# SES II Task Order SOWs

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## Task Order # Title/Description

## 0003 ETD Systems Administration Support

Date: June 1, 2019
Task Monitor (TM): Medora Macie
Contract number: NNG15CR67C
Contract SOW Reference: 4.0.1 Division Specific Systems Administration Support

### Scope

Background
The contractor shall provide Information Technology (IT) technical support to the Engineering Technology Directorate (ETD) as described below. The contractor shall provide computer backup/restore services, computer patching services, system maintenance and system administration to the ETD Divisions as detailed below. On-site support is required between the hours of 8:00am-5:30pm on weekdays excluding holidays, with occasional after-hours support for system maintenance. The contractor shall support ETD Division personnel at the GSFC, primarily located in buildings 1, 4, 5, 5A, 7, 11, 12, 15, 19, 22, 23, 25, 28, 29, 30 and 33. The contractor shall manage the systems in accordance with the security plan on which they reside, primarily the ETD Laboratory Systems Multi-Program IT & Project Unique IT (CD-9999-M-GSF-3275) security plan and the Conjunction Assessment Risk Analysis (CARA) IONet systems in accordance with the Flight Dynamics Facility (FDF) (CD-9999-H-GSF-3262) plan. Support shall be required for the Integrated Design Center (IDC). Other than the CARA systems, no support shall be required for the Flight Dynamics Facility (FDF). No support shall be required for the Spacecraft Testing Complex (STC). The contractor shall provide primary support for 3rd party applications to ETD employees with ACES-managed systems, as needed. (The term ACES is used within this SOW to refer to the ACES contract and the ACES follow-on contract NEST). The contractor shall provide IT architecture engineering, configuration management, system administration and computer security support.

Summary of work
Details of work to be performed are provided in the descriptions given below. Each description identifies specific activities to be conducted. Work priorities will be defined by this task's Government TM and reviewed no less frequently than monthly.

Systems Operations Support for ETD
The contractor shall:
Secure equipment in the event of utility outages
Relocate equipment within the building and potentially other buildings at GSFC, as needed.
Interface with Lab Managers to resolve facility and IT specific problems
Interface with hardware and software maintenance personnel to resolve any issues
Receive and inspect new property and plan for its deployment
Coordinate the disposal (excess) of unneeded property, including the sanitization of media

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Backup and Restore support for ETD
The contractor shall install, configure, update and resolve any issues with the backup software and operating environment.
The contractor shall develop, maintain and test appropriate backup procedures for workstations. (The term workstation is used within this SOW to refer to workstations, desktops, laptops and lab computers.)
The contractor shall assist lab managers and users with data backup, recovery and archive processes.
The contractor shall review the backup logs to identify failures and last successful backups.
The contractor shall ensure that all workstations have successful weekly full backups.
The contractor shall ensure that monthly full backups to a location in a different building than the primary backup are successfully completed
The contractor shall contact the primary user and the Division IT Manager whenever a device has not had a successful backup within the past 30 days.

System Administration Support for ETD

The contractor shall provide system administration support. This support includes setting up new user hardware, installation and configuration of software, maintenance of disk space, user help, system backups and restores, system monitoring and maintenance, security updating and monitoring and troubleshooting and problem resolution. This support shall include, but not be limited to, the following operating systems: Microsoft Windows, MacOS, RedHat, CentOS, Scientific Linux, and Ubuntu. This support includes supporting all 3rd party applications and peripherals on ACES managed computers for Division users. Specific requirements are:
Provide workstation system administration support
Provide support to meeting NASA mandates for user operating systems and office automation software
Test available software updates to OS and available engineering applications (i.e. Solidworks, Mathematica, DW2000, STAR-CCM+, ViTech CORE, etc.)
Perform software patches/updates, including: critical or performance to OS and available engineering applications.
Schedule, Test and Perform updates to backup software.
Ensure that all workstations implement security requirements
Ensure that all systems are running approved operating systems
Provide installation, set-up, and configuration of new user hardware and software
Provide general purpose user help and assistance with establishing new accounts through IdMAX/NAMS
Provide support to managing division commercial off-the-shelf (COTS) software licenses including, but not limited to, STK, Matlab, ProE and ANSYS
Provide general system backups and restores, system monitoring and maintenance of division IT resources in the Division Labs
Provide user workstation backups and restores
Provide assistance to the users of IT resources in Division conference rooms.

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All SAs must maintain SA certification required by NASA for ACES and non-ACES computers and submit all required forms to obtain and maintain SA privileges
Submit ESD tickets on behalf of the user for all Division users requiring support that cannot be completed by a Division SA. Follow-up on all tickets until the issue is resolved to the users satisfaction.
Provide primary support for all 3rd party applications and peripherals on ACES-managed computers

Code 540 specific support includes: The contractor shall provide specialized operational, technical, and property accountability support staff for the Code 540 CAD/CAE facilities, systems, physical inventory and maintenance of Codes 540 hardware property, as needed. Provide technical support for engineering software tools running on a mixed network of Unix-based and Windows-based servers and client workstation systems. In this highly technical area - unlike normal general-purpose computer support - the operating systems, file/application servers, and associated client workstations must be configured and tuned for the specific technical engineering applications that are being utilized. The systems, software and associated support must be adjusted and tailored to meet the requirements imposed by the technical workgroups using the CAD/CAE applications and not vice-versa.

Code 550 specific support includes: The contractor shall provide secondary support for the RedHat, CentOS, Ubuntu, Windows and Sun systems in the Detector Characterization Lab (DCL). Assist the DCL lead admin with developing requirements for hardware and software for the lab, and documenting process and procedures within the lab including, but not limited to, backups. The contractor shall oversee the system administration duties of the DCL when the lead admin is unavailable and inform the lead admin of all tasks addressed upon his/her return. The contractor shall serve as liaison between the users of the lab and the Code 550 Division. The contractor shall work with the lead system admin to provide IT solutions that meet both the end-user requirements and the ETD Security Plan requirements. The contractor shall ensure that all systems meet NASA and ETD security standards, and shall notify the Code 550 IT Manager of any systems that are found to be deficient.

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Code 560 specific support includes: The contractor shall assist users of engineering software tools and resolve problems as they arise. The contractor shall attend Directorate meetings to discuss future trends and collaborate with and support other ETD Divisions with engineering software tools and licensing. The contractor shall provide backup support when requested.
The contractor shall provide backup support for the Communications and Standards Laboratory (CSTL).
The contractor shall provide system administration support for the Electrical Systems Engineering Services III (ESES-III) contractors on systems identified by the SES-II subtask 3.0003 monitor.

Code 580 specific support includes: The contractor shall provide Information Technology (IT) technical support to the Software Engineering Division (SED), Joint Polar Satellite System (JPSS) Mission, and associated desktops as described below. SED IT facilities support a variety of activities associated with NASA projects. This task supports approximately 600 engineers and support staff for activities that include the development of ground and flight software for new and on-orbit Missions, science processing, testbeds, and technology development.
Flight Software (FSW) Development Lab Support: includes the buildup, maintenance, and operations of computer labs used to develop FSW directly supporting active Missions.
Flight Software (FSW) Sustaining Engineering Lab Support: includes the operations of computer labs used to maintain the on-orbit FSW directly supporting active Missions.
nonFSW Development Lab Support: includes the buildup, maintenance, and operations of computer labs used to develop ground, science and institutional based software.

Code 590 specific support includes: The contractor shall provide primary support for the Formation Flying Testbed (FFTB) lab in Code 590. This support includes the FFTB collaboration web server and repositories and the Scientific Linux, Ubuntu and Windows workstations. The contractor shall ensure that all systems meet NASA and ETD security standards, and shall notify the Code 590 IT Manager of any systems that are found to be deficient.

IDC specific support includes: The contractor shall provide Operations and IT support for the National Aeronautics and Space Administration's (NASA's) Goddard Space Flight Center (GSFC) Integrated Design Center (IDC). Goddard's IDC comprises three engineering design facilities (the Mission Design Lab (MDL) the Instrument Design Lab (IDL), and the Architecture Design Lab (ADL)). The IDC, through the people, processes, tools, and facilities involved, provides a unique environment for rapid development of space flight instrument and mission design concepts as well as for technology/risk assessments, independent technical assessments, and trade space evaluations. The results of these studies are used by the Center, Agency, and other organizations to make important decisions of future instrument and mission development activities and funding. The contractor shall provide the services and activities necessary to maintain the IDC facilities' infrastructure to ensure continuous study capabilities, to support the operations of the facilities and people during study execution, and to contribute to the continuous improvement of the IDC systems and capabilities.

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CARA specific support includes: The contractor shall provide support for the Conjunction Assessment and Risk Analysis (CARA) systems located at GSFC, primarily in buildings 28 and 13. This includes the CARA primary, backup and integration environments on the IONET and the development environment on the CNE. The contractor shall provide: system administration for the computing systems; operations analysis; hardware and system software maintenance and upgrade support; configuration and validation support; data storage and archiving solutions support; system security support; support for large-scale projects; and support of operational process improvements. To ensure adequate services are rendered, regular coordination between the contractor and CARA FDSS-II contractor will be required to ensure that any and all requirements are known in advance. This includes any and all system changes: scripts, applications, software packages, internal development, user requests, authentication, data locations, data flows, as well as any other modifications to the systems. The contractor teams will meet together at least weekly.
The ETD ticket system will be used to input tickets/work items and be prioritized by the subtask monitor. Resolution to all tickets will be provided by the mutually agreed upon due dates unless justification and a new due date is agreed upon by the subtask monitor.
The contractor shall be CARA's point-of-contact for all external/network communications. This includes, but is not limited to: IONET whitelist, IONET and CNE firewall rules, CNE and IONET network maintenance/outages, all STRAW requests/entries, power maintenance/outages notifications, data calls, network scans and pen testing, Computer Security Official (CSO) meetings and technical meetings.

The contractor shall assist the CARA team with cloud integration and migration support for the CARA software implementation on the NASA Headquarters-owned fully-managed AWS Cloud environment. The contractor shall provide immediate emergency support during business hours to correct issues preventing the CARA system from performing its normal operations function.

The contractor shall maintain CARA's part of FDF/CARA Documents (SSP, Risk Assessment, Continuous Monitoring Plan, Contingency Plan, etc.), represent CARA at annual A&A, mitigate risks identified by quarterly scans and new system scans, respond to all CARA-related security incidents, perform annual contingency plan training and contingency plan test. The contractor shall perform any work required to close POA&Ms, request scoping of controls, and request risk acceptance. The contractor shall coordinate with the CARA FDSS-II contractor, as needed.
The contractor shall provide property management for all existing and procured CARA hardware and software. Provide manual inventory data for all CARA hardware and software via Lansweeper reports or other means to include configurations, licenses, warranties, and specifications. Provide 8 weeks notification (at minimum) of any hardware expirations. Provide 8 weeks notification (at minimum) of any software upgrades required.
The contractor shall create and maintain documentations needed to perform System Administration duties specific to CARA systems ensuring continuity of support. Documents include, but are not be limited to the following: project implementation plans for CARA hardware and software architectural changes and upgrades, system administration-components of POA&Ms, and procedures developed in response to CARA-specific processes.

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The contractor shall provide proactive system hardware and software update recommendations for required hardware updates or new system design. This includes: technical review of any hardware/software required to ensure most appropriate solution for new components or upgrades, technical analysis of procurement responses for assurance of meeting requirements of CARA needs and accuracy of quotes, yearly summary of hardware and software recommendations plus any changes to existing licensing agreements including vendor quote and justification.

Code 562 Photonics specific support includes: The contractor shall provide System Administrator (SA) support for Code 562 IT hardware and software primarily on laboratory and test equipment, but also including end user machines. Support the maintenance and operation of both the Parts Analysis Laboratory and Photonics Laboratories equipment test hardware and software. Work daily with the Code 562 Photonics Group to support multiple and concurrent testing and manufacturing activities requiring configuration and deployment of test equipment and IT hardware and software, data collection and management, and IT security protocols. Provide SA support to the operation and maintenance of the Photonics calibration database and the WOA (Work Order Authorization) tracking system, and support modifications to those systems as needed per customer requests. Support configuration and deployment of IT hardware and software for EEE Parts Engineers and Material Coordinators in Code 562.
Supports/maintains the NEPP databases in accordance with NASA HQ requirements.

The contractor shall provide for assistance in the definition of the hardware configuration for the ETD Divisions IT infrastructure. This includes providing recommendations and specifications for general purpose IT infrastructure hardware purchases (e.g. user Office Automation hardware, lab machines, conference room systems, peripherals, IT supplies, etc.) The contractor shall submit the requests to https://esd.nasa.gov to have required IT items added to the ACES catalog for the ETD Divisions IT purchases.
The contractor shall provide for maintenance of a Configuration Management plan for the Division labs. This plan will include but not be limited to disk space management, workstation configuration and management, server configuration and management, back-up procedures, software licensing configuration and operations plan and security plan.
The contractor shall:
Maintain a configuration management plan for the Division Labs and shared resources management, laptop configuration and management, back-up procedures, software licensing configuration and operations plan and security plan
Maintain the ETD Users IT Policies and Procedures Document
Maintain the ETD System Administration Policies and Procedures Document
Maintain a parts list of all ETD IT resources by Division
Maintain a database of IP addresses by Division

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Required skills/knowledge –

Training for Elevated Privileges as documented in the NASA IT Security Handbook for Access Control: Managed Elevated Privileges (EP) and NAMS workflow for requesting elevated privileges
Cleanroom training and certification
Electrostatic Discharge (ESD) training
Global Export Compliance (ITAR/EAR) training

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2020.

## Subtask Description

The task will be broken down into the following functional subtasks:
3.0001 – Work completed for the Code 540 Division
3.0002 – Work completed for the Code 550 Division
3.0003 – Work completed for the Code 560 Division
3.0004 – Work completed for the Code 580 Division
3.0005 – Work completed for the Code 590 Division
3.0006 – Work completed for Code 50x
3.0007 – Work completed for the IDC
3.0008 – Work completed for CARA
3.0009 – Work completed for Code 562 Photonics

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:
Task deliverables shall be emailed to the TM and placed on a centrally managed sever. Task deliverables shall be maintained on this server such that (1) all ETD Division IT Managers and other authorized personnel designated by the TM can view the deliverables, and (2) the deliverables are maintained over the life of the contract plus two years by due date.

Deliverables –
Document all patches/updates/modifications in a central location that all Division IT Managers and Admins can access. Due: within 1 day of implementing patch/update
Update System specific documentation (i.e. network diagrams, user's guide, etc.) upon any change/modification to the functionality of the system. Due: Within 1 week of modification/change to the system
Parts list spreadsheet for all untagged IT items in the Division's supply inventory, by Division, maintained in a central location that all IT Managers can access. Updates: Due within 1 week of change

Monthly Deliverables – (due by the 15th, unless otherwise noted)

Backup status report of all ETD Division workstation backups, including the date of last successful backup and results of restore test of each computer and file share.
Vulnerability Mitigation and Waivers. Ensure that all devices are patched or waivered prior to the monthly block date
Report showing planned upgrade and maintenance for the upcoming month and perceived IT risks. The report shall list all proposed maintenance outages for the upcoming month.
Provide manual inventory data for all devices that do not provide automated reporting, properly formatted for submittal to the Information Technology Security Enterprise Data Warehouse (ITSEC-EDW).

Quarterly Deliverables – (due by April 15th, July 15th, Oct 15th and Jan 15th, unless otherwise noted)

Semi-Annual Deliverables (Due Oct 15th and April 15th, unless otherwise noted)-

Provide a report detailing the hardware and software refreshes and/or maintenance that are due during the upcoming 9-months. This should include refresh and/or maintenance due date, vendor refresh and/or maintenance quote, license renewal, storage augmentations, UPS battery replacements and any other relevant terms and/or conditions as appropriate.
Code 580 specific: Meeting minutes detailing a biannual meeting between the system administrator team lead (or designee) and each lab manager. The meeting will be used to discuss the prior 6-month performance, lessons learned, review of backup procedures, and overall lab performance.
Provide assessment/review of resources to determine if additional applications or consolidation are needed.
Network diagram of servers, storage, firewalls, and any private networks supported under this task.

Annual Deliverables -

The contractor shall exercise the contingency plan and deliver a report with lessons learned and any updates needed to the contingency plan. Due: June 1st
On an annual basis the contractor shall provide a hardware and software inventory report by the end of January. The asset report will detail the hardware and software assets located in supported labs and conference centers maintained under this task. The report will highlight the date hardware and software maintenance/upgrades required by supported labs.

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

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The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

Configuration Management
All changes to CM of the lab machines must be recorded in the lab notebooks resident in each lab or combined in a centrally managed server.

Facilities
The contractor shall reside onsite and the contractor shall provide appropriate IT support. No regular teleworking shall be allowed, any teleworking may not impact mission accomplishment. The Division IT Manager may withdraw teleworking privileges at any time.

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
The performance metrics are:
Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Ability of the contractor to meet the goal of zero devices blocked due to failure to patch or waiver systems by the monthly block date
Surveys received from users receiving service from this task
Contractor Communication
Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

There is no non-local travel for this task.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site). No regular teleworking shall be allowed, any teleworking may not impact mission accomplishment. The Division IT Manager may withdraw teleworking privileges at any time.

## Reporting Requirements

See Section IV: Deliverables/Schedules/Milestones

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be handling SBU and ITAR data, all necessary Non-Disclosure Agreements must be signed by each contractor handling this data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

## 1004 GOES-R Flight Project Software Systems Engineering

Date: 12-14-2018
Task Monitor (TM): Waka Waktola
Contract number: NNG15CR67C
Contract SOW: 4.1 Software Systems Engineering, Studies and Analysis

### Scope

Background –
The GOES-R Project is managed by NOAA and GSFC Civil Service personnel and supported in several disciplines/subsystems with technical expertise from contractors. The purpose of this task is to provide technical expertise for flight software and its associated supporting systems in support of the Spacecraft team.

The spacecraft bus is built by Lockheed Martin of Littleton, CO & Newtown, PA. The Advanced Baseline Imager (ABI) is built by Harris of Fort Wayne, IN. The Space Environment In-Situ Suite (SEISS) is built by Assurance Technology Corporation of Carlisle, MA and Cocoa, FL. The Extreme Ultraviolet Sensor(EUVS)/ X-Ray Sensor(XRS) Irradiance Sensor (EXIS) is built by the Laboratory of Atmospheric & Space Physics (LASP) of Boulder, CO The Solar Ultraviolet Imager (SUVI) and Geostationary Lightning Mapper (GLM) are built by Lockheed Martin Advanced Technology Center of Palo Alto, CA.

Summary of work –
Specific Software Systems Support services provided shall include:

Provide technical support for the GOES-R Series spacecraft and ABI, SEISS, SUVI, EXIS, and GLM instrument systems in their implementation, test, and operation. This effort includes monitoring implementation, test, and operation phase efforts; evaluating trades, and monitoring software maintenance.

Provide support at GOES-R Project meetings both scheduled (GOES-R Staff Meeting, spacecraft vendor and instrument contractor telecoms), and ad hoc; and present software subsystem issues as appropriate.

Provide technical expertise in the review and assessment of GOES-R Series spacecraft and ABI, SEISS, SUVI, EXIS, and GLM instrument software system implementation, test, and operation; and its associated documentation, to include software test documents, software delivery packages, and anomaly reports.

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Provide support to the GOES-R Project for Instruments and Spacecraft software systems, which includes technical monitoring, engineering evaluations/analyses, and attendance at meetings and reviews.

Attend software peer reviews, and formal software tests for the GOES-R Series spacecraft and ABI, SEISS, SUVI, EXIS, and GLM instruments.

Participate in software working meetings and teleconferences in the GOES-R Project, at the GOES-R Series spacecraft and ABI, SEISS, SUVI, EXIS, and GLM instrument contractors, and at subcontractor facilities.

Review and provide recommendations on requested related problem reports, waivers, and deviations.

Specialized Skills: End to End data systems experience, flight, ground and science data processing systems development or test experience. Knowledge of NASA NPR7150.2a and working knowledge of software development process and practices is required.

For test procedure and script development, experience with RAD 750 is required. Experience with spacecraft Guidance, Navigation, and Control, Command and Data Handling, or Spacewire is required.

## Period of Performance

The period during which the work for this task shall be performed is from task award through March 31, 2020.

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## Subtask Description

Not Applicable

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Peer Review Reports/ Trip Reports | As requested by TM |
| 2 | Status Reports | Weekly |
| 3 | Performance Reports | Monthly |
| 4 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

The contractor shall reside onsite and the project will provide appropriate IT support.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Performance metrics will be:

Number of peer reviews attended either in-person or via telecom versus not attended

Action Item metrics (pertains to only those actions assigned to the contractor)

Number of actions open, closed, and planned versus actual duration to close

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Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

Travel: Travel will be required for engineering support task activities as directed by the Project. Assume travel for one to Suitland, MD and travel for two to the other destinations:

| Location | Duration | Frequency |
|---|---|---|
| Littleton, CO (spacecraft) | 1 week | Every 12 months |
| Fort Wayne, IN (ABI) | 1 week | Every 12 months |
| Palo Alto, CA (SUVI, GLM) | 1 week | Every 12 months |
| Cocoa, FL (SEISS) | 1 week | Every 12 months |
| Boulder, CO (EXIS) | 1 week | Every 12 months |
| Suitland, MD (NSOF) | 1 week | Every 1 month |

## Work Location

This work shall be performed at the Goddard Space Flight Center (On-site).

## Reporting Requirements

Weekly status report

The contractor shall participate in the Software Team's weekly meeting. The contractor shall report, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks, action item status assigned to the contractor and customer meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

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There will be no handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

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## 1009 LCRD Ground Segment Support

Date: 07/15/2019
Task Monitor (TM): Miriam Wennersten
Contract number: NNG15CR67C
Contract SOW Reference: 4.1 Software Systems Engineering, Studies and Analysis

### Scope

Background – The Laser Communications Relay Demonstration (LCRD) mission will demonstrate optical communications relay services between GEO and Earth over an extended period. The mission will demonstrate some optical communications technologies, concepts of operations, and advanced networking technologies applicable to both near earth and deep space missions; gain knowledge and experience base that will enable NASA to design, procure, and operate cost-effective future optical communications systems and relay networks. LCRD is considered a critical step of providing an optical communications service on Next Generation Tracking and Data Relay Satellites. The LCRD team is led by NASA's Goddard Space Flight Center and partners include JPL and MIT Lincoln Lab. LCRD is expected to fly as a hosted payload. Ground Stations in California and Hawaii will test LCRD's invisible, near-infrared lasers, beaming data to and from the satellite as the mission progresses. LCRD is planning to have Preliminary Design Review in October 2013, Delta PDR in July, 2016, Critical Design Review in June 2017 and launch in August 2020.
GSFC Software System Engineering Branch (Code 581) is providing leadership of the development of LCRD Mission Operation Center (LMOC), and interface development to Ground Station 1 (the development of GS-1 is performed by JPL), interface development to Ground Station 2 (Hawaii), integration of the elements in Ground Segment (LMOC, GS-1, GS-2) and the integration of future Test and Maintenance System (TAMS).

Summary of work – The contractor will assist Ground Segment Manager and the LMOC Lead to provide technical expertise to support all Ground Segment responsibilities through out the LCRD life cycle. The tasks include:
Support Level 4 and Level 5 Requirements development
Support Level 4 and Level 5 IRD/ICD development
Coordinate technical issues among LMOC and Ground Stations
Support LMOC and Ground Stations integration and testing
Oversee the software development life cycle
Serve as Ground Segment liaison to support Mission I&T
Provide software engineering, development, and test support of the LMOC subsystems
Provide System Administration (IT) support
Provide software engineering, development, and test support of the CODEC control computer for the ground modems.
Support any LCRD Ground Segment activities not specified above when Ground Segment Manager deems appropriate.
Provide engineering support for the LCRD SHIM box.

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Provide Mission Operations support

Required skills/knowledge – Extensive experience in NASA space/ground system, Software System Engineering, Software full life cycle development, System Integration and Testing required. Optical communication experience strongly desired.

## Period of Performance

From Task Mod Award to August 31, 2020

## Subtask Description

1009.0001 – LMOC Offline

The LMOC Offline subtask is for the systems engineering and software development of LMOC subsystems that interact with the government supplied command and telemetry subsystem. Skills needed for this subtask include: systems engineering, and software design and development. ~~Provide local (GSFC) Mission Operations support.~~

1009.0002 – LMOC Command and Telemetry

Not applicable for this task mod

1009.0003 – High Bandwidth RF

The High Bandwidth RF subtask is for the integration of a Ka-band ground station. Skills needed include: systems administration, and software design and development.

1009.0004 – Integration and Test Support

The Integration and Test Support subtask provides systems administration support for the ground during the period of Payload Integration and Test and through Mission Integration and Test and Launch preparation.

1009.0005 – CODEC Software Development and Test

The CODEC Software Development and Test subtask provides software support for the CODEC subsystem. Working knowledge and experience with ground-based system embedded software is required. Working knowledge of typical GSFC lab and testing protocols (QA, PR, WOA practices) is required. Familiarity with GSFC 580 division software tools is desirable. Institutional knowledge of the LCRD project is required. Majority of the work will be developing, testing and documenting the software design of the CODEC subsystem. Contractor shall support and participate in various aspects of concept formulation, requirements development, schedule planning, production of review materials, design, implementation/verification/manufacturing planning and presentations/project meetings.

1009.0006 – Simulator Development

Subtask work is complete; close subtask
1009.0007 – SHIM Engineering Support
On an as-requested basis, the contractor shall provide continuing engineering support on SHIM operation and functional design that may include analysis and/or simulation.
On an as-requested basis, the contractor shall provide continuing manufacturing support on any SHIM rework.
1009.0008 – Project Direct Engineering and IT Support
Contribute to architecture decisions for Ground Segment
Design and implement architecture of Ground Segment IT systems
Design and implement integration and test IT systems
Contribute modifications to MIT Lincoln Labs-supplied command and telemetry system, including porting to LCRD IT systems, and modifications to make the system LCRD-specific.

The contractor will provide Desktop Support for Aces and non-Aces machines and system administration support for the Laser Communications Relay Demonstration (LCRD) Project. The contractor will troubleshoot and maintain Management Information Systems in a Windows and Mac Environment.
Contractor will maintain Management Information Systems (MIS) not covered by the Aces contract on a Windows or Mac.
The contractor shall assist with the planning, execution, and maintenance of LCRD Project IT Security.
Provide MIS user support of desktop hardware. Load, update and troubleshoot desktop and server software. Implement information technology security requirements.

1009.0009 – Project GOES IT Support
The contractor shall assist with the planning, execution, and maintenance of LCRD Project IT Security.
Provide enterprise level IT Security guidance and support to the LCRD Project.

Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | LCRD Weekly Report | COB every Friday |
| 2 | Monthly Financial Report | 15th of every month |

| | | |
|---|---|---|
| 3 | End-of-task Report | End of task |

## Management Approach

Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.
Subtask 6:
The contractor shall configuration manage and deliver documents to the government for review and acceptance into the government's configuration management (TDMS) system through the Contracting Officer (CO).

Facilities

The contractor will reside onsite and project will provide appropriate office and workstation accommodations with IT support to maximize productivity.

Subtask 6:
The contractor shall provide the off-site facilities as required for the design support, development, fabrication, integration, testing, and verification of the LCRD SHIM including the integration of the GFE encryption unit.
The facilities require a Secret Level facilities clearance.

Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics:
Planned versus actual progress
Delivery dates

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be

maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

Subtask 1

| Location | # of Travelers | Duration | Dates |
|---|---|---|---|
| Las Cruces, NM | [redacted] | 10 days | October 2019 |
| Las Cruces, NM | [redacted] | 10 days | December 2019 |
| Las Cruces, NM | [redacted] | 10 days | February 2020 |
| Las Cruces, NM | [redacted] | 10 days | March 2020 |
| Las Cruces, NM | [redacted] | 10 days | April 2020 |
| Las Cruces, NM | [redacted] | 10 days | June 2020 |
| Pasadena, CA | [redacted] | 5 days | February 2020 |

Subtask 3

| Location | # of Travelers | Duration | Dates |
|---|---|---|---|
| none | | | |

Subtask 4

| Location | # of Travelers | Duration | Dates |
|---|---|---|---|
| Las Cruces, NM | [redacted] | 6 days | Sept 2019 |
| Las Cruces, NM | [redacted] | 10 days | Oct 2019 |
| Las Cruces, NM | [redacted] | 6 days | Nov 2019 |
| Las Cruces, NM | [redacted] | 6 days | Dec 2019 |
| Las Cruces, NM | [redacted] | 6 days | Jan 2020 |
| Las Cruces, NM | [redacted] | 6 days | Feb 2020 |
| Las Cruces, NM | [redacted] | 6 days | March 2020 |
| Las Cruces, NM | [redacted] | 6 days | April 2020 |
| Las Cruces, NM | [redacted] | 6 days | May 2020 |

Subtask 8

| Location | # of Travelers | Duration | Dates |
|---|---|---|---|
| Las Cruces, NM | [redacted] | 6 days | Sept 2019 |
| Las Cruces, NM | [redacted] | 10 days | Oct 2019 |

| | | | | |
|---|---|---|---|---|
| Las Cruces, NM | | [redacted] | 6 days | Nov 2019 |
| Las Cruces, NM | | | 6 days | Dec 2019 |
| Las Cruces, NM | | | 6 days | Jan 2020 |
| Las Cruces, NM | | | 6 days | Feb 2020 |
| Las Cruces, NM | | | 6 days | March 2020 |
| Las Cruces, NM | | | 6 days | April 2020 |
| Las Cruces, NM | | | 6 days | May 2020 |

No IT acquisition planned for this task order.

## Work Location

This work shall be performed on-site at the Goddard Space Flight Center.

## Reporting Requirements

The contractor shall provide weekly technical and monthly cost progress reporting to the TM in accordance with the WBS. See items reporting specified in section IV above.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. Ability to handle classified material up to the Secret Security Clearance level, or above will be required.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## References

# 1012 GOES-R Ground Systems Engineering

Date: February 1, 2019
Task Monitor (TM): Heather Keller
Contract Number: NNG15CR67C
Contract SOW: 4.3 Ground System Software Systems Engineering

Scope
The National Oceanic and Atmospheric Administration (NOAA) operates a system of Geostationary Operational Environmental Satellites (GOES), providing continuous monitoring from directly above the Earth's equator. GOES satellites provide critical atmospheric, oceanic, climatic and solar products supporting weather forecasting and warnings, climatologic analysis and prediction, ecosystems management, and safe and efficient public and private transportation. The GOES satellites also provide platforms for space environmental observations and communication links for remote data collection, satellite aided search and rescue, and other data services.

GOES is collaboratively developed and acquired by NOAA and National Aeronautics and Space Administration (NASA); with NASA's focus being the space segment, and NOAA's focus the ground segment.

The GOES-R Program currently consists of a series of three satellites, with a fourth likely. The GOES series is a major system capabilities upgrade. The GOES Ground Segment (GS) is an advanced system that will provide enterprise management communications, mission management, product generation, and product distribution capabilities for the entire GOES system. The GOES GS will be a state-of-the-art ground system for the GOES series satellites. The GOES GS Project is responsible for Ground Segment development, operations, sustaining engineering activities for the GOES-R program at GSFC. The Project Office performs engineering and technical management of all GOES ground systems and networks.

The purpose of the GOES Ground Systems Engineering Task is to provide systems engineering and specialty discipline engineering services for the GOES Project Office engineering and technical management activities.

Summary of work (SOW)
Specific Ground System software and System Engineering Support services shall include:

### General Systems Engineering

Perform systems engineering and analysis of configuration change requests (CCRs) affecting the Ground Segment. Work with Government personnel, the spacecraft contractor, and the Ground Segment contractor personnel to perform systems engineering. Other System and Software Engineering support will be needed to develop prototypes, strategies, plans and designs for the potential movement of GOES-R Ground Segment capabilities to cloud technologies.

### Instrument Algorithm Development and Implementation Engineering

Perform systems engineering and software engineering related to the development and implementation of GOES-R instrument algorithms in the Ground Segment.

### Interface Engineering

# SES II Task Order SOWs

Provide systems and software engineering services related to the development of technical details of various ground-to-ground and space-to-ground based communications interfaces.

## Networks and Communications Engineering

Identify and analyze end-to-end Ground Segment communications requirements, develop system level concepts to meet those requirements, analyze proposed design solution options, model end-to-end (spacecraft-to-end user) communications flows, report technical status, facilitate transition of the network elements to operational status and evaluate operational effectiveness.

## Hardware Engineering

Identify and analyze Ground Segment hardware development requirements, develop system level concepts to meet those requirements, review and analyze proposed design solutions, report technical status, facilitate transition of the hardware elements to operational status, and evaluate operational effectiveness. Hardware elements include RF-baseband chain components, various computing hardware and other specialty and COTS hardware related to spacecraft ground operations and high-performance production computing.

## Operations Engineering

Identify and analyze Ground Segment operations requirements, develop system level concepts to meet those requirements, review and analyze the operability of proposed design solutions, develop and manage Operational Procedures, report technical status, and evaluate operational efficiency of the delivered system.

## Test Engineering

Identify and analyze Ground Segment test requirements, develop test program concepts to meet those requirements, develop, review and analyze proposed test plans, conduct tests, evaluate test results and report technical status.

## Product Distribution Engineering

Identify and analyze Product Distribution requirements, develop system level concepts to meet those requirements, analyze proposed design solution options, model end-to-end data flows to the customer facilities, report technical status to the development lead, review GS Contractor designs; facilitate transition of the data distribution elements to operational status and evaluate operational effectiveness.

## Project Configuration Management

Ensure Configuration Management (CM) processes and procedures are defined, implemented, and executed consistently across the GOES-R, S, and T Ground Segment Project. CM documentation shall be implemented to describe the functional and physical characteristics of the end products and systems being developed and maintain consistency of product and system changes. The following activities are included in configuration management:

Develop a plan for configuration management for the project.
Identify the configuration items to be placed under change management.
Identify and control changes to the configuration items.
Track change information.
Ensures configuration item changes match the project documentation.
Manage Configuration Control Board (CCB) and CM database activities.

# SES II Task Order SOWs

## Software Development

Design, Develop, Test, and prepare for turnover and operational support, Ground Segment software components. Software development support for implementing cloud technologies may also be required.

## Training

Provide training content and deliver training events for tools that will support Ground Segment Operations.

## Ground Systems Preparation, Launch, and Transition

The contractor will support to the operations, planning, and sustainment for GOES-R series satellite Ground Systems launch preparation and transition to operations. The contractor will be coordinated through the NASA Ground Systems Manager. The contractor's support to operations and functions fall into three general functional areas:
General Programmatic Operations Support
Provide staffing as needed to support customer
Assist in management and planning for successful GOES-R,S, and T launch and transition to operations
The contractor will support the following activities:
Operational product planning and management.
Management of the DOST team
Creation of MOR, FOR, ORR packages etc. as needed.
System test planning support and coordination.
Operational Management of Ground MOC operations
Operational Management of Ground sites (Antenna operations)
Coordination and planning to support Flight operations as needed.
Required skills/knowledge

## Specialized Skills

# SES II Task Order SOWs

Systems Engineering Experience for engineering tasks. Operations support tasks do not require the same experience or degree. End to End data systems experience, flight, ground and science data processing systems development or test experience. Knowledge of NASA NPR7150.2a and working knowledge of software development process and practices is required.

Period of Performance
The period during which the work for this task shall be performed is from task award, April 1, 2019 thru March 31, 2020.

Subtask Description
Not Applicable

Deliverables/Schedules/Milestones
All deliverables shall be accepted by the Task Monitor, or his representative. If the deliverable is deemed unacceptable or incomplete, the task monitor will state the reason and the deliverable shall be corrected by the contractor and resubmitted for acceptance. At a minimum, the contractor shall deliver the items specified below:

| Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Monthly Progress & Financial Reports | Monthly, by the 15th |
| Informal Bi-weekly Progress Reports | Bi-weekly by e-mail |
| Summary Schedules of Task Activities | Monthly, by the 15th |
| Technical and Managerial Meeting Minutes, Reports, Presentations, and Project Reviews, Document review reports | As required by the Project – NLT 15 days after event |
| Engineering Analysis Reports | As required by the Project – NLT 15 days after event |
| Financial and Budget Planning Estimates for Technical Areas of Effort | As required by the Project – NLT 15 days after event |
| Configuration Change Request (CCR) Materials | As required by the Project |
| Configuration Management Change Reports | As required by the Project |
| Final Task Report | Within 15 days of task end date |

Management Approach
The contractor shall perform Technical Management of the task resources. Technical Management Activities shall include, but not be limited to, the following functions:
Coordinate scheduling, budgeting, and staffing with the Task Monitor.
Plan, manage, and coordinate the task activities.
Anticipate and recommend system and procedural changes to meet mission requirements or improve mission operations.
Maintain schedules for all task activities, as necessary.
Participate in GOES-R Project and Program external reviews, as necessary.
Provide relevant engineering analysis to review boards, as necessary.

Technical Management shall also include secretarial and clerical support in the preparation of technical and managerial minutes, reports and presentations

### Staff Allocation, Expertise, and Skill Mix

This task requires expertise in systems engineering, software engineering, instrument algorithms, interface engineering, facilities engineering, IT network engineering, hardware development engineering, test engineering, operations engineering, and experience with technical management techniques and tools.

### Configuration Management

Configuration management activities include management of documentation, participation in relevant Program and Project Configuration Control Board meetings and on-line reviews, and preparation of related CCR materials, as necessary.

### Facilities

The contractor shall reside onsite (Building 6) and the project will provide appropriate IT support.

### Work Location

This work shall be principally performed on-site (GSFC – Bldg. 6) except as estimated under ODC/Travel.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit as documented in Section IV- Deliverables/Schedules/Milestones.

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

The contractor providing technical services shall comply with all processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7123.1A NASA Systems Engineering Processes and Requirements
NPR 7120.5D NASA Program and Project Management Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

### ODC (Travel and Procurement)

The contractor shall receive prior authorization from the CO, as requested by the TM or his representative, for all travel associated with the conduct of this SOW. Travel may be proposed for Technical Interchange Meetings (TIMs), reviews, workshops, conferences, and other engineering support task activities as directed by the task monitor. This task requires local travel and long-distance travel to visit remote sites.

Long distance travel to meetings or reviews is required; e.g. GS contract development/performance reviews, and spacecraft reviews and instrument reviews.
The contractor shall plan for representative trips in support of the GSP. Additional travel may be required to support GOES-R Ground Segment representation at industry and technical conferences. The following paragraphs provide a characterization of representative trips. During this period of performance, travel will be required to the NOAA satellite facility in Suitland, MD, to the NOAA Wallops Island, VA facility, the Consolidated Back-up (CBU) Facility in WV, the Lockheed spacecraft facility in Denver, CO, and the Harris Corporation facility in Melbourne, FL. Inherent in launch preparations, and in initial on-orbit operations and commissioning, it is impossible to accurately forecast exactly what SME will be needed at any particular point in time.

Estimation of long distance travel consist of no more than 12 trips requiring a senior engineer to Melbourne and no more than 4 senior engineering trips to Denver.
Estimation of local travel (travel that does not consist of airfare) will be numerous during this period of performance both during and after launch preparation. These trips will be to the Wallops Island, the CBU facility in WV, and NOAA's Suitland facility. Estimated travel trips needed by any staff level/contractor employee are estimated to be 36 (3 trips per month for 12 months) to the out of state locations in WV and VA, and trips to the NOAA facility in Suitland could be as many as 5 trips per week for 52 weeks.

## Reporting Requirements

Management reporting shall include preparation and delivery of managerial, technical, and business notes, minutes, and reports. This includes:
Provide 533 reports
Provide task technical activity status bi-weekly, either verbally or by email.
Summary schedules of task activities - monthly
Provide written task management status reports monthly.
Provide budget-planning data, as required.
Provide technical and managerial meeting minutes, reports and presentations, as required.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.
There will be no handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC

52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2A: NASA Software Engineering Requirements
GPR 7150: Goddard Software Engineering Requirements
NPR 7123: NASA System Engineering standards

## References

GOES-R documents are available and baselined in the GOES portal.

## 1013 James Webb Space Telescope Software Systems Eng

Date: 02/01/2019
Task Monitor (TM): Gary Smith
Contract number: NNG15CR67C
Contract SOW: 1.1 Software Systems Engineering

### Scope

Background – The James Webb Space Telescope is a large infrared telescope with a 6.5-meter primary mirror. Launch is planned for no sooner than November 2020. JWST will be the premier observatory for the next decade, serving thousands of astronomers worldwide. It will study every phase in the history of our Universe, ranging from the first luminous glows after the big bang, to the formation of solar system capable of supporting life on planets like earth, to the evolution of our own solar system.

The observatory is comprised of three major parts, the spacecraft built by Northrop Grumman; the Integrated Science Instrument Module built by GSFC in partnership with a number of foreign organizations, and the optical telescope element consisting of the primary and secondary mirrors and associated support structure built by Northrop Grumman and subcontractors.

The foreign partners consist of the European Space Agency, and the Canadian Space Agency and their contractors.

The Space Telescope Science Institute is responsible for the operation and science data planning through distribution.

Summary of work – The engineer will support the James Webb Space Telescope Project Software Systems Engineer with the primary responsibility of:
Attending and supporting peer reviews, Technical Interchange Meetings, working groups, telecons, and system and mission reviews at contractor facilities, GSFC, and Space Telescope Science Institute sites.
Reporting to Mission Systems Engineering on development activities of the Spacecraft, Observatory, Cryo-cooler and Ground System.
Reporting to Branch and Division on Acquisition activities of the Spacecraft, Observatory and Cryo-cooler.
Act as a consultant to the Integrated Science Instrument Module.
Support Spacecraft vendor technical meetings on a regular basis.

Required skills/knowledge:
Previous On Orbit Large Telescope Experience Preferred.

Previous work experience interacting with the Space Telescope Science Institute preferred. The software systems engineer contractor shall be very experienced working in complex embedded architecture and NASA software development processes.

## Period of Performance

The period during which the work for this task shall be performed is from April 1, 2019 thru March 31, 2020.

## Subtask Description

Not Applicable

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Peer Review Comments | For each Peer Review |
| 2 | Monthly summary of accomplishments to be included in Acquisition Status Reporting to Branch/ Division | Monthly |
| 3 | Monthly Inputs to the JWST Project Systems Engineering Monthly | Monthly |
| 4 | Weekly inputs to JWST Systems Engineering | Weekly |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

The contractor shall reside onsite and the project will provide appropriate IT support.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and

delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Performance metrics will be:
Number of peer reviews attended versus not attended
Action Item metrics (pertains to only those actions assigned to the contractor)
Number of actions open, closed, and planned versus actual duration to close

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

Travel will be required for engineering support task activities as directed by the Project and approved by the CO. Assume travel to Manhattan Beach, CA with each trip having one week duration.
Assume 1 trip every 3 months.

## Work Location

This work shall be performed on-site at the Goddard Space Flight Center

## Reporting Requirements

Weekly status report
The contractor shall participate in the Systems Engineering Teams weekly meeting. The contractor shall report, as a minimum, a summary of the week's highlights/accomplishments, milestones/schedule/deliverables, risks, action item status assigned to the contractor and customer meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the

contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

EXAMPLE: In the performance of this task, the contractor shall comply with the following documents:

| | |
|---|---|
| NPR 7150.B | NASA Software Engineering Requirements |
| GPR 7150.1 | Goddard Software Engineering Requirements |

## References

# SES II Task Order SOWs

## 1019 SPOCC Sustaining Engineering

Date: June 11, 2019
Task Monitor (TM): Bob Kozon
Contract number: NNG15CR67C
Contract SOW Reference: 4.3 Ground Software and Systems

## Scope

Background
The Science & Planetary Operations Control Center (SPOCC) is a multi-mission operations facility located in Bldg. 32, Room C101C. The SPOCC hosts operations centers supporting two different Mars missions, as well as multiple Earth and Space Science missions. The operations centers are: Neutron Star Interior Composition Explorer (NICER) Science and Mission Operations Center (SMOC); Global Ecosystem Dynamics Investigation (GEDI) SMOC; Ice, Cloud, and land Elevation Satellite (ICESat-2) Advanced Topographic Laser Altimeter System (ATLAS) Instrument Support Facility (ISF); Deep Space Climate Observatory (DSCOVR) Science Operations Center (DSOC); Sample Analysis at Mars (SAM) instrument planning and ops center; Neutral Gas and Ion Mass Spectrometer (NGIMS) Instrument Team Facility (ITF); backup Mission Operations Center (BMOC) for the Magnetospheric Multiscale (MMS) mission; the Space Geodesy Network Operations Center (SGNOC); and the CubeSat for Solar Particles (CuSP) SMOC. This task will provide Sustaining Engineering and Systems Administration in support of the SPOCC tenant missions and to the SPOCC infrastructure supporting the missions.

Summary of work
This Task Order (TO) provides on-going Sustaining Engineering / Systems Administration support from experts in specific mission system deployments for SPOCC tenants. These systems include the Galaxy Telemetry, Command & Control system; the Integrated Test and Operations System (ITOS); and the Data Management System (DMS) maintained by the Hammers Company, as well as components of infrastructure in the supported facilities including SPOCC operations centers, associated Integration and Test (I&T) facilities and development labs for missions hosted in the SPOCC. The majority of the work is anticipated to be in support of CuSP SMOC and DSOC systems deployed in the SPOCC.

Required skills/knowledge
The scope and intricacies of the mission-related work as well as the specific systems architecture of the SPOCC make it imperative that the original Systems Engineering team continue to provide support as required by the missions.

## Period of Performance

The period during which the work for this task mod shall be performed is from task award effective August 31, 2019 through August 28, 2020.

## Subtask Description

Not applicable; there are no Subtasks associated with this Task Order.

## Deliverables/Schedules/Milestones

The contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Monthly Status / Performance Reports | Monthly |
| 2 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor / subcontractor shall plan staffing for this work with the appropriate skill mix.

### Configuration Management

Documents will be covered under Project Configuration Management and will be configured using the GSFC Management Information System (MIS) tool.

SPOCC Systems will be under SPOCC Configuration Management, using local tools for software versioning and tracking.

### Facilities

Support shall be provided as required for the instances of key systems deployed in the SPOCC or Environmental Test Facility locations.

Some Labs will be decommissioned subsequent to the completion of key milestones. For work that will continue and/or systems that must remain in use, some of the work and/or systems may transition to the SPOCC.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

The following Performance Metrics will be used by the TM:

Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance

Contractor Communication
Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide accounts and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable documents include, but are not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)
There are no hardware, software, or other purchases currently planned for this TO.
No travel is required.

## Work Location
This work shall be performed on-site at NASA's Goddard Space Flight Center.

## Reporting Requirements
Monthly Reports
The contractor shall provide brief written monthly technical and schedule progress reports, in Microsoft Word or PowerPoint file, to adequately describe the status of activities to the TM. In the event there is no activity for any given month, this requirement is waived.

The contractor shall perform monthly cost reporting and submit a formal monthly cost report in accordance with the WBS.

## Security Requirements
The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

## Data Rights
This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

# SES II Task Order SOWs

## 1022 WFIRST Dynamics Simulation Support

Date: 7/12/2019
Task Monitor (TM): Joel Gallun
Contract number: NNG15CR67C
Contract SOW: 4.1 Software Systems Engineering

### Scope

Background – The Wide Field Infrared Survey Telescope (WFIRST) is a NASA observatory designed to perform Wide Field imaging and surveys of the near infrared (NIR) sky. The current design of the mission makes use of an existing 2.4m telescope, which is the same size as the Hubble Space Telescope. WFIRST is the top-ranked large space mission in the New Worlds, New Horizon Decadal Survey of Astronomy and Astrophysics. The Wide Field Instrument will provide a field of view of the sky that is 100 times larger than images provided by HST. The coronagraph will enable astronomers to detect and measure properties of planets in other solar systems.

Summary of work – The staff assigned to this task will support the WFIRST Goddard Dynamics Simulator (GDS) with the primary responsibility of:
Developing simulator software requirements, developing a design, supporting FSW integration with the Simulator, and assisting the FSW test engineers with simulation setup and control.
Writing new code and adapting heritage code per the requirements, and testing the Simulator software.
Planning, specification of components, assembly, test and documentation of the WFIRST prototype Simulator hardware.
Additionally, the staff assigned to this task will attend and support peer reviews, Technical Interchange Meetings, working groups, weekly and monthly status meetings.

Specialized Skills: Software Systems Engineering Experience. End to End data systems experience, flight, ground and science data processing systems development or test experience. Knowledge of NASA NPR7150.2a and working knowledge of software development process and practices is required.
Desired Skills: Experience with the Goddard Dynamics Simulator highly desired.

Specialized Skills: Software Engineering Experience. Real-time embedded systems development and test experience.
Desired Skills: Experience with MatLab and control systems highly desired.

Specialized Skills: Experience in assembling and testing of complex electronic systems including planning and documenting the assembly process and specifying sub-assemblies and parts to be procured.
Desired Skills: Experience with the Goddard Dynamics Simulator highly desired.

## Period of Performance

The period of performance shall be October 1, 2019 to September 30, 2020.

## Subtask Description

Not Applicable

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Technical Input to S/W Status Reports | Weekly, due Wednesday COB |
| 3 | Performance Reports with metrics | Monthly |
| 4 | End-of-task Report | End of task |
| | | |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

Facilities
The contractor shall reside onsite and the project will provide appropriate IT support.

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics will be:
GDS Software Requirements Spec, Subsystem Implementation Plan, three software build deliveries, Version Description Documents for each software build, and a WFIRST GDS User