Issuing items from the tool crib in good working order and examining all returned items to determine their condition;
- d) Maintain accurate records of the location of all tools issued including the name and location of the person last issued the item;
- e) Inventory control of consumable supplies and materials;
- f) Material handling, cutting, material certification, and restocking support for all shop operations in accordance with GSFC Work instruction 547-WI-4520.2.2C Receipt, Verification, Testing, and Storage of Raw Materials<sup>15</sup> .;
- g) Maintain the equipment and chemicals at the required standards in the Plating shop; and
- h) Provide shipping, receiving, and inventory control of the building 5 Truck Lock in conformance with GSFC Work Instruction 547-WI-4520.2.1, Building 5 East Truck Lock Receiving Procedures<sup>16</sup>.

### **1.1.5 Lifting Devices and Equipment (LDE)/ Pressure Vessels and Systems (PVS) – (Recertification)**

The contractor shall provide manpower and expertise for management, engineering, technical, and clerical support to implement the Center’s LDE/PVS Program. LDE/PVS provides for test, inspection, certification, and recertification of Lifting Devices and Equipment (LDE), for the inspection, certification, and recertification of ground-based Pressure Vessels and Pressurized Systems (PVS), and for the nondestructive examination of both LDE and PVS. The primary location of work is at NASA Goddard Space Flight Center (GSFC) and the Wallops Flight Facility (WFF). GSFC is located in Greenbelt, Maryland and WFF is located in Wallops Island, Virginia.

In addition, on an annual basis, the contractor shall certify and recertify LDE Operators, LDE and PVS at Goddard Space Flight Center (GSFC), Wallops Flight Facility (WFF), the National Scientific Balloon Facility (NSBF) (Palestine, Texas and Fort Sumner, New Mexico), and the Poker Flat Research Range (PFRR) near Fairbanks, Alaska.

Current LDE and PVS inventory shall be provided as a reference within Task Orders. There are approximately 700 pressure systems, 350 overhead cranes/gantries/monorails/etc., 3 mobile cranes, 188 mobile aerial platforms/powered industrial trucks, and 12,000 pieces of lifting equipment.

In implementing the Program, the contractor must maintain the flexibility to be able to alter personnel work schedules, when required, to accommodate on-going critical Center operations by performing tests and/or inspections that require system or building outages during off-duty hours including weekends and/or holidays.

The contractor shall provide program management and engineering support to the GSFC LDE and PVS Manager including the development and preparation of status reports, cost estimates, engineering analyses, management review materials, attending and documenting meetings, program planning (cost, manpower, and procurement) and special presentations as required on an ad-hoc basis.

Required contractor expertise must include extensive knowledge and experience in applying applicable codes and standards, such as: Department of Labor (OSHA), ANSI, CMAA, ASME (such as the Boiler and Pressure Vessel Code, pressure piping codes, overhead or mobile crane, rigging, etc.), ASTM, NBIC, NFPA, API, ASNT, and other national consensus codes and standards that are pertinent to LDE and PVS design, fabrication, installation, operation, test, and inspection. Contractor shall provide expertise in performing hazard analysis (fault tree, failure mode effects analysis, event tree, or cause/effect analysis) on both PVS and LDE.

Certification of LDE and PVS includes review of the existing documentation, preparation for inspection, visual and non-destructive examinations, engineering evaluation, risk assessment and recommendation to meet NASA/GSFC requirements. The Contractor shall review all related existing documentation, generate new drawings, if required, make all necessary preparations for inspection, perform all visual and non destructive examinations, conduct all engineering evaluations, develop risk assessment documentation; and the contractor shall review all supporting documentation involved with repairs to PVS and LDE. The contractor shall be responsible for periodic in-service inspections and shall be responsible for maintaining the accuracy of the database on certification activities. Certification is defined as all activities including recertification and periodic in service inspections.

The contractor shall identify innovative and creative approaches in organizing, staffing, managing, and implementing all LDE/PVS work to maximize program value to the Government. However, all LDE/PVS work must be in compliance with all referenced Compliance Requirement Documents listed herein.

The Contractor shall provide personnel that have the appropriate skills for that trade. The Contractor shall ensure that the degree of skills be commensurate with that required to perform the work. Those personnel working in trades, whose performance requires license or certification or both, shall be so licensed/certified and said documentation shall be made available to the LDE and PVS Managers upon request. The Contractor shall ensure that all necessary licensing, certification, qualification and training requirements for performing work under this contract remain current. Training classes shall be approved by the LDE and PVS Managers . Certification records shall be kept in an electronic format accessible to the LDE and PVS Managers at any time. The Contractor shall develop a process to ensure that all licensing, certification, qualification and training records can pass annual audits.

The Contractor shall communicate, inform, and interact with other Government personnel including, but not limited to: Systems Managers; Facilities Managers; Building Managers; Engineers; Safety and Environmental Management Office Personnel; System & Research Engineers and other Government and contractor personnel. This communication shall take place during the normal operations and in emergency situations. The Contractor shall maintain communications in the coordination of activities, troubleshooting of problems, preparation of equipment for inspections and testing, and conducting necessary system isolation and safety Lockout/Tagout (LO/TO) activities.

#### 1.1.5.1 Lifting Devices and Equipment (LDE)

The contractor shall provide LDE test, inspection, certification, and recertification services in accordance with existing Program requirements (see section below - Compliance Requirement Documents), configuration management (CM) schedule, and procedures. LDE includes a variety of cranes, gantry cranes, hoists, mobile cranes, Hydra-sets, Load Cells, slings, structural slings, sling assemblies, and miscellaneous lifting rigging hardware and components. The LDE Program also covers powered industrial trucks (PIT) including forklifts, tugs, trailer, and mobile aerial platforms (MAP) used for lifting and handling activities in support of space flight projects and critical industrial type operations. Additionally, the program will include material handling equipment used in the handling of critical flight hardware, this may include positioning tables, dolly's, and tables. At Greenbelt, maintenance is included for Center-wide cranes, and Mechanical Systems Division-owned PITs and MAPs.

Train, certify, and recertify Civil Servant and personnel from multiple on- and off-site contractors for rigging, mobile aerial platform operations, powered industrial truck operations, crane operations (pendant and radio controlled cranes) as well as critical lift coordination. Training classes shall be conducted in accordance with existing syllabi. Administrative tasks for candidate recall, scheduling, coordinating training facilities, correspondence, issuing licenses, and record keeping are required.

