# STATEMENT OF WORK

## Introduction

The Goddard Space Flight Center (GSFC) is a recognized leader in Safety and Mission Assurance, with a history of implementing effective, innovative, and cost-effective approaches to reduce risk and enable mission success. Safety and Mission Assurance (SMA) personnel and processes are integrated throughout Goddard, assuring safety and mission success for the full spectrum of GSFC flight and ground-based programs and projects.

The SMA Directorate provides support to GSFC projects in the development of safety and mission assurance requirements, and the independent surveillance, audit, review and assessment of design, development, test, and Mission Operations activities on-site and at supplier facilities. This includes management of institutional risk related to project operations. The SMA Directorate also manages the GSFC Quality Managements Systems, and the implementation of institutional safety for center operations.

## Scope of Work

The GSFC SMA Directorate was reorganized with the objective of improving the effectiveness of SMA, and formally adopting a risk-based strategy of doing business. In addition, it reflects the directorate's vision for excellence in safety, risk management, quality engineering and mission assurance at the center. See the GSFC SMA website for complete organization details, at http://sma.gsfc.nasa.gov.

In concert with the new strategic vision of the SMA Directorate, the Contractor shall provide a risk-based approach to the flow-down, tailoring and implementation of mission assurance requirements for the following services:

- Safety Division Services
  - Systems Safety Engineering
  - Industrial Hygiene and Radiation Protection
  - Occupational Safety
- Quality and Reliability Division Services
  - Reliability and Risk Assessment Engineering
  - Mission Software & Ground Systems Assurance
  - Quality Engineering
  - Metrology and Calibration/Repair Service of Measurement and Test Equipment
  - Lifting Devices Engineering and Pressure Vessel Systems
- Assurance Systems Division Services
  - Systems Review
  - Management Systems

Additionally, the Contractor will be required to support GSFC SMA Directorate operations and development initiatives, aimed at improving the quality of service delivery, and expanding the range of services provided, and fostering stronger

relationships with internal and external customers and partners. Services to be provided include:

- Program Development
- Information Technology Support

# 1 GENERAL REQUIREMENTS

The following requirements have general applicability for the contract, and shall be adhered to in the performance of all services within this Statement of Work.

## 1.1 Personnel

GSFC flight projects require unique SMA skills generally found within the aerospace community. It is imperative to ensure personnel have appropriate levels of expertise to meet the requirements identified in this statement of work. In addition, the Contractor shall provide personnel that are knowledgeable of NASA/GSFC policy and standards related to Program and Project Management, and Systems Engineering.

Contractors supporting Ground Systems and Mission Operations shall possess security clearances up to the Top Secret level.

## 1.2 Deliverable Submission, Reporting and Communication

Contractor document deliverables shall be reviewed internally prior to submission to the government, with final deliveries provided in Microsoft office compatible formats.

The Contractor shall prepare written weekly and monthly reports to address the status of activities performed under tasks written against this statement of work.

The Contractor shall provide technical and management in-person support to weekly and monthly status meetings with the SMA Directorate, Division, and Branch Management.

The Contractor shall provide all electronic correspondence through their NASA provided email account.

## 1.3 Property and Information Management

Any equipment, or property provided to the Contractor in order to facilitate the accomplishment of work required by this contract shall be maintained in working order and adequately secured to prevent loss or theft.

In addition to data management policy and protocol specific to the service being provided, the Contractor shall appropriately control and handle restricted, proprietary, and other sensitive information, such as that controlled by Export Control Regulations, ITAR (International Traffic in Arms Regulations), and EAR (Export Administration Regulations).

# 2 SYSTEM SAFETY ENGINEERING SERVICES

The Contractor shall support the Safety Division in ensuring that GSFC managed space flight missions establish a system safety program.

The Contractor shall be responsible for supporting the implementation of systems safety over the program life cycle for GSFC-managed space flight missions and ground-based projects. The Contractor shall provide technical support and consultation to the project teams in defining and interpreting requirements, analyzing mission systems for safety hazards, supporting hazardous operations, and in developing solutions to safety issues in order to enhance the likelihood of achieving mission success.

The Contractor shall provide the following services to the Safety Division:

## 2.1 System Safety Planning

The Contractor shall prepare a System Safety Plan for each GSFC managed space flight mission or ground-based project, detailing how the system safety program will meet NASA Safety requirements. The Contractor shall also review externally developed System Safety Plans and submit written findings and recommendations to the Safety Division.

Applicable standards for system safety planning include the following:

- NPR 8715.3C "NASA General Safety Program Requirements"
- NPR 8715.7A "Expendable Launch Vehicle (ELV) Payload Safety Program Requirements"

## 2.2 Defining System Safety Requirements

The Contractor shall be technically proficient in NASA and Launch Site Range Safety requirements, and provide technical expertise to GSFC managed space flight missions and ground-based projects in their application and implementation. They shall identify any non-compliances to these requirements and support processing of any necessary waivers. They shall provide safety requirements input to development of Mission Assurance Requirements (MAR) for flight and ground-based programs.

## 2.3 Hazard Analysis

The Contractor shall perform hazard analyses on GSFC-managed space flight missions and ground-based projects. The Contractor shall also provide technical review and comment on externally developed hazard analyses and associated analyses and reports and submit written findings and recommendations to the Safety Division.

## 2.4 Safety Data Packages

The Contractor shall document results of hazard analyses in Safety Data Packages. Safety Data Packages encompass Missile System Prelaunch Safety Packages (MSPSPs), and Instrument Safety Assessment Reports (ISARs).

Applicable Standards for Safety Data Packages include but are not limited to the following:

- NPR 8715.7A “Expendable Launch Vehicle (ELV) Payload Safety Program Requirements”
- SSP 51700 "Payload Safety Policy and Requirements for the International Space Station"
- NSTS/ISS 13830, Rev C “Payload Safety Review and Data Submittal Requirements For Payloads Using the Space Shuttle or International Space Station (ISS)”

## 2.5 Integration & Test Support

The Contractor shall support GSFC in-house integration and test activities, including reviewing and approving procedures for hazardous operations, performing safety audits, and providing real-time support of hazardous operations. The contractor shall provide expertise in operational safety requirements pertinent to these activities. The Contractor shall also support select out-of-house integration and test activities as directed by the Safety Division.

## 2.6 Launch Range Support

The Contractor shall support pre-launch and launch activities including reviewing and approving hazardous procedures, performing safety audits, monitoring hazardous pre-launch activities, and closing out all hazard control verification items. The Contractor shall provide reports on activities as required.

## 2.7 Safety Reviews & Payload Safety Working Group Support

The Contractor shall support Safety Reviews and Payload Safety Working Group meetings and develop necessary documentation as requested by the Safety Division. The Contractor shall also develop and present safety status and technical issues at design and programmatic/milestone reviews.

## 2.8 Mishap Reporting

The Contractor shall report any mishaps and close calls in NASA Mishap Information System (NMIS). The Contractor shall provide support as needed on any mishap or close call investigations as directed by the Safety Division.

Applicable standards for mishap reporting include the following:

- GPR 8621.4 “GSFC Mishap Preparedness and Contingency Plan”

# 3 INDUSTRIAL HYGIENE AND RADIATION PROTECTION

The Contractor shall provide Comprehensive Industrial Hygiene (IH) and Radiation Protection Program services for GSFC at the Greenbelt, Maryland and Wallops Flight Facility, Wallops Island, VA locations. Related services shall also be provided for NASA employees located at the Goddard Institute for Space Studies (GISS) in New York City, the Independent Validation & Verification (IV&V) Facility in Fairmont, WV, the White Sands Complex (WSC) in Las Cruces, New Mexico, Merritt Island (MILA), and Florida and at temporary job sites.

The Contractor shall provide the following Industrial Hygiene and Radiation Protection Services:

## 3.1 Industrial Hygiene Program Services

The Contractor shall effectively manage an operationally comprehensive IH Program; maintain procedures and record keeping per GSFC’s organization and management; and develop/recommend appropriate policies and procedures necessary to ensure safe operations. The Contractor shall be guided by NASA policies and procedures, GSFC policies and procedures, applicable federal and state regulations and national standards (e.g., American Conference of Governmental Industrial Hygienists (ACGIH), American National Standards Institute (ANSI), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)).

### 3.1.1 Comprehensive Baseline IH Surveys

The Contractor shall conduct comprehensive baseline surveys of all GSFC organizations and workplace operations. Comprehensive Baseline Surveys Employee exposure to carcinogens, extreme toxicants, substances with low occupational exposure limits or high risk of exposure, sensitizers, and developmental/reproductive hazards shall be specifically evaluated for health risk. Comprehensive baseline survey shall follow established GSFC protocols.

Applicable standards for performing Comprehensive Baseline Surveys include the following:

- GPR 1840.2B “Industrial Hygiene Program”

### 3.1.2 Comprehensive IH Surveys (Follow-up)

The Contractor shall conduct Comprehensive Follow-up IH Surveys periodically after the initial Comprehensive Baseline Survey. Follow-up surveys shall take place every one, two or three years in accordance with the level of the organization’s operational hazards.

### 3.1.3 Indoor Air Quality Surveys

The Contractor shall respond to Indoor Air Quality (IAQ) concerns and assess conditions and the potential hazard qualitatively and/or quantitatively, as appropriate.

### 3.1.4 Local Exhaust Ventilation Systems Surveys

The Contractor shall conduct annual surveys of Local Exhaust Ventilation (LEV) to evaluate compliance with GSFC requirements and Work Instructions. The Contractor shall also track LEV system equipment, evaluation measurements, and overall effectiveness to determine trends in flow rates and other parameters. The Contractor shall maintain current and historical databases listing all LEV's on GSFC, type, location, date of certification, and findings/recommendations.

### 3.1.5 Respiratory Protection Program

The Contractor shall manage and maintain a Respiratory Protection Program (RPP) that is compliant with Federal Regulations, NASA and GSFC requirements.

### 3.1.6 Hearing Conservation Program

The Contractor shall manage and maintain a Hearing Conservation Program that is compliant with Federal Regulations, NASA and GSFC requirements.

### 3.1.7 Personal Protective Equipment Program

As part of the Comprehensive Baseline and Follow-up Surveys, the Contractor shall evaluate GSFC operations to identify required and recommended Personal Protective Equipment (PPE) for the respective operations.

### 3.1.8 Ergonomics Program

The Contractor shall manage and maintain an Ergonomics Program following NASA and GSFC requirements.

### 3.1.9 Asbestos Program

The Contractor shall review all aspects of the asbestos abatement project process, including submittals by asbestos abatement contractors, to ensure the protection of GSFC employees and compliance with Federal and State Regulations, and GSFC requirements. The Contractor shall monitor asbestos abatement projects to ensure compliance with Federal and State regulations, GSFC requirements, and in accordance with the abatement plans.

### 3.1.10 Prescription Safety Eyeglasses Program

The Contractor shall coordinate the process for ordering prescription safety glasses for GSFC employees required to wear safety glasses.

### 3.1.11 Consultant Services

The Contractor shall provide technical assistance to GSFC engineering organizations necessary to incorporate preventative measures and concepts in early design stages of new construction, new equipment and facility modifications.

The Contractor shall review plans, drawings, and design specifications for new facilities and modifications to existing facilities to ensure inclusion of necessary health hazard controls.

The Contractor shall provide support (participate in telecoms, coordinate requests for information) related to meetings, audits and visits from Federal, State and Local agencies concerning workplace health matters.

The Contractor shall support incident response and disaster control operations at GSFC Greenbelt. The Contractor shall have the capability to provide emergency response services.

### 3.1.12 Food Preparation Areas

The Contractor shall provide a food safety professional to perform quarterly food safety audits of all food service establishments, to include cafeterias, food courts, dining services, child development centers, and cafes. Farmer's markets and concessions stand shall receive a semiannual food safety audit, and vending areas shall be inspected annually by the Contractor. The Contractor shall conduct audit in accordance with NASA and GSFC requirements, with reference to the Federal Food Safety Code and State and Local procedures.

Applicable standards for auditing food preparation areas include the following:

- GPR 1870.1B "Food Sanitation and Foodborne Illness Prevention Program"

### 3.1.13 Safety Data Sheet (SDS) Electronic Database Support

The Contractor shall provide consultative support to Management Operations regarding inclusion of chemical products in the Safety Data Sheet (SDS) database. The Contractor shall also review all new purchases of chemical products to determine safety and health considerations, and provide recommendations to the product requester and Management Operations.

### 3.1.14 Pre-renovation Surveys

In preparation for renovation or demolition projects, the Contractor shall collect samples and provide reports regarding the presence of asbestos-containing materials and lead-containing paint. The Contractor shall collect samples in accordance with Environmental Protection Agency (EPA) protocols and acceptable industry practice.

### 3.1.15 Emergency Response

The Contractor shall be available to respond to GSFC emergency situations where IH support is needed or requested. Normal request for support comes when an Emergency is Toned Out on the two-way radios or from a call from the Safety Division. During core working hours the response time shall be within 10 minutes of notification of an incident. During non-business hours the response time shall not exceed two (2) hours.

### 3.1.16 Industrial Hygiene Laboratory Services and Analysis

The Contractor shall provide or obtain accredited laboratory services necessary for the execution of the IH services in the contract.

## 3.2 Radiation Protection Program Services

The U.S. Nuclear Regulatory Commission (NRC) has issued licenses to GSFC, which authorize handling of radioactive materials. The current NRC licenses used on-site include a broadscope byproduct material license, a Source Irradiator license, and materials under other general NRC licenses. The Contractor shall maintain complete records on each radioactive source (ionizing and non-ionizing) at GSFC.

The Contractor shall work with the Radiation Safety Officer (RSO), who leads the Radiation Protection Office (RPO) to effectively manage the Radiation Protection Program.

The objective of the GSFC Radiation Protection Program is to limit exposure of personnel to ionizing and non-ionizing radiation to As Low As Reasonably Achievable (ALARA). However, under no circumstances shall exposure exceed appropriate Federal standards. National standards shall be used as guidelines to determine ALARA for non-ionizing radiation (e.g. American National Standards Institute (ANSI), American Conference of Governmental Industrial Hygienists (ACGIH)).

The Contractor personnel shall be located at GSFC/Greenbelt and most of the work in the program will be accomplished at the Greenbelt site. The Contractor shall travel to outside locations as needed and to WFF at least semiannually to provide radiation protection services.

### 3.2.1 Monitoring of GSFC Radioactive Sources

The Contractor shall conduct testing of sealed radiation sources for leakage or contamination. Sealed sources are required to be leak tested in accordance with GSFC's NRC licenses. In addition, sources shall be tested by the Contractor, whenever they are suspected of leakage.

### 3.2.2 Inventory of Radioactive Sources

The Contractor shall physically inventory all radioactive sources at GSFC to verify their location on a quarterly basis. The Contractor shall make appropriate changes to the source records in order to maintain an accounting of current sources status. The Contractor shall maintain/modify the existing computerized tracking systems to maintain an accurate and up-to-date source inventory.

### 3.2.3 Shipping, Receipt, and Transfer of Radioactive Sources

Shipments of all radioactive sources shall be made in accordance with the Department of Transportation (DOT) and other applicable regulations. At a minimum, one Radiation Protection Services Contractor shall be certified per NRC regulations to ship radioactive source material.

The Contractor shall be responsible for the physical transportation of radioactive materials on the GSFC/Greenbelt campus. This entails the transfer of sources between buildings for test and evaluation, moving to and from storage.

### 3.2.4 Thermal Vacuum Testing of Radioactive Sources

The Contractor shall be ensure that radioactive sources to be used in a space environment are certified for environmental extremes. After thermal vacuum testing, the Contractor shall be responsible for certifying that the sealed source is not leaking.

### 3.2.5 Inspection of Areas Where Radioactive Sources are Used or Stored

The Contractor shall periodically inspect (at a minimum semiannually) any area where radiation sources are used or stored to ensure sources are being used in a safe and secure manner. The Contractor shall monitor areas where radioactive sources are used or stored.

### 3.2.6 Radioactive Waste Disposal

The Contractor shall manage radioactive waste in accordance with applicable Federal and state regulations. Radioactive waste shall be packaged in approved DOT containers and prepared and stored for disposal.

### 3.2.7 Radioactive Source Storage

The Contractor shall manage the radioactive source storage facility at the GSFC/Greenbelt campus.

### 3.2.8 Decontamination

In the event an area or items are found to be contaminated above GSFC limits, the Contractor shall work with the RSO and GSFC Emergency personnel to isolate the area or items. The Contractor shall use proper decontamination methods to eliminate the contamination to regulatory acceptable limits. Large scale, catastrophic events shall be managed by the Contractor to the point of regulatory acceptable final release to the public.

### 3.2.9 Maintenance, Repair, and Calibration of Radiation Detection Instruments

The Contractor shall ensure that radiation detection instruments are calibrated as required by regulation or manufacturer's guidance and when otherwise necessary to support GSFC requirements.

### 3.2.10 X-Ray Devices and Accelerator Surveillance

The Contractor shall maintain an inventory of all X-Ray devices and accelerators. The Contractor shall survey the equipment in accordance with regulation or manufacturers recommendations at least annually.

### 3.2.11 Emergency Response

The Contractor shall be available to respond to radiation safety emergencies (potential/actual radioactive material spills, employee overexposures) on an as needed basis. During core working hours the response time shall be within 10 minutes of notification of an incident. During non-business hours the response time shall not exceed two (2) hours.

### 3.2.12 Decommissioning of Radiological Sites, Buildings, or Outdoor Areas

The NRC requires the radiological decommissioning of sites, buildings and outdoor areas where licensed activities have ceased radiological operations, even while licensed activities continue to be conducted at other site locations. The Contractor shall plan for and conduct appropriate radiological surveys that demonstrate compliance with NRC regulations and allow for “free release” of such areas for unrestricted use.

### 3.2.13 Laser and Laser Systems

The Contractor shall provide a Laser Safety Officer (LSO) who meets the requirements of federal and ANSI standards. The LSO shall conduct a laser hazard analysis for each GSFC project using Class 3B or 4 laser systems or any laser system used outdoors. LSO

shall provide support to the RSO for documentation and program requirements for any outdoor laser system, which will need an evaluation by the NASA Laser Safety Review Board (LSRB) and for GSFC's projects anywhere in the world, which require laser safety plan evaluation.

The Contractor shall maintain inventory records of laser systems for hazardous lasers (Class 3B and 4). The Contractor shall conduct inspections of Class 3B and 4 laser operations at a minimum annually, which includes visits to off campus locations (i.e. MOBLAS 4).

The Contractor shall develop and maintain requirements specific to the use of lasers that comply with Federal regulations and ANSI standards. The Contractor shall provide oversight and direction to the outdoor laser activities to assure adequate protection of air transportation. The Contractor shall ensure coordination with the NASA Laser Safety Review Board, Federal Aviation Administration, and the US Space Commands Laser Clearinghouse for outdoor laser activities as required by the ANSI standards.

### 3.2.14 Electromagnetic Radiation

The Contractor shall develop, maintain, and implement safety programs and activities for radio frequency, microwave, electromagnetic, extra low frequency and other appropriate radiations in accordance with Federal, State and National Consensus Standards.

The Contractor shall maintain inventory records of category 3 and category 4 radio frequency radiation emitters. The Contractor shall conduct inspections of IEEE C95.1 Category 3 and Category 4 Radio frequency Emitters at least annually.

The Contractor shall conduct a hazard evaluation of all potentially hazardous emitters. Potentially hazardous radio frequency radiation emitters that are located in accessible areas shall be surveyed at least annually.

### 3.2.15 Ultraviolet Radiation/High Intensity Light sources

The Contractor shall develop, maintain and implement safety programs and activities for ultraviolet radiation and high intensity light sources in accordance with Federal, State and National Consensus Standards.

The Contractor shall conduct a hazard assessment of ultraviolet radiation/high intensity light source use.

## 4 OCCUPATIONAL SAFETY

The estimated population for services includes approximately 3000 NASA civil service personnel, located within 38 major facilities and encompassing over 3.4 million square feet of office, industrial and laboratory space.

The Contractor shall provide occupational safety and engineering services to the GSFC/Greenbelt Occupational Safety and Health Division helping to ensure GSFC is in compliance with required NASA, Federal, State and local standards. The interpersonal relationships, contacts, and image the contractor fosters with our internal customers is also a vital key to the adoption and participation of our employees in the GSFC Safety Management System. Facility inspection support is required at other satellite GSFC sites (GISS, IV&V, and WSC), this support includes one visit per year to perform an inbrief meeting, entire facility inspection, and an outbrief meeting.

The Contractor shall provide Comprehensive Occupational Safety Program services for the GSFC/Greenbelt Campus. Related services shall also be provided for NASA employees located at the Goddard Institute for Space Studies (GISS) in New York City, the IV&V Facility in Fairmont, WV, and the White Sands Complex (WSC), New Mexico.

The Contractor shall provide the following Occupational Safety Services:

4.1 Facility Drawing Reviews

The Contractor shall provide an individual to perform engineering design reviews of requirements, specifications, and applicable 30%, 50%, 90% and 100% submittals for new facilities and facility modifications to ensure the incorporation of safety and fire protection requirements and resolution of identified hazards. The Contractor shall coordinate review designs with the Industrial Hygiene Office, Radiation Office, Safety, Pressure Vessel System/Lifting Devices and Equipment and Environmental staffs as appropriate to ensure compliance standards within those program areas are addressed within the drawings. The Contractor shall attend meetings related to reviews.

The Contractor shall conduct review of drawings in accordance with the following administrative requirements:

1. Comments from reviews and meetings shall be provided to the Facilities Management Division (FMD) within five working days of the request or meetings, respectively.

2. Electronic copies of comment reviews shall be maintained and stored in an established shared drive compatible with Microsoft Word with an electronic copy submitted to FMD.

Applicable standards for Facility Drawing Reviews include the following:

- NPR 8715.3 Rev 3 “NASA General Safety Program Requirements”
- NPD 8710.5, Revision D "NASA Safety Policy for Pressure Vessels and Pressurized Systems"
- NASA-STD-8719.11, Revision A "Safety Standard for Fire Protection"
- GPR 8715.5B “Fire Protection at GSFC Greenbelt”
- National Fire Protection Association (NFPA) Standards 70E “Standard for Electrical Safety in the Workplace”

- International Building Code

4.2 Occupational Safety Assessment Team Building and Laboratory Surveys

The Contractor shall identify and assure through annual surveys and associated follow-up surveys, that 100% of all identified buildings and adjacent structures and operations at GSFC are in compliance with applicable NASA, Federal, State, national safety consensus standards, and/or other accepted safety criteria. All Contractor activities shall be coordinated with Supervisors and the Building, Facility Operations, Project, and Laboratory Managers including other Directorate Safety Personnel as required for task completion. The Contractor shall perform other specialized analyses on identified hazards, equipment, or operations that may include the following:

1. Hazard Resolution Verification
2. Operating and Support Hazard Analysis
3. Building Code and National Fire Codes Compliance Assessment

Findings and recommendations shall be recorded, maintained, and tracked to final resolution in the current Safety Findings Database, or one promulgated by the Contractor.

The Contractor shall prepare and distribute the annual and follow-up reports. The Contractor shall perform safety spot inspections as requested by the Safety Division. Safety spot inspections could be facility or process related.

Applicable standards for building and laboratory surveys include the following:

- NASA STD 8719.7 “Facility System Safety Guidebook”
- 350-WI-1700.1.1A “Occupational Safety Assessment Team Audit Program”

4.3 Construction Safety

The Contractor shall provide construction safety support services at GSFC/Greenbelt. This may include participating in preconstruction and construction meetings to determine whether operations at the construction site will be in compliance with Federal safety standards, and/or other designated criteria. When tasked, the Contractor shall perform construction job-site surveys and acceptance walk-throughs to verify the safety of construction operations and proper function of installed safety devices. Acceptance walk-throughs shall be attended as a witness upon request from the Safety Division.

Applicable standards for performing construction safety support include the following:

- OSHA Regulations
- NPR 8715.3 Rev 3 “NASA General Safety Program Requirements”

4.4 Acceptance Testing & Operational Readiness Reviews

The Contractor shall represent the Occupational Safety and Health Division at acceptance testing of fire protection/life safety equipment and/or systems. Operational readiness

reviews of new construction, renovation, repair, or rehabilitation projects shall be attended by the Contractor upon request.

### 4.5 Safety Training Courses

The Contractor shall assist in developing, reviewing, coordinating, and delivering general industry and construction safety education classes and awareness programs for GSFC Civil Service personnel.

### 4.6 Interim Response Assistance

The Contractor shall assist the GSFC Interim Response Team by conducting or assisting in any or all of the following tasks; securing the scene, documenting the scene using photography, video, sketches, and debris mapping, and identifying witnesses.

### 4.7 Adjacency Studies

The Contractor shall perform adjacency studies, which address higher hazard operations and are a qualitative analysis of how different operations affect the facility and personnel safety. In conjunction with the adjacency study, the Contractor shall perform hazard analysis on these buildings and should encompass inputs from building users as well as safety and fire protection professionals to identify safety issues that are currently present in the facility. The Hazard Analysis provides an organized means to identify, rank (using the risk management process outlined in the Code 360 work instruction) and track all current hazards as well as giving recommendations for their resolution.

## QUALITY AND RELIABILITY DIVISION SERVICES

# 5 RELIABILITY AND RISK ASSESSMENT ENGINEERING

The Reliability and Risk Assessment Branch (RRAB) provides technical authority for GSFC's interpretation, flow down and implementation of agency-level policies, standards, and directives relating to reliability, maintainability, availability, and risk assessment for space flight and ground system projects. Support services include planning, and analysis, in the areas of reliability, maintainability, and availability from mission formulation through operations, and management of commodity or vendor-based issues that present institutional risks.

The Contractor shall provide the following services to the Reliability and Risk Assessment Branch:

## 5.1 Defining Reliability and Risk Assessment Procedural Requirements

The Contractor shall derive project specific Reliability and Risk Assessment procedural requirements in accordance with project technical and programmatic (cost, schedule) parameters.

Applicable standards and directives for Reliability and Risk Assessment include the following:

- NPD 8720.1 "NASA Reliability and Maintainability (R&M) Program Policy"
- NPR 8705.5 "Technical Probabilistic Risk Assessment (PRA) Procedures for Safety and Mission Success for NASA Programs and Projects"
- NASA-STD-8729.1 "Developing and Managing an Effective Reliability and Maintainability (R&M) program"
- GPR 7120.4A "Risk Management"
- GPR 8705.4 "Risk Classification Guidelines and Risk-based SMA practices for GSFC Payloads and Systems"
- 300-PG-8730_5 "SMA Acceptance of Inherited and Build-to-Print Products"

## 5.2 Developing R&M and Risk Assessment Plans and Programs

The Contractor shall develop and integrate plans for performing Reliability, Maintainability, and Risk Assessment, consistent with the project specific requirements for Reliability and Risk Assessment.

The Contractor shall also review externally developed Reliability and Risk Assessment Plans and submit written findings and recommendations to the Reliability and Risk Assessment Branch.

## 5.3 Heritage and Re-use Analysis

The Contractor shall support Heritage assessments by analyzing GSFC failure review data, Spacecraft Orbital Anomaly Reporting, and other performance/reliability data; identifying trends and cross-cutting issues or risks; assessing the relevancy of performance and reliability information to new project development or re-use activities, recommending areas for improvement of future GSFC missions; and assemble required data for publishing corresponding analysis reports.

## 5.4 Reliability Analysis

The Contractor shall conduct and document the following analyses and utilize the results to identify system and component level requirements for reliability, maintainability, and availability:

- Reliability & Maintainability (R&M) and Availability Analysis
- Failure Mode and Effects Analyses (FMEA), Failure Mode Effects Criticality Analyses (FMECA), and Develop Critical Items Lists (CIL)
- Fault Tree Analyses (FTA)
- Limited Life Item Analysis
- Stress and Derating Analysis
- Worst Case Analysis (WCA)
- Probabilistic Risk Analysis (PRA).
- Perform Human Reliability Analysis
- Life Test and Data Analysis

The Contractor shall also review externally performed analysis and associated deliverables, and submit written findings and recommendations to the RRAB.

Applicable standards for performing reliability analysis include the following:

322-WI-8720.0.1 "Performing a Fault Tree Analysis (FTA)"

322-WI-8720.0.2 "Part Stress and Derating Analysis"

322-WI-8720.0.3 "Project Reliability Program Plan/Probabilistic Risk Assessment Plan Preparation (RPP/PRAP)"

322-WI-8720.0.4 "Limited Life Item Analysis (LLI)"

322-WI-8720.0.5 "Worst Case Analysis (WCA)"

322-WI-8720.0.6 "Load-Strength Analysis"

322-WI-8720.0.7 "Performing Reliability Predictions and Maintainability Predictions"

322-WI-8720.0.8 "Code 322 Peer and Branch Review Process"

322-WI-8720.0.9 "Human Reliability"

322-WI-8720.0.10 "Life Testing/Accelerated Life Testing"

322-WI-8720.0.11 "Probabilistic Risk Assessment (PRA)"

322-WI-8720.0.12 "Review of External Reliability Analysis/Reports"

322-WI-8720.0.13 "Probabilistic Risk Assessment (PRA) Plan Approval, Submission, and Recording"

### 5.5 On-orbit Surveillance and Data Analysis

The Contractor shall evaluate mission operations and all redundancies or back-up systems used to ensure the availability of critical functions when the mission is exposed to complete failure, partial mission failure, or mission degradation with respect to mission success and safety criteria. These redundancies or back-up systems may include cross-strapping, design for graceful degradation, fault management, and fault tolerance.

The Contractor shall support On-Orbit performance by archiving performance and anomaly data, and analyzing trends, and providing the resultant data analysis as feedback into mission operations and the systems engineering cycle for current and future missions.

### 5.6 Commodity and Institutional Risk Assessments

The Contractor shall identify, characterize, and recommend resolutions for cross-cutting and high impact issues or risks that affect programs, projects, or organizations. Corresponding modeling and analysis, performed at the appropriate level of detail ranging from piece-part design/construction to an overall system; shall support commodity, project/program, and institutional risk assessment and risk management activities.

### 5.7 Participate in Reviews and Audits

The Contractor shall participate in formal and informal reviews, audits, and other surveillance activities as requested.

## 6 **MISSION SOFTWARE AND GROUND SYSTEMS ASSURANCE**

The Mission Software and Ground Systems Assurance Branch provides technical authority for the GSFC interpretation and flow down of agency-level policies, standards, and directives related to assurance of software and ground systems. Support services include flight software assurance, assurance of ground system hardware, software, and infrastructure, and assurance of mission operations.

The Contractor shall provide the following services to the Mission Software and Ground Systems Assurance Branch:

### 6.1 Software Assurance

The Contractor shall provide software assurance support for GSFC developed or acquired software.

Applicable standards for Software Assurance include the following:

- 320-PG-7120.2.1D "Procedure for Developing and Implementing Software Quality Programs"
- GPR 7150.4 "Software Safety and Software Reliability Process"

### 6.1.1 Developing Assurance Requirements and Activities

The Contractor shall perform a Software Classification and Criticality Assessment to determine the applicability of the NASA Software Engineering, Software Assurance, and Software Safety Standard. The Contractor shall use this assessment along with other project parameters, such as mission class, system architecture, software heritage, and the project lifecycle to develop and maintain a Software Assurance Basis of Estimate, the Software Assurance Plan, and the Software Assurance Activity Schedule.

### 6.1.2 Evaluating Software Processes and Work Products

The Contractor shall provide an independent and objective assessment of software engineering and software assurance (for acquisition efforts only) processes and associated work products against the applicable NASA agency-level, project-level, and supplier/vendor specific software standards, process descriptions, and procedures.

### 6.1.3 Performing Software Safety and Software Reliability

The Contractor shall work collaboratively with their System Safety, Reliability Engineering, Software and Systems Engineering counterparts to apply GPR 7150.4, and perform the following tasks:

- Identify critical system functions
- Identify software contributions to nominal and off-nominal operations of critical system functions
- Establish traceability between the operations concept, analysis, and requirements
- Evaluate requirements, design, code for completeness and robustness
- Ensure the adequacy of testing
- Review changes and discrepancies for impact and risk

## 6.2 Ground Systems Assurance

The contractor shall define and apply the relevant SMA standards for Safety, Quality and Reliability in the evaluation of facilities, structures, electronics, software, and IT infrastructure/services that support Space-Ground Communications, Mission Operations, and Ground System Communications.

### 6.3 Mission Operations Assurance

The Contractor shall work collaboratively with the Flight Operations Teams (FOT), Mission Directors, and Flight Software Sustaining Engineering (FSSE) teams to provide pre and post-launch assurance of the health, safety and success of spacecraft and/or science operations.

Applicable standards for Mission Operations Assurance includes the following:

- 302-PG-8700.0.1 "Mission Operations Assurance".

## 7 QUALITY ENGINEERING

The Contractor shall provide a range of discipline engineering support for quality engineering and quality assurance for all manufacturing disciplines applicable to spacecraft, ground systems, and science instrument production. When providing quality engineering services for direct project support, the quality engineers shall participate as a member of the Project SMA team, which is led by the Project Chief Safety and Mission Assurance Officer (CSO). Standard quality engineering processes, practices, and deliverables review will be provided through the Quality Engineering Branch.

The Contractor shall provide quality engineering support that provides all of the support services and deliverables on-site at GSFC's prime and subcontractors in a temporary duty assignment (days or weeks) and semi-permanent or permanent duty assignment (months or years) as required.

The Contractor shall provide the following services to the Quality Engineering Branch:

### 7.1 Requirements Development, Implementation Review, and Review of Flight Hardware Procurements

The Contractor shall formulate the quality assurance requirements for GSFC missions and for all phases of hardware production until launch. These requirements shall be provided to the Project CSO for development of in-house SMA implementation plans and for out of house Mission Assurance Requirements (MAR) documents for application to contracts on flight and ground system hardware.

The Contractor shall ensure that GSFC's in-house processes, prime contractors and subcontractors comply with the Project's established quality assurance and inspection requirements.

The Contractor shall provide expert review and assurance support ensuring Project quality engineering and mission assurance deliverables comply with the applicable mission assurance requirements and implementation plans.

The Contractor shall provide written reports on review results, including conclusions regarding the adequacy of the deliverable and to ensure compliance with the applicable mission assurance requirements.

The Contractor shall review procurement requests for flight hardware to ensure applicable assurance provisions are specified. The Contractor shall provide recommendations to the Project CSO for standardizing improvements in procurement specifications used both by GSFC suppliers and by GSFC internally.

### 7.2 Review Board Participation

The Contractor shall provide quality engineering discipline support for preparation of Project status and readiness reviews and for presentations that address specific technical or assurance risks, issues or failures, or other reviews conducted by a GSFC Directorate, Division or Branch, the project, the prime contractor or the subcontractor.

### 7.3 Process Engineering

The Contractor shall provide process engineering services for on-site and off-site manufacturing lines for the purposes of standard and special process development including designing or reviewing quality monitoring or quality control sub-processes and for developing and implementing process qualification test plans. Contractor support shall be provided for collection and analysis of quality control data for the purposes of process improvement and defect reduction and for documenting processes.

### 7.4 Quality Inspections

The Contractor shall perform quality conformance inspections of hardware during and after production processes to ensure the hardware meets all engineering documentation requirements, project quality requirements, and the hardware is defect-free. The Contractor shall document their work on the appropriate manufacturing travelers.

Applicable standards for performing quality inspections include the following:

- 320-WI-5330.1.1 “Quality Assurance and Safety Review and Approval of Work Orders and Procedures for Flight”
- GPR-5330.1H “Product Processing, Inspection, and Test”

### 7.5 Managing Non-conformances

The Contractor shall note all failures to comply with the established requirements and shall record non-conformances in GSFC databases established for this purpose or in reports when the databases do not accommodate the record. The Contractor shall provide quality engineering oversight of non-conformances identified or witnessed within off-site contractor processes (prime or subcontractor) and shall ensure they are reported, tracked and resolved including root cause analysis, corrective action and preventative action. The Contractor quality engineer shall collaborate with the RRAB when one or more non-conformances indicates the need for a reliability analysis or risk assessment to resolve unintended negative consequences.

Applicable standards for managing non-conformances include the following:

- GPR 5340.2K “Documentation and Control of Process Non-conformances and Customer Complaints”

7.6 Integration and Test Support

The Contractor shall assure compliance to requirements and defect avoidance during hardware integration and test activities.

7.7 Launch Range Support

The Contractor shall support pre-launch, launch, and post launch activities including witnessing, handling, receiving inspection, performing or monitoring inspections and tests, monitoring contractor pre-launch activities, reviewing documentation, and coordinating and participating in problem and failure reporting/resolution.

7.8 Materials and Parts Assurance Engineering

The Contractor shall provide engineering expertise and analyses for establishing materials and parts (mechanical and electrical) selection and processing requirements for GSFC and NASA Projects. The Contractor shall provide engineering review and analysis services to verify that NASA and GSFC prime and subcontractors comply with established parts and materials requirements. The Contractor shall ensure that risks are defined, evaluated, and mitigated using standard assurance methods, including but not limited to focused evaluation and test, when established materials and parts requirements cannot be met. The Contractor Materials Processes Assurance Engineers (MPAE) and Parts and Radiation Assurance Engineers (PRAE) will provide assistance to Projects impacted by GIDEP alerts or advisories that have risk implications. The Contractor MPAEs and PRAEs will provide Projects assurance support in material review boards and parts control boards and will be a liaison between the Project’s materials engineers and EEE parts engineers for routine verification of material and part list reporting and review results.

The Contractor shall support the NASA Electronic Parts Program (NEPP) manager in the technical administration of the NEPP Program and in developing engineering deliverables and content produced by the Program (see https://nepp.nasa.gov for more information).

7.9 GSFC Electrostatic Discharge (ESD) Control Program

The Contractor shall provide engineering expertise and analyses for establishing ESD control requirements for NASA and GSFC Projects, GSFC labs, and standardized procedures and other aspects of implementation, when ESD sensitive (ESDS) items are processed or otherwise handled in-house. The Contractor shall be a contributor to the GSFC Lab Safety and Quality Improvement team for continuous improvement of compliance and processes in GSFC labs for ESD control. The contractor shall use and develop data and information management systems for maintaining ESD control compliance. The Contractor shall manage and perform all of the duties of an ESD

Protected Area (EPA) Certifier for ESD controlled area certifications. Equipment needed to replace non-functional equipment or to introduce new equipment to the assessment kit shall be identified by the Contractor.

The Contractor shall be capable of applying risk-based decision-making, when evaluating the impact of non-conformance related to the ESD control requirements.

Applicable standards for ESD analysis and control include the following:

- GPR 8730.6B "Electrostatic Discharge (ESD) Control"
- 300-PG-8730.6.1 "GSFC Electrostatic Discharge (ESD) Control Plan"

### 7.10 Technology Insertion and Design for Manufacturability

The Contractor shall prepare analyses regarding new or advanced technology, designs and manufacturing methods for evaluation of suitability for integration in GSFC and Agency projects. Computer-aided modeling and testing shall be executed to provide supporting data as needed.

### 7.11 Government Industry Data Exchange Program (GIDEP)

The Contractor shall provide support and participate in the preparation and distribution of GIDEP Alerts, GIDEP Safe-Alerts, GIDEP Problem Advisories, and GIDEP Agency Action Notices. In addition, the Contractor shall participate in the preparation and distribution of NASA Advisories.

Applicable standards for support of the GIDEP program include the following:

- S0300-BT-PRO-010 " Government - Industry Data Exchange Program (GIDEP) Operations Manual"
- NPR 8735.1, Revision C "Procedures for Exchanging Parts, Materials, Software, and Safety Problem Data Utilizing the Government-Industry Data Exchange Program (GIDEP) and NASA Advisories"
- GPR-5340.3G "Preparation and Handling of GIDEP Alerts, GIDEP Safe-Alerts, GIDEP Problem Advisories, GIDEP Agency Action Notices, and NASA Advisories"

## 8 METROLOGY AND CALIBRATION/REPAIR SERVICE OF MEASUREMENT AND TEST EQUIPMENT

The Metrology and Calibration Program provides end to end metrology support services for the GSFC Greenbelt Facility. The services include but not limited to, the coordination with sub-contractor and customer's requirements as each pertains to metrology calibration and repair. The program is responsible for procedure writing, when manufacturer's procedure requires modifications to fit the needs of customers or a unique capability requires a written procedure and provides procedure validation. It performs calculations for the measurement uncertainty analysis (MUA), test uncertainty

ratio (TUR) and guard-banding, as necessary. The program conducts quality assurance testing and investigate failures and write the corrective action. In addition, the program works with customers on traceability and reverse traceability for Out of Tolerance measurement and test equipment (MTE) and provides technical expertise.

The Contractor shall provide Metrology, calibration, and repair services of measurement and test equipment (MTE) for various equipment housed at GSFC-Greenbelt Facility. MTE includes but not limited to, electronic instrumentation, optical devices, mechanical gauges and fixtures, laser equipment, and blackbody sources. GSFC shall provide, upon request from the Contractor, the Installation-Accountable Government Property listed and the Government Furnished Property (GFP).

The Contractor shall have written procedures that establish the bases of compliance/certification with GSFC Metrology and Calibration standards.

Applicable standards for Metrology and Calibration include the following:

- ANSI/ISO/ASQ Q9001:2000 "Quality Management System-Aerospace Requirements"
- ISO 10012-1 "Quality Assurance Requirements For Measuring Equipment-Part 1: Metrological Confirmation System for Measuring Equipment"
- ANSI/ISO/ASQ Q10012-2003 "Measurement management systems-Requirement for measurement processes and measuring equipment-An American Standard Approved 2006"-Section 7: Metrological Confimation System for Measuring Equipment"
- NPD 8730.1C "Metrology and Calibration"
- GPR 8730.1K "Metrology and Calibration"

The Contractor shall furnish qualified personnel to operate the on-site Metrology and Calibration laboratory. When the on-site laboratory does not have the working standards or technical capabilities to perform the necessary service required by the MTE, the Contractor shall use qualified vendors/facilities. Proper documents, requirements, and policies shall be flowed down to the vendors/facilities, as required.

The Contractor shall provide the following Metrology and Calibration/Repair Services:

8.1 Field Service

The Contractor shall have the capability to provide for field service calibrations and/or verifications on MTE.

8.2 Pick-up and Delivery of MTE

Upon customer notification, the Contractor shall pick-up MTE, within 24 hours, at the customer's location or designated drop-off site, as required. The Contractor shall provide a designated drop-off site for emergencies, if different from the on-site laboratory location.

### 8.3 Calibration Procedures and Records

The Contractor shall prepare and maintain calibration procedures and records for services to MTE and shall maintain file copies of operating and maintenance manuals or maintain those records electronically or a combination thereof.

### 8.4 Metrology Information System

The Contractor shall provide a web-based interface Metrology Information System (MIS) or a MIS at the Government's discretion for all services rendered to each MTE. The MIS database shall allow customers to submit service requests for metrology services. The web-based interface shall allow customers and the government Technical Monitor, at a minimum, to determine the status of the MTE brought in for service requests after submission, including expected pickup and return dates and the location of the equipment (whether at GSFC-Greenbelt, the Contractor's off-site facility, the Original Equipment Manufacturer (OEM) or another qualified outside service calibration/repair vendor). The database shall have several reporting features and provide for expansion of features, as required by the government.

Applicable standards for Metrology Information System data entry (minimum fields) include the following:

- ANSI/NCSL Z540.1-1994 (R2002), Calibration Laboratories and Measuring and Test Equipment – General Requirements
- ANSI/NCSL Z540.3-2006, Requirements for the Calibration of Measuring and Test Equipment.
- AS9100 Quality Management Systems - Requirements for Aviation, Space and Defense Organizations

### 8.5 Measurement and Test Equipment Used as Working Standards in the Laboratory

The Contractor shall maintain and operate a standards system and maintain results of all MTE serviced where the results of the calibration or measurement is traceable through a controlled, unbroken chain of competent calibrations to and through the National Institute for Standards and Technology (NIST) to the SI units of measurement or other mutual recognized agreement is in affect with NIST or when the calibration service of the NIST is not available or does not meet the measurement performance requirements.

## 9 LIFTING DEVICES AND EQUIPMENT (LDE)/ PRESSURE VESSELS AND SYSTEMS (PVS) – (RECERTIFICATION)

The GSFC LDE/PVS program 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, and for the nondestructive examination of both LDE and PVS. The primary location of work is at GSFC Greenbelt campus.

In addition, on an annual basis, the Contractor shall certify and recertify LDE Operators at GSFC Greenbelt campus.

There are approximately 700 pressure systems on the GSFC Greenbelt Campus, of which approximately 300 have been certified as of January 2015. There are approximately, 250 overhead cranes/gantries/monorails, 100 mobile aerial platforms/powered industrial trucks, and 12,000 pieces of lifting equipment located on the GSFC Greenbelt Campus.

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 GSFC 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 Managers, 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 shall include extensive knowledge and experience in applying applicable codes and standards, such as: the Occupational Safety and Health Administration (OSHA), ANSI, Crane Manufacturers Association of America (CMAA), the American Society Of Mechanical Engineers (ASME), the American Society for Testing and Materials (ASTM), the National Board Inspection Code (NBIC), the National Fire Protection Association (NFPA), American Petroleum Institute (API), American Society For Nondestructive Testing (ASNT), and other national consensus codes and standards that are pertinent to LDE and PVS design, fabrication, installation, operation, test, and inspection. The Contractor shall provide expertise in performing hazard 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 GSFC requirements. The Contractor shall review all related existing documentation, generate new drawings, as required, make all necessary preparations for inspection, perform all visual and non-destructive examinations, conduct all engineering evaluations, and develop risk assessment documentation. 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 work to maximize program value to GSFC. However, all work shall 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/or PVS Managers. Certification records shall be kept in an electronic format accessible to the LDE and/or 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 Division 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 communication in the coordination of activities, troubleshooting of problems, preparation of equipment for inspections and testing, and conducting necessary system isolation and safety Lockout/Tag out (LO/TO) activities.

Applicable standards for PV/LDE recertification include the following:

- NPR 8715.3C, "NASA General Safety Requirements"
- NASA-STD-8719.9, "NASA Standard for Lifting Devices and Equipment
- NPD 8710.5, Revision D " NASA Policy for Pressure Vessels and Pressurized Systems"
- NASA-STD-8719.17, "NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems"
- GPR 8719.1C, "Lifting Devices and Equipment (LDE) Certifications and Operations"
- GPR 8710.3B, "Certification and Recertification of Ground-Based Pressure Vessels and Pressurized Systems"
- OSHA 29 CFR 1910 "Occupational Safety and Health Standards"
- OSHA 29 CFR 1926 "Safety and Health Regulations for Construction"
- GPR 8710.7B "Cryogenic Safety"
- 500-WI-8719.1.1 "Test and Inspection of Overhead Cranes"
- ASNT SNT-TC-1A" Personnel Qualification and Certification in Nondestructive Testing"

The Contractor shall provide the following LDE/PVS Services:

9.1 Lifting Devices and Equipment (LDE) Support

The Contractor shall provide LDE test, inspection, certification, and recertification services in accordance with existing Program requirements, configuration management

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 includes material handling equipment used in the handling of critical flight hardware, this may include positioning tables, dollies, and tables. At GSFC, maintenance shall be included for GSFC-wide cranes.

The Contractor shall train, certify, and recertify civil servant and Contractor 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.

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

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

The Contractor shall provide PVS inspection, certification, and recertification services in accordance with Program requirement, Configuration Management schedule, and procedure. PVS includes cryogenic, vacuum, hydraulic, and compressed gases (including air) systems, subsystems, purge carts, payload environmental transportation systems, 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. The Contractor shall recertified pressure systems and components 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 Greenbelt campus (both onsite and offsite locations).

The Contractor shall train, certify, and recertify civil servant and contractor 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.

The Contractor shall perform periodic PVS program requirement reviews to support continuous improvement to update or develop in-service inspection procedures. The Contractor shall provide consulting services to user organizations on PVS compliance requirements, design, fabrication, installation, and testing.

## 9.3 Configuration Management (CM)

The CM system keeps track of the total LDE and PVS inventory for GSFC Greenbelt Campus. 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 or model number in response to OEM recalls or Safe Alerts. The current software supporting the CM system is a software program housed at GSFC in Code 585, Computing Environments and Collaborative Technologies Branch.

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 GSFC's recertification priorities. GSFC prioritizes the recertification work efforts. GSFC 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 successfully 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. The CM system shall be a central point for record keeping of material handling equipment used for critical flight hardware.

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 are uniquely identified, including manufacturer, serial number, model number and size.

## 9.4 Nondestructive Examination (NDE)

The Contractor shall provide NDE personnel to perform NDE on both LDE and PVS at the GSFC Greenbelt Campus.

## 9.5 Requirement Compliance

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 as 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.

The Contractor shall gather existing documentation 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. The Contractor shall establish appropriate recertification files and Configuration Management data to provide a permanent recertification record that includes all follow-on 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 and remaining life evaluation. 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 assessments 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 ISI, re-certification schedule, operating restrictions if any and re-rating or de-rating is 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, Division 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. The Contractor shall provide the PVS Manager a completed Certification Report every thirty days showing which systems have been certified over the past year and which systems need to be certified.

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

## ASSURANCE SYSTEMS DIVISION SERVICES

# 10 SYSTEMS REVIEW

The Systems Review Branch (SRB) supports Center and Agency leadership in the independent review and assessment of projects per NASA and GSFC directives and standards. This is accomplished in the form of life cycle reviews and represents essential elements of conducting, managing, evaluating, and approving space flight programs/projects.

The Contractor shall provide the following services to the Systems Review Branch:

## 10.1 Lifecycle Reviews

The Contractor shall provide subject matter experts to support formal, fully independent reviews on flight missions, flight spacecraft, flight instruments, shuttle attached payloads, flight support ground systems and unique support equipment to evaluate and provide recommendations concerning design, development and testing (including technical and related programmatic aspects) of the flight and ground segments. Selected review members shall commit to participation in every System Review Branch review to the extent possible throughout the project lifecycle of the mission. The Contractor shall conduct pre-review activities (reviewing documents, technical interchange meetings, executive sessions, and teleconferences) and post-review activities (RFA disposition, trip report development, team caucuses, teleconferences, and final report development and review).

As part of this process, compliance with GSFC systems safety, mission assurance and systems management requirements shall also be evaluated.

Applicable standards for Lifecycle Reviews:

- GPR 8700.4H “Goddard Systems Reviews”
- NPR 7120.5, Revision E “NASA Space Flight Program And Project Management Requirements”
- GSFC-STD-1001 “Criteria for Flight And Flight Support System Lifecycle Reviews”

# 11 MANAGEMENT SYSTEMS

The Management Systems Branch (MSB) performs assessments within the scope of the GSFC Management System and supports the planning, operation and improvement of the system and related processes. MSB services are focused on evaluating conformance of GSFC mission products and services to requirements, and providing data analyses, risk informed decision-making, and corrective/preventive actions throughout GSFC’s organizations and suppliers to reduce risks and strengthen mission performance.

## 11.1 Internal Assessments

The Contactor shall provide technical expertise for the planning, improvement and operation of the GSFC ISO 9001 certified Management System. This support shall include not only conducting internal audits of GSFC and the GSFC Management System Committee (MSC) but also supporting external audits of GSFC by NASA and 3rd party ISO 9001 auditors.

Applicable standards for GSFC Quality Management Assessments include the following:

- GPR-1280.1E "The GSFC Quality Manual"

## 11.2 External Assessments

The Contractor shall also provide technical expertise in assessing the compliance of GSFC suppliers to the AS9100/ISO 9001 Quality standard and other NASA and/or GSFC SMA requirements.

Applicable standards for external assessments include the following:

- GPR 5100.4E "Goddard Space Flight Center Supplier Assessments"
- AS9100/ISO 9001

## 11.3 SMA Data Collection and Analysis

The Contractor shall provide technical expertise in the use of database software purchased by GSFC from Intelex Technologies Inc. for the creation and administration of SMA databases as well as analyses of SMA data from other GSFC databases, to identify potential trends and improvements in GSFC processes and operations. This expertise shall include administration, configuration management, user assistance and training, planning, and improvement of the SMA databases. These databases include but are not limited to data such as supplier assessments, GSFC internal assessments, GSFC's internal Problem Report/Problem Failure Report (PR/PFR) system, GSFC's Spacecraft Orbital Anomaly Reports (SOARs).

## DIRECTORATE OPERATIONS SERVICES

# 12 PROGRAM DEVELOPMENT

The Contractor shall participate in the evaluation and implementation of changes to federal regulations, and NASA/GSFC policy and directives that impact GSFC SMA strategy, standards, methodology, and all other elements of GSFC SMA operations.

The Contractor shall contribute to the advancement of GSFC SMA and Engineering practices by documenting new "Best Practices" and contributing to "Lessons Learned" repositories and information sessions.

The Contractor shall support Conferences, Working Groups, center committees and other forums for technical interchange, that foster advancements in Agency and Center-level SMA practices and those specific to our supply chain.

The Contractor shall support the preparation of responses to Center and Agency-Level data calls related to the status of GSFC SMA Operations.

# 13 INFORMATION TECHNOLOGY SUPPORT

The Contractor shall provide support to SMA in the areas of Server Systems Administration, IT Security, Web Development, Applications Integration to Federal IT Systems, and management of a local IT Help Desk.

Applicable standards for IT Support Services include the following:

- NIST SP800-37 “Guide for Applying the Risk Management Framework to Federal Information Systems”
- NIST SP800-53 “Security and Privacy Controls for Federal Information Systems and Organizations”
- ITS-HBK-2810.02-02 "NASA IT Security Handbook"
- NPR 2810.1A “Security of Information Technology”
- NID 7120.99 "NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements"
- NPR 7150.2B “NASA Software Engineering Requirements”
- Section 508 (36 CFR 1194) "Electronic And Information Technology Accessibility Standards"

The Contractor shall provide the following Information Technology Services:

## 13.1 Server Systems Administration

The Contractor shall provide on-site Windows and Linux server administration, maintenance, and support. There shall be staff present Monday - Friday during working hours (8 AM and 5 PM), and the systems shall be self-operational during all other periods. These services shall provide support for co-located users who support SMA

Directorate's mission responsibilities elsewhere on GSFC. Completion of duties and technical activities will occur primarily in Building 6 at GSFC with the exception of co-locations. Primary responsibilities include interfacing with Center Network Environment (CNE) and Agency Consolidated End-user Services (ACES) personnel as required; interfacing with IT security personnel within the Office of the CIO at GSFC and implementing security measures on the SMA infrastructure; and full responsibilities for system management and maintenance including reviewing and scheduling system patching, verification of backup processes, daily review of system log files, and hardware maintenance including optimization of the infrastructure environment.

### 13.2 Information Technology (IT) Security

The Contractor shall provide service to the SMA Directorate in the area of IT Security. This service shall be delivered commensurate with NIST, NASA and GSFC-level policies, procedures, guidelines, and work instructions. The service will also be used to integrate routine security patches, COTS and highly-specialized systems into the NASA NAMS workflow, management of accounts of those systems and COTS packages, review of those systems for security vulnerabilities, and ensure that all IT security functions are managed and maintained current according to NASA standards on those systems. All implementation and management will occur under the guidance and rules set forth via the SMA CCB process.

### 13.3 Electronic and Information Technology (EIT) and compliance with Federal law and regulation

In order to comply with the Section 508 Electronic and Information Technology Accessibility Standards, the contractor shall perform all work required under this contract in compliance with the following technical standards delineated in Code of Federal Regulations (CFR) Title 36:

- 1194.21 Software Applications and Operating Systems
- 1194.22 Web-based Intranet and Internet Information and Applications

### 13.4 SMA IT Helpdesk

The Contractor shall establish and maintain an IT Helpdesk. The Contractor's responsibilities shall include: the tracking; qualifying; and, prioritizing of help calls as well as problem resolution, support to the employees of SMA when needing additional assistance from ACES or ACES-related services, and timely support of the SMA Front Office. Further responsibilities will include COTS security assessments and recommendations and management of the IT peripheral and commodity purchase process with the SMA Resources team. The user Help Desk applies to all SMA front office and senior staff customers (Directorate staff, division chiefs, branch chiefs, and secretaries) as well as SMA staff and contractors as necessary.

### 13.5 Web Development and Maintenance

The Contractor shall support development, maintenance and enhancement of all SMA

web pages and provide maintenance of existing web pages. These web pages include the SMA's web pages and other web sites within the SMA directorate for which the Contractor has direct oversight. The Contractor shall maintain the web sites according to NASA web standards, requirements and policies. Web access statistics may be collected and analyzed and reports generated depending on the requirements of each web page owner. All web sites shall conform to GSFC and NASA standards. The Contractor shall support the GSFC Web Council (as applicable) and participate in reviews of standards as requested. The Contractor shall ensure the security of all SMA web sites by integrating the maintenance process with the SMA IT CCB. The Contractor shall ensure that all development and maintenance frameworks utilized do not impact the SMA IT security posture. This work shall apply to static and highly specialized web sites developed for SMA. Highly specialized systems that contain web front ends are not applicable to this effort.

## ACRONYMS

NOTE: The following acronyms are used throughout this Statement of Work:

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|---|---|
| ACES | Agency Consolidated End-User Services |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ALARA | As Low As Reasonably Achievable |
| ANSI | American National Standards Institute |
| API | American Petroleum Institute |
| ASHRAE | American Society of Heating, Refrigerating and Air-Conditioning Engineers |
| ASME | American Society of Mechanical Engineers |
| ASNT | American Society for Nondestructive Testing |
| ASQ | American Society for Quality |
| ASTM | American Society for Testing and Materials |
| CCB | Change Control Board |
| CFR | Code of Federal Regulations |
| CIL | Critical Items Lists |
| CM | Configuration Management |
| CMAA | Crane Manufacturers Association of America |
| CNE | Center Network Environment |
| COTS | Commercial off-the-shelf |
| CSO | Chief Safety and Mission Assurance officer |
| DOT | The Department of Transportation |
| EAR | Export Administration Regulations |
| EEE | Electronic, Electrical, and Electromechanical |
| EIT | Electronic and Information Technology |
| ELV | Expendable Launch Vehicle |
| EPA | Electro-Static Discharge Protected Area |
| EPA | Environmental Protection Agency |
| ESD | Electro-Static Discharge |
| ESDS | ESD Sensitive |
| FMD | The Facilities Management Division |
| FMEA | Failure Modes and Effects Analysis |
| FMECA | Failure Modes, Effects, and Criticality Analysis |
| FOT | Flight Operations Teams |
| FRB | Failure Review Board |
| FSSE | Flight Software Sustaining Engineering |
| FTA | Fault Tree Analysis |
| GEVS-SE | General Environmental Verification Specification for STS & ELV Payloads, Subsystems, and Components |

| | |
|---|---|
| GFE | Government Furnished Equipment |
| GIDEP | Government Interagency Data Exchange Program |
| GISS | Goddard Institute for Space Studies |
| GPD | GSFC Policy Directives |
| GPR | Goddard Procedural Requirement |
| GSE | Ground Support Equipment |
| GSFC | Goddard Space Flight Center |
| I&T | Integration and Test |
| IAGP | Installation Accountable Government Property |
| IAQ | Indoor Air Quality |
| IH | Industrial Hygiene |
| ISAR | Instrument Safety Assessment Report |
| ISI | In-Service Inspection |
| ISO | International Standard Organization |
| ISS | International Space Station |
| IT | Information Technology |
| ITAR | International Traffic In Arms Regulations |
| IV & V | Independent Validation & Verification |
| LDE | Lifting Devices and Equipment |
| LEV | Local Exhaust Ventilation |
| LO/TO | Lockout/Tag Out |
| LSO | Laser Safety officer |
| LSRB | Laser Safety Review Board |
| MAP | Mobile Aerial Platforms |
| MAR | Mission Assurance Requirements |
| MIL | Military |
| MILA | Merritt Island |
| MIS | Metrology Information System |
| MPAE | Materials Processes Assurance Engineers |
| MSB | Management Systems Branch |
| MSC | Management System Committee |
| MSPSP | Missile System Prelaunch Safety Package |
| MTE | Measurement and Test Equipment |
| MTE | Measurement and Test Equipment |
| MUA | Measurement Uncertainty Analysis |
| NASA | National Aeronautics and Space Administration |
| NBIC | National Board Inspection Code |
| NDE | Nondestructive Evaluation |
| NEPP | Nasa Electronic Parts Program |
| NFPA | National Fire Protection Association |
| NIST | National Institute for Standards and Technology |
| NMIS | Nmis - Nasa Mishap Information System |

| | |
|---|---|
| NPD | Nasa Policy Directive |
| NPR | Nasa Procedures and Requirements |
| NRC | Nuclear Regulatory Commission |
| NSC | Nasa Safety Center |
| NSTS | National Space Transportation System |
| OEM | Original Equipment Manufacturer |
| OSHA | Occupational Safety and Health Administration |
| PFR | Problem Failure Report |
| PG | Procedures and Guidelines |
| PIT | Powered Industrial Trucks |
| PPE | Personal Protective Equipment |
| PR | Problem Report |
| PRA | Probability Risk Assessment |
| PRAE | Parts and Radiation Assurance Engineers |
| PSE | Pressure Systems Engineer |
| PVS | Pressure Vessels and Systems |
| R&D | Research and Development |
| R&M | Reliability and Maintainability |
| RFA | Request for Action |
| RPO | Radiation Protection office |
| RPP | Respiratory Protection Program |
| RRAB | Reliability and Risk Assessment Branch |
| RSO | Radiation Safety officer |
| SDS | Safety Data Sheet |
| SMA | Safety and Mission Assurance |
| SOARs | Spacecraft Orbital Anomaly Reports |
| SOW | Statement of Work |
| SRB | Systems Review Branch |
| STD | Standard |
| TUR | Test Uncertainty Ratio |
| WCA | Worst Case Analysis |
| WFF | Wallops Flight Facility |
| WI | Work Instruction |
| WSC | White Sands Complex |