Perform periodic LDE program requirement reviews to support continuous improvement. Update and/or develop inspection and maintenance procedures. Assist in the turn-key projects for installation of new cranes, and replace/upgrade existing cranes. Provide consulting services to user organizations for special tasks on rigging, handling, and lifting; and on LDE compliance requirements, design, installation, and testing.

#### 1.1.5.2 Ground-Based Pressure Vessel and Pressurized Systems (PVS)

The contractor shall provide PVS inspection, certification, and recertification services in accordance with Program requirement (see section below - Compliance Requirement Documents), Configuration Management schedule, and procedure. PVS includes cryogenic, vacuum, hydraulic, and compressed gases (including air) systems, subsystems, purge carts, payload environmental transportation systems (PETS), R&D systems, relief valves, gages, flexible hoses, and other components. PVS are utilized for the storage, transfer, and distribution of high-pressure media. Most of the pressure systems are over 30 years old and may not be designed to the current national consensus codes and standards. The purpose of the certification process is to assure that the systems are recertified and maintained to the current standards to the extent possible; pressure system certification is a continuous process. Pressure systems and

components are recertified on a periodic basis to meet the current requirements. The systems and equipment to be certified under this contract are housed in various buildings and locations throughout GSFC (onsite and offsite locations).

Located within Appendix 1 are references on how the certification process is currently conducted and the minimum qualifications of the key personnel involved.

The contractor is to train, certify, and recertify Civil Servant and personnel from multiple on- and off-site contractors for High Pressure Systems. Administrative tasks for candidate recall, scheduling, coordinating training facilities, correspondence, issuing licenses, and records keeping are required

Perform periodic PVS program requirement reviews to support continuous improvement. Update or develop in-service inspection procedures. Provide consulting services to user organizations on PVS compliance requirements, design, fabrication, installation, and testing.

#### 1.1.5.3 Configuration Management (CM)

The CM system keeps track of the total LDE and PVS inventory for GSFC. The contractor shall maintain and update the CM system to reflect any additions, deletions, or changes, and ensure that the documentation for each LDE and PVS reflects its current field conditions. The CM system provides pertinent information including the certification status and required test, inspection, and recertification schedules for each LDE and PVS. The CM system also provides the capability to search/screen components from the database using criteria such as serial number, model number, etc., in response to OEM recalls or Safe Alerts. The current software supporting the CM system is a SQL based software program housed in Code 585.

The Contractor shall schedule and complete work in a manner that minimizes disruption of the GSFC mission and daily activities. The Contractor shall work together with the LDE and PVS Managers and others in the research community to maintain awareness of the Government's recertification priorities. The Government prioritizes the recertification work efforts. The Government reserves the right to upgrade or change the current CM system at any point in time during the life of this contract. The Contractor shall be able to perform the required CM system functions at the start and for the duration of this contract. The Contractor shall continually update/maintain the CM database and shall be responsible for its accuracy as it relates to this SOW.

LDE Requirements - The CM system provides an inventory of each uniquely identified Lifting Device (LD) and piece of Lifting Equipment (LE). In addition to delineation of LDE inspection dates, the system provides criticality categorizations (critical/noncritical), service classifications (regular service/standby service/idle service), and information regarding the compliance with NASA requirements (FMEA's, redundant brakes, etc.) for each LDE, as well as the LDE owner and location. The CM system will also be a central point for record keeping of material handling equipment used for critical flight hardware.

PVS Requirements - The PVS CM system maintains documentation for all existing, modified, and new systems. Documentation includes the necessary information to certify PVS in accordance with NASA standards. Examples could include original design drawings,

manufacturer's fabrication drawings, test and inspection reports, and data sheets. CM system documentation also includes PVS modification, repair, replacement drawings and history, as well as the certification status and in-service inspection (ISI) schedules for each PVS. Each PVS within the CM system is uniquely identified by a system number. Components within each System is also uniquely identified, including manufacturer, serial number, model number, size, etc.

#### 1.1.5.4 Nondestructive Examination (NDE)

The contractor shall provide NDE personnel to perform NDE on both LDE and PVS. The technician is required and must have completed related classroom training in accordance with ASNT SNT-TC-1A<sup>43</sup>, plus experience in the inspection and examination of pressure vessels, piping and tanks in the cryogenic/gas aerospace, chemical, nuclear, refining and/or petrochemical industry; and ASNT certification to perform visual, leak testing, liquid penetrant, magnetic particle, radiography, ultrasonic shearwave, and ultrasonic thickness testing. The lead must be certified by ASNT at a minimum of Level II. The individual must also be trained and qualified by the National Board of Boiler and Pressure Vessel organization to repair relief valves and other PVS related components. In addition, NDE services will also be made available to support flight projects and Center organizations.

#### 1.1.5.5 Compliance Requirement Documents

The contractor shall assure that the Recertification Program is in compliance with the following documents (enforcement of edition at time of non-compliance or contract start):

- NPR 8715.3, "NASA General Safety Requirements"<sup>17</sup>
- NASA-STD-8719.9, "NASA Standard for Lifting Devices and Equipment"<sup>18</sup>
- NPD 8710.5, " NASA Policy for Pressure Vessels and Pressurized Systems"<sup>19</sup>
- NASA-STD-8719.17, "NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems"<sup>20</sup>
- GPR 8719.1, "Certification and Recertification of Lifting Devices and Equipment"<sup>21</sup>
- GPR 8710.3, "Certification and Recertification of Ground-Based Pressure Vessels and Pressurized Systems"<sup>22</sup>
- GPR 8834.1 "Lifting Operations Requirements"<sup>23</sup>
- OSHA 29 CFR 1910/1926<sup>24</sup>
- GPR 8710.7 "Cryogenic Safety"<sup>37</sup>
- 500-PG-8715.1.1 "Applied Engineering and Technology Directorate Safety Program Plan"<sup>28</sup>
- 540-PG-8715.1.2 "Mechanical Systems Division Safety Manual"<sup>39</sup>
- 540-WI-8719.1.1 "Certification and Recertification of Lifting Devices and Equipment"<sup>40</sup>
- 540-WI-8719.1.3 "Sample Lifting Device Daily Inspection Form"<sup>41</sup>
- 540-PG-8719.1.1 "Lift Sling Design"<sup>42</sup>
- ASNT SNT-TC-1A "Recommend Practice for the Personnel Qualification and Certification in Nondestructive Testing "<sup>43</sup>

#### **1.1.6 Optical Integration**

The contractor shall provide optical integration services necessary to install, align, and calibrate spacecraft or flight experiment instruments, components, or elements. These services include

integration operations in the GSFC Building 7/10/15/29 integration facilities, other GSFC facilities, other NASA centers or contractor sites, and pre-flight and post-flight operations at the launch site. The contractor shall provide the following optical services for space flight, atmospheric flight (balloon and aircraft) and ground support hardware. These services are provided in support of GSFC Code 551 Optics Branch.

#### 1.1.6.1 Optical Testing

The contractor shall utilize the GSFC Optical Test Facility in Building 7, optical laboratories in Building 5, and associated optical instrumentation, equipment, and facilities to verify alignment of flight, engineering model, and ground system optical instruments, breadboards and components; perform active alignment of systems; and perform pre and post environmental test distortion effects measurements. In addition the contractor shall conceive and construct optical breadboards, test and evaluate optical components, collect and analyze data, document procedures, and write and present results. Task Orders shall include facility information.

The contractor shall use the GSFC provided optical laboratory facilities and equipment to perform optical testing and performance verification in accordance with the Optical Testing Function Level Procedure, 09P-FP01<sup>25</sup>.

#### 1.1.6.2 Optical Fabrication

The contractor in accordance with the Optical Testing Function Level Procedure, 09-FP01<sup>25</sup> shall use GSFC facilities to fabricate specialized optical fixtures and tooling required during optical alignment, fabrication, and assembly. The staff shop consists of typical machine tools including a band saw, milling machine, lathe, drill press, and grinder.

#### 1.1.6.3 Optical Assembly

The contractor shall use GSFC facilities and equipment to assemble flight and non-flight optical systems in accordance with Work Order Authorizations. GSFC will provide WOAs and optical components and subassemblies as required per the WOA. Optical systems to be assembled include calibration systems, flight and non-flight instruments, and supporting optical GSE.

### **1.1.7 Facility Acquisition or Modification**

The contractor shall provide all support required to acquire and put into service new technical facilities or to modify existing technical facilities to meet new requirements. These services include project management, administration, procurement, subcontractor management, engineering, installation, construction, and facility commissioning. Technical facilities include the technical equipment and building modifications or development as necessary to deliver a complete, functioning system in accordance with performance or design specifications provided by the customer. Any required building modification or development shall be coordinated with and reviewed by all appropriate GSFC organizations.

## **1.2 Goods**

### **1.2.1 Electrical Cable Harness**

The contractor shall use GSFC facilities and equipment to provide flight and ground support system wiring harnesses and cables in accordance with Harness/Cable Fabrication Function Level Procedure 549-PG-8072.0.1<sup>26</sup>. This function level procedure includes design, procurement, fabrication, verification, modification, delivery, and installation. GSFC will provide the facilities, tools, and equipment, and serve as Product Design Lead and Verification Engineer as specified in 549-PG-8072.0.1. Work is performed to Work Order Authorizations that are provided to the contractor, or WOA's may be generated by the contractor as part of the design effort.

### **1.2.2 Thermal Blankets**

The contractor shall use GSFC facilities and equipment to provide flight and ground support system thermal blankets and tape application in accordance with 549-PG-80.71.0.2. This procedure includes requirement development, design, procurement, fabrication, verification, delivery and installation. GSFC will provide the facilities, tools, and equipment, and serve as Product Design Lead as specified. Work is performed to Work Order Authorizations that are provided to the contractor, or WOA's may be generated by the contractor as part of the design effort. Installation or modification support may be required at the launch site, other NASA facilities, or commercial sites.

Thermal Blanket engineering support shall be provided in terms of providing the capability of evaluating and assessing blanket and fabrication requirements for spacecraft and instruments. Contractor shall provide the capability of interfacing with the customer to provide guidance with scheduling the progression of blanket fabrication and installation and resolving issues and customer concerns. The contractor shall provide the capability of creating templates from electronic drawing formats. The contractor shall maintain an inventory of electronic and hard copy blanket templates.

## **1.3 Functional Support**

### **1.3.1 Safety**

The contractor shall ensure that all services and operations that are provided by this Statement of Work are conducted in a manner that is safe to personnel, facilities, flight hardware and ground support equipment. The contractor shall:

a. Ensure that services provided under this contract conform to the requirements of the GSFC Applied Engineering and Technology Directorate Safety Manual 500-PG-8715.1.2<sup>28</sup> and other applicable safety requirements including OSHA Standards, NPR 8715.3" NASA Safety Manual"<sup>17</sup>, NASA-STD-8719.9, Standard for Lifting Devices and Equipment<sup>18</sup> and NASA-STD-8719.17 NASA Requirement for Ground-based Pressure Vessels and Pressurized Systems<sup>22</sup>;

- b. Serve as assistant to the Facility Operations Managers in buildings 7/10/15/29 and at the Magnetic Test Facility. Typical tasks include facility and personnel safety preparedness, safety inspections, hazard identification, and corrective actions;
- c. Prepare safety analyses and plans including operations hazards analysis (OHA), and Failure Modes and Effects Analysis (FMEA) in support of all operations as required, including LDE and facility operation/flight programs;
- d. Report all unusual, undesirable, or dangerous system operating conditions immediately to the FOM, or his designee(s) as soon as such conditions are observed. Act to immediately stop and remedy such situations as appropriate;
- e. Take remedial action based on established emergency procedures and the observers best judgment as soon as unusual, undesirable, or dangerous conditions are observed;
- f. Perform flight systems safety analysis in accordance with the requirements of 321-WI-7120.0.1- Safety Data Package Development<sup>29</sup> as required;
- g. Provide safety support to projects and missions in terms of ground based safety both at GSFC and launch sites as well as other sites as required; and
- h. Provide top level safety program management including establishment, management, and documentation of mishap and incident reporting and closeout, remedial action implementation, continuous improvement, and use of leading metrics collection and analysis for understanding status, allocating resources and effective focusing of management attention.

### **1.3.2 Facility Maintenance**

The contractor shall provide maintenance for GSFC technical facilities including the Environmental Test and Integration test equipment, physical plant, cleanroom HVAC and air handlers, and software, as specified in the following WBS Element descriptions. Sufficient planning, on-site and on call maintenance service, subcontracted maintenance services, back up systems, and hardware spares shall be available such that no scheduled test shall be delayed longer than 72 hours due to an equipment failure The contractor shall provide engineering support for monitoring performance of the systems utilized for integration, optical alignment, testing, and recertification. The focus shall be on system degradation that would affect operational readiness. The contractor shall recommend modifications that could improve operational readiness, reliability, and cost reduction. The definition of maintenance includes replacement of obsolete systems and subsystems, and upgrading of existing equipment to enhance capabilities and minimize risks. The contractor shall maintain a Facilities Condition Assessment and Risk Management report to be used for long range maintenance planning. The report shall be updated yearly.

#### 1.3.2.1 Facility Equipment

The contractor shall maintain facility equipment as identified in Task Orders. Facility equipment includes built in test facilities such as vacuum chambers, shielded enclosures, fixed vibration shakers and the high capacity centrifuge, as well as instrumentation and control systems. The

contractor shall also maintain any electrical or mechanical support equipment that is required for facility equipment operation.

#### 1.3.2.2 Physical Plant

During the performance of periodic and emergency maintenance on integration and test support systems, the contractor must interface with utility systems such as power, steam, chilled water, and process cooling water, and mechanical systems such as heating, ventilating, and air conditioning. The contractor is responsible for maintenance of the utility systems to the interfaces as defined in Task Orders.

The contractor shall maintain and operate certain services in Buildings 7, 10, 15, 29 and other areas such as the facility process water system, the emergency power systems, secondary switchgear and circuits for facilities/equipment, the high pressure GN2 generating and storage systems, the LN 2 storage systems, and the emergency compressed air system.

#### 1.3.2.3 Cleanroom Maintenance

The contractor shall maintain GSFC cleanrooms and clean tents such that continuous operations are maintained. Maintenance may require additional special filters for projects with unique airborne cleanliness concerns from recirculated and makeup air. Cleanrooms and tents to be maintained are as identified in Task Orders.

#### 1.3.2.4 Software

The contractor shall have the necessary skills to create and maintain GSFC specific test and operation applications written with various tools and languages including, but not limited to: Matlab, Python, LABVIEW, Agilent VEE, Pro, GE iFIX SCADA, Power Builder, Oracle SQL, C, Visual Basic, Modicon PLC, Intellution, iRMX and Reliance Automax . Other languages and tools may be used as appropriate. The list of applications currently supported shall be identified in Task Orders.

#### 1.3.2.5 Housekeeping

The contractor shall supply custodial and cleaning services for selected areas of the building 7, 10, 15, and 29 complex, and the magnetic test site. The routine daily and/or weekly services are carried out to a normal reaching height above the floor. Building layouts giving areas of responsibility are as identified Task Orders. The contractor is also responsible for providing special periodic (every 1 to 2 years) facility cleaning which includes all areas not covered by routine services, especially the elevated high bay areas.

#### 1.3.2.6 Machine Tool Maintenance

The contractor shall provide maintenance and emergency repair for equipment in the Building 5 Advanced Manufacturing Branch, and staff shops located throughout GSFC. The Building 5 facility and remotely located staff shops include the machine tools and facilities as identified in Task Orders. Machine tools and equipment are to be maintained in accordance with GSFC Work Instruction 547-WI 8072.1.1 Preventative Maintenance of Aerospace Fabrication Equipment<sup>30</sup>

and repaired in accordance with GSFC Work Instruction 547-WI-8072.1.2, Corrective Maintenance of Aerospace Fabrication Equipment<sup>31</sup>.

#### 1.3.2.7 Plating Facility Maintenance

The contractor shall provide chemical and mechanical maintenance for facilities located in Building 5 performing metal plating, chemical polishing, and other chemical treatments of metals supporting the fabrication process.

#### 1.3.2.8 Calibration

The contractor shall ensure up-to date calibration is maintained for various in-house sensors including, but not limited to test antennas; magnetometers; accelerometers; load cells; torque wrenches; and ion gauges.

The contractor shall be responsible for managing the maintenance of all other laboratory equipment and transducers requiring calibration. In addition, the contractor shall maintain a calibration database in accordance with GSFC ISO 9001 policy.

#### 1.3.2.9 Computer Maintenance Management System (CMMS) and Reliability Centered Maintenance (RCM)

The contractor shall maintain and enhance as necessary the approved Computer Maintenance Management System (CMMS) database. Currently MAXIMO is used as the CMMS application. The GSFC Facilities Management Division provides access to the database via MAXIMO. The CMMS is used to schedule Periodic Maintenance (PM), issue PM and Corrective Action Work Orders, and track maintenance activities. In conjunction with the CMMS the contractor shall utilize the principles of Reliability Centered Maintenance as the basis for the ETIS II facilities maintenance program.

### **1.3.3 Engineering**

Specific engineering tasks that are required for providing each service or delivered end product are identified under individual WBS element descriptions for goods and services. In addition to these specific engineering tasks, the contractor shall have the capability to conduct the following engineering tasks as required to support flight projects or for test facility operations, improvements, and modification. The requirements for providing these services are defined in Task Orders.

#### 1.3.3.1 Test Engineering

The contractor shall provide engineering for:

- a. Analysis of test requirements and conditions to determine the need, if any for unique test support equipment required for environmental conditioning and testing of spacecraft systems and subsystems;
- b. Planning for functional testing of unique support equipment in preparation for testing flight hardware;

- c. Hardware/software analysis of data acquisition and measurement problems;
- d. Providing engineering support for planning and implementing environmental testing for selected projects utilizing in-house facilities;
- e. Preparing test plans, environmental verification plans, and procedures for use in demonstrating conformance to verification requirements;
- f. Serving as test director in GSFC facilities with responsibility of assuring that test objectives are met without unwarranted risk to personnel, test item, or facilities;
- g. Performing operations hazards analyses;
- h. Design test support instrumentation including system definition, signal conditioning electronics, data acquisition system interfacing, cable harnessing, and data acquisition and analysis software implementation; and
- i. Provide full scope test design and analysis using flight hardware design and analysis models as input. The contractor must be able to design tests, analyze test setups, demonstrate that the test will generate qualification and/or development data required, implement the test, and report results. This applies to Thermal, EMI and Magnetics, Dynamics, and Statics test areas.

#### 1.3.3.2 Integration Engineering

The contractor shall provide engineering and management of the integration of spacecraft, instruments, other related types of space flight hardware, and ground support equipment as required in terms of:

- a. Analysis of requirements
- b. Design
- c. Coordination of integration activities
- d. Advanced and detailed planning and scheduling
- e. Resource planning, scheduling, and leveling
- f. Oversight of integration activities
- g. All required supporting engineering analysis such as structural or thermal analysis
- h. Procedure and WOA development

#### 1.3.3.3 Facilities Engineering

The contractor shall analyze physical plant and/or facility limitations to determine feasibility of carrying out integration, testing, and related support activities and to recommend modifications or alternatives with options as necessary.

Analysis may include concept drawings, equipment layouts, systems definitions and alternate approaches, structure design and analysis, mechanical systems design and analysis, and electrical systems design and analysis.

The scope of such engineering includes all test, integration, and recertification technical equipment, plant equipment, and building infrastructure. Such systems include building systems such as HVAC systems, sprinkler systems, water and electrical systems, steam systems, other building utility systems, wall partitions, and all other such systems necessary to accomplish the required change. For facilities engineering involving building utilities, partitions, and similar structures and systems, designs, drawings, and execution must be coordinated with and approved by the GSFC Facilities Management Division.

#### 1.3.3.4 Engineering Design and Analysis

The Contractor shall perform mechanical designs studies, and provide designs and drawings of spacecraft, aircraft instruments, balloon, instrument and mechanical ground support equipment (including launchers and instrumentation trailers). These services involve the translation of a system (or subsystem, program, project, or activity) concept into a preliminary and detailed design (engineering plans and specifications), and then integrating the various components to produce a working prototype or model of the system. Typical associated tasks include, but are not limited to; computer-aided design; engineering design and analysis; fabrication; assembly; modeling; training; outsourcing and integration activities.

#### **1.3.4 Cleanroom Operations and Contamination Control**

The contractor shall monitor and operate the cleanrooms as identified in Task Orders. The cleanrooms shall be operated such that cleanliness levels, temperature, and humidity remains within specified operational/facility limits and project requirements. Operation includes the operational support required by users of the facilities including:

- training
- hardware pre-cleaning and bagging
- pre and post cleaning and certification
- gowning room operations and “housekeeping” maintenance
- sampling of facility or test articles for particulate or molecular contaminants for both airborne volumetric measurements and surfaces
- providing silicone free and lot sampled clean room garments and approved consumable supplies
- provide lot sampled ESD certified blue frocks and approved consumable supplies
- precision cleaning operations
- implementation of the project contamination control plan

The contractor shall obtain and provide training on equipment procured under this contract.

The contractor shall provide technically competent and demonstrated support personnel with direct applicable spacecraft contamination experience. The contractor shall maintain proficiency with ongoing advancements in the contamination control field: in cleaning procedures for hardware and cleanrooms; cleaning tools; and surfactants, monitoring tools.

The contractor shall provide personnel familiar with and able to implement industry standards, such as American Society for Testing and Materials (ASTM), International Organization for

Standardization (ISO), and Institute of Environmental Sciences Technology (IEST) for cleanliness control operations, accepted standards, and recommended practices.

The contractor shall work as a cohesive and supportive team with other contractors procured by the Center and/or project.

The contractor shall identify prime engineering and technician support personnel dedicated to project support.

The contractor shall conduct cleanroom operations and support activities in accordance with Contamination Control Function Level Procedure 549-PG-8700.0.1<sup>32</sup> and WOA's as appropriate. Similar services to other cleanrooms at other GSFC and off-site locations shall be provided as requested.

In addition to the contamination control support associated with the operation of GSFC cleanrooms, the contractor shall provide contamination control services required or requested by GSFC flight projects for preship operations at off site locations, transportation to the launch site, and preflight operations at the launch site. These contamination control services shall be performed in accordance with approved ISO-9001 procedures.

### **1.3.5 Logistics**

The contractor shall manage the stock levels of supplies and materials required to meet normal operational demands, utilizing the GSFC stores stock system when possible. The contractor shall inspect all incoming purchases or subcontracted items to ensure compliance with quality standards. The contractor shall provide inventory control.

The contractor shall manage the staging of in coming, out going, and temporary storage of test hardware and support equipment. The extent of such services is defined in Task Orders.

### **1.3.6 Quality Assurance**

The contractor shall follow the GSFC Quality Management system as specified by the GSFC documentation identified throughout this statement of work. The contractor's Quality System shall be compliant with ISO 9001. Further quality requirements may be specified in flight project Work Order Authorizations and/or 540 policies.

### **1.3.7 Computer Systems Management**

The contractor shall provide computer systems management and maintenance for computer systems as identified Task Orders. Systems management includes implementing software updates, controlling hardware and software configurations, maintaining software security including virus protection, controlling network resources, supporting users accounts, implementing hardware and software upgrades, file/data backup and archiving, and tracking all ADP resources.

## **1.4 Management**

The contractor shall provide a management staff and structure to efficiently implement the requirements of this SOW. Management requirements are defined in the following Work Breakdown Structure (WBS) definitions.

### **1.4.1 Senior Management**

The contractor shall establish a support services contractor organization on site at the GSFC headed by a single Point Of Contact (POC) responsible for the work associated with this contract. This manager shall be responsible to GSFC and to the parent company for the fulfillment of all terms and conditions of this contract and shall have the authority to direct and control the actions of the contractor personnel insofar as they are part of or impact the requirements of this support services contract. The contractor's performance including management, technical capability, reliability, responsiveness, productivity, and cost will be evaluated per the Performance Evaluation Plan developed by the government.

It is imperative that the contractor maintain quick response capability to react to rapidly changing requirements that increase or decrease staffing. Therefore, the contractor shall have the capability for supporting the financial activity necessary for emergency procurements including sub-contracting, recruiting and staffing necessary for quick response, and for rapidly responding to any labor relations problems.

The contractor shall maintain a staff and schedule work in an optimum manner to provide economical and efficient support for engineering, operations, maintenance, and fabrication. The contractor shall maintain a backlog of unscheduled approved tasks to fully utilize personnel not involved in current scheduled tasks. The contractor work force shall be adjusted as necessary to accommodate the total workload as agreed to in negotiated Task Orders.

All plans and procedures for operating Government facilities will be reviewed and approved by the Government.

The contractor shall review all facility operating procedures at least once per year.

The contractor shall provide the following plans and procedures:

- a. Procedures for periodic and emergency maintenance of the facilities and ancillary equipment;
- b. Maintenance schedules for periodic maintenance of facilities and equipment;
- c. Contingency plans and procedures required for responding to emergencies, including operations of critical facilities such as cleanrooms, weather related problems, power outages, work stoppages due to labor unrest, and unscheduled absences of the on-site Project Manager or supervisors, to minimize hazards to personnel, flight hardware, facilities, and equipment; and to minimize adverse schedule impact to project integration and test activities.

The contractor shall provide the following reports and reviews:

- a. Monthly and semi-annual reports on work assigned for facilities and/or services; and

b. A monthly status review of significant work in progress with the Contracting Officer's representative (COR).

#### **1.4.2 Project Management**

The contractor shall have the capability to manage large and small-scale improvements to GSFC technical facility capability or capacity. These improvements shall be managed by the contractor. The contractor shall provide the planning, organizing, directing, and controlling of improvement projects as these projects are identified and approved by the COR.

The contractor shall provide single points of contact (POCs) to manage the customer interface for selected environmental test and integration projects. These POCs are responsible for planning, cost estimating, scheduling, coordinating, tracking, and directing the use of the environmental test and integration services provided by this contract to customers of the GSFC Environmental Test Engineering and Integration Branch.

#### **1.4.3 Line Management**

The contractor shall provide the supervisory line management necessary to ensure that goods and services provided by this contract are delivered on time and meet the appropriate quality standards. Technical requirements, funding authority, and status are documented and tracked by Work Directives (WD's) that are presented to the contractor by the Government. Section VI of this SOW describes the contract administrative process. Line management shall ensure the following:

- a. No operational activities are initiated prior to approval of plans and procedures by the government;
- b. All facilities and services are in a state of operational readiness at all times unless specifically exempted in writing by the Contracting Officer Technical Representative (COR);
- c. Contractor personnel understand the requirements for each Work Directive, including subsequent changes, and shall initiate resolution and clarification of detailed requirements with technical personnel designated on the Work Directive as required;
- d. Qualified technical and supporting personnel are assigned to the Work Directives and that personnel assigned to potentially hazardous operations are trained and certified per the requirements of NPR 8715.3<sup>17</sup>. ;
- e. The Work Directives are completed on schedule within the estimated cost or the Contracting Officer and COR is notified in advance of the cost and/or schedule impact, and of potential priority/schedule conflicts;
- f. Support is coordinated with other functional areas within the Mechanical Systems Division, other Center organizations, and building Facilities Operations Managers, as appropriate;

g. Support is coordinated with other sources such as the GSFC Logistics Management Division; and

The contractor is responsible for management of operations associated with the typical integration and test facilities and equipment described in the GSFC test and Integration Facilities Handbook; PVS/LDE equipment identified in the PVS/LDE Equipment and Systems Summary<sup>15</sup>; and in the description of the optical facilities in WBS Element 1.1.6.

#### **1.4.4 Configuration Management**

The contractor shall:

a. Provide technical and administrative support in accordance with configuration management requirement document Code 549 Configuration Management Plan 549-PG-1410.2<sup>33</sup> to ensure that changes to hardware, software, and procedures are properly documented and coordinated; and,

b. Provide for control, approval, and documentation of: maintenance, engineering, hardware, and software, changes affecting operation and maintenance procedures; all facilities and equipment modifications including those required for maintenance of systems or components of systems; and those changes that result from the modification of system capabilities.

#### **1.4.5 Cost Control**

The contractor shall maintain cost accountability and control of each Work Directive (WD) and advise the COR of potential overruns. Included are labor hours -- regular and overtime -- and travel, materials, and subcontract costs. At a minimum the contractor shall review Work Directives for potential overruns when 75% of the authorized spending limit is reached. The results of this review shall be reported to the Contracting Officer and the COR.

#### **1.4.6 Special Procurements**

The contractor shall utilize the GSFC stores stock system as much as possible but shall be prepared to procure and furnish required supplies and materials on a quick response basis. The scope of procurement ranges from small purchases to major test facility modifications, upgrades, or improvements.

#### **1.4.7 Equipment and Property Control**

The contractor shall establish a property management and accountability procedures in accordance with the NASA Equipment Management System and the applicable provisions of the Federal Acquisition Regulation (FAR) Subpart 45.2 and the NASA FAR Supplement 1845.202, as in effect on the date of this contract and shall:

a. Maintain control, or location, of all assigned property,

b. Provide continued surveillance to ensure that equipment is used for official, purposes only,

- c. Report untagged controlled equipment (including fabricated equipment) found in their assigned property management area to the Contracting Officer,
- d. Conduct, and cooperate in periodic review of, the physical inventory of assigned controlled equipment,
- e. Identify and report any controlled equipment no longer needed in their property management area, and
- f. Accompany the civil service inspector during the annual property inventory walk-through inspection.

## **VI CONTRACT ADMINISTRATION**

The interface between GSFC organizations and the contractor will be through formal and informal channels. After the award of a Task Order (TO), work flow for specific tasks to be performed under the TO are documented and tracked by utilization of the Test and Integration Management Information System (TIMIS). TIMIS is a web-based application that controls workflow through issuing and tracking Work Directives (WD's). Each WD describes the scope of the effort, the needed requirements, points of contact for the responsible parties, the spending authority; as well as, the funding source. Work Directives shall be consistent with Task Order requirements for any particular TO period of performance. The extent of the formality and depth of detail to be employed in a WD response/approval cycle is dependent on the complexity of technical and financial requirements of the particular project or program, but the same flow of authority/responsibility shall be maintained during the lifetime of the WD. Information flow for Work Directives is shown in Figure 1. Government personnel are designated for each WD and are responsible for conveying technical details to the contractor designee to assure requirements are properly communicated and clearly understood.

The contractor shall implement a system for developing estimates in response to requests by the Government for support in developing WD's. Estimates shall include number and type of skill required, labor and materials cost, a complete description of work to be performed, schedule where applicable, and impacts, if any, to on-going operations. Estimates may be simple or complex as required by the scope of the work to be performed. Estimates at a minimum shall be by month and shall not change unless a modification is issued.

Contractor estimates are given to the Government Environmental Project Engineer (EPE) to create the WD in the Test & Integration Management Information System (TIMIS). Once this WD is created, it is forwarded through the necessary approval channels for verification of project requirements; as well as financial information.

Once a WD is approved and issued, the contractor is to record the actual costs for each WD; including labor hours worked-- regular and overtime, travel, materials, and subcontract costs in their own approved accounting system. Once a week, these actual costs shall be uploaded into the TIMIS system against each WD. Upon the completion of each calendar month not later than the tenth (10th) working day following the close of the contractors' monthly accounting period, the contractor is responsible for uploading the NASA Form (NF) 533, a detail by WD of actual costs

incurred during the prior month plus an accrual of costs for the current month, into the TIMIS system.

The contractor shall maintain cost accountability and control of each WD and advise the Contracting officer's technical representative (COR) of potential overruns. These costs are to be monitored on a monthly basis against the estimate to make sure that the work is being performed as outlined within each WD. At a minimum the contractor shall review each WD for potential overruns when 75% of the authorized spending limit is reached. The results of this review shall be reported to the Contracting Officer and the COR. New cost estimates shall be generated as the scope changes or overruns occur.

Upon completion of each WD, the contractor shall notify the Government Code 549 Environmental Project engineer (EPE). The Government EPE will close the WD in the TIMIS system.

**WORK DIRECTIVE PROCESS FLOW CHART**

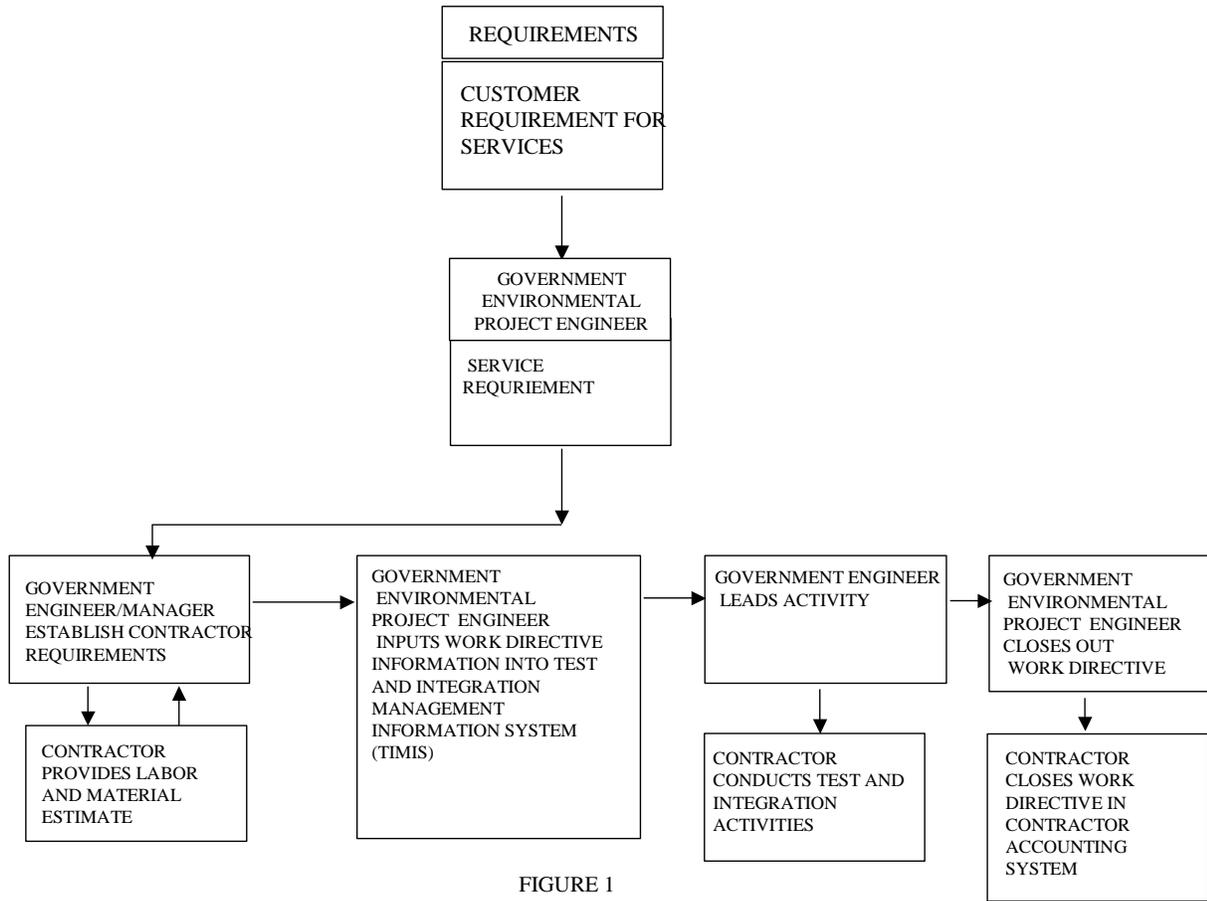


FIGURE 1

**Appendix 1**

The technical certification personnel shall be comprised of Pressure Systems Engineers, Inspector/Technicians, and Drafters as described below.

The Contractor shall determine the requirements necessary for the certification of systems and or components by interpreting the NASA requirements documents and applicable national codes and standards. The Contractor shall be responsible for determining what equipment needs recertification and how best to achieve this with minimum cost.

For each specific certification task, the Contractor shall; review all related existing documentation, generate new drawings if required, make all necessary preparations for inspection, perform all visual and non-destructive examinations, conduct all engineering evaluations, develop risk assessment documentation, and upon completion of the repairs, review and approve all supporting documentation involved with the repairs. The Contractor shall use qualified engineers and technicians in the performance of certification work. There are numerous steps used in the certification process at GSFC, they are outlined below.

The Contractor shall gather existing documentation (or create new documentation in some cases) and other information that is necessary in performing the certification to the current standards. These documents shall include, but are not limited to; the design drawings; materials identification; fabrication information; NDE records; code/design calculations and engineering analysis; and code certification data, etc. The Contractor shall establish appropriate recertification files and Configuration Management data to provide a permanent recertification record that includes all follow-on In Service Inspection (ISI) requirements.

The Contractor shall review existing documentation to identify and determine the adequacy of the pressure system components with respect to the NASA requirements, current codes and standards. This includes review of maximum allowable working pressure and temperature, remaining life evaluation, etc. In most cases, simple code calculations or evaluations using commercial codes are adequate. However, in some cases a finite element analysis, and/or fatigue and fracture life assessment may be required. The Contractor shall have demonstrated capabilities to perform all type of engineering assessment and, in addition to the above calculations, shall provide relief valve sizing calculations and piping system flexibility analyses of piping systems, as required.

The Contractor shall determine the best suitable method to evaluate the current condition of the pressure systems and components based on the code requirements, risk assessments, and cost considerations. This will require review of past operating history, operating conditions, understanding of possible damage mechanisms and review of past in service inspection records. The Contractor shall, based on this evaluation, determine and specify non-destructive examination (NDE) requirements for systems and components.

The contractor shall perform NDE based on the above determination and document all findings. The Contractor shall be capable of providing all types of NDE testing, including visual examination, liquid penetrant examination, magnetic particle examination, radiographic examination, ultrasonic examination, ultrasonic thickness testing, eddy current inspection, hardness testing, acoustic emission examination, positive material identification and replication testing.

The Contractor shall, based on the results of the NDE evaluation, determine the current condition of the pressure system and all of its components and shall update all preliminary calculations to reflect the current conditions. The Contractor shall establish required corrective actions, depth and schedule of future in-service inspections (ISI), re-certification schedule, operating restrictions if any and re-rating or de-rating required prior to releasing the system for operation. In many cases, there are choices between making modifications and performing detailed engineering evaluation using ASME section VIII, Div II and finite element analysis. The contractor shall make the recommendations necessary to bring PVS up to certification requirements.

The Contractor shall prepare final certification reports documenting results of all the steps mentioned above. In addition, the Contractor shall establish risk assessment code determinations based on NASA standard 8719.17<sup>20</sup>, risk assessment procedure. The Contractor shall provide the PVS Manager a completed Certification Report thirty (30) calendar days after the task completion.

The Contractor shall perform scheduled inspections in accordance with in-service inspection requirements identified in the data books and/or NASA/GSFC requirements documents. The

Contractor shall include post inspection reports and documentation to reflect inspection completion and recommended future inspection actions and requirements. The Contractor shall update as necessary the data books, databases, and drawings.

Safety is of paramount importance in all issues related to the activities covered under this SOW. Due to high-pressure and/or temperatures, as well as cryogenic conditions, knowledge of, and strict adherence to, NASA, GSFC, ASME, ANSI, DOT and other applicable national codes and standards is imperative. The Contractor shall ensure that personnel performing this work possess a comprehensive understanding of their duties and all applicable codes and standards.

A pressure systems engineer (PSE) must have: completion of a ABET accredited engineering degree, requiring four or more years of full-time study. Experienced in overseeing and managing fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels, piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry. Formal classroom training in the following courses is also required: ASME B&PV Section VIII Div 1 and 2, ASME B31.3, ASME / NBIC NB-23, API RP-579, and API RP-520. The position of a senior PSE requires that the individual be a state registered professional engineer.

A drafter is required that works closely with design with Pressure Systems engineers and Technicians preparing drawings or computer models of Pressure Systems and components found throughout GSFC.

## REFERENCE LIST

1. GPR 1280.1, "The GSFC Quality Manual"
2. <http://gdms.gsfc.nasa.gov/gdmsnew/home.jsp>
3. <http://code210.gsfc.nasa.gov/ETIS/home.html>
4. GSFC Environmental Test and Integration Facilities Handbook
5. 09PC-PP01, "Steady State Acceleration Testing Process Operating Plan"
6. 549-PG-8072.1.1, "Vibration Testing"
7. 09PC-PP03, "Modal Survey Testing Process Operating Procedure"
8. 09PC-PP04, "Mass Properties Measurement System Process Operating Procedure"
9. 09PC-PP05, "Static Loads Testing Process Operating Procedure"
10. 09PC-PP06, "Acoustic Testing Process Operating Procedure"
11. 549-PG-8080.0.1, "Standard EMC Test Facility"
12. 09PC-PP09, "Standard Magnetic Test Facility Process Operating Procedure"
13. 549-PG-8071.0.1, "Product Testing in a Vacuum Chamber"
14. 09PC-FP05, "Mechanical Integration Function Level Procedure"
15. 547-WI-4520.2.2 Receipt, Verification, Testing, and Storage of Raw Materials"
16. 547-WI-4520.2.1, Building 5 East Truck Lock Receiving Procedures
17. NPR 8715.3, "NASA General Safety Requirements"
18. NASA-STD-8719.9, "NASA Standard for Lifting Devices and Equipment"
19. NPD 8710.5, "NASA Policy for Pressure Vessels and Pressurized Systems"
20. NASA-STD-8719.17, "NASA Certification Requirements for Ground-Based Pressure Vessels and Pressurized Systems)
21. GPR 8719.1, "Certification and Recertification of Lifting Devices and Equipment"
22. GPR 8710.3, "Certification and Recertification of Ground-Based Pressure Vessels and Pressurized Systems"
23. GPR 8834.1 "Lifting Operations Requirements""
24. OSHA 29 CFR 1910/1926
25. 09P-FP01, "Optical Testing Function Level Procedure"
26. 549-PG-8072.0.1, "Harness/Cable Fabrication"
27. 549-PG-8071.0.2, "Thermal Systems Support"
28. GSFC Applied Engineering and Technology Directorate Safety Manual 500-PG-8715.1.2
29. 321-WI-7120.0.1- Safety Data Package Development
30. 547-WI-8072.1.1, "Preventative Maintenance of Aerospace Fabrication Equipment"
31. 547-WI-8072.1.2, "Corrective Maintenance of Aerospace Fabrication Equipment"
32. 549-PG-8700.0.1, "Contamination Control Function Level Procedure"
33. 549-PG-1410.2.1 "Code 549 Configuration Management Plan"
34. Federal Acquisition Regulation (FAR) Subpart 45.3
35. NASA Federal Acquisition Regulation Supplement
36. <http://recert.gsfc.nasa.gov/index.htm>
37. GPR 8710.7 "Cryogenic Safety"
39. 540-PG-8715.1.2 "Mechanical Systems Division Safety Manual"
40. 540-WI-8719.1.1 "Certification and Recertification of Lifting Devices and Equipment"
41. 540-WI-8719.1.3 "Sample Lifting Device Daily Inspection Form"
42. 540-PG-8719.1.1 "Lift Sling Design"
43. ASNT SNT-TC-1A "Recommend Practice for the Personnel Qualification and Certification in Nondestructive Testing"<sup>43</sup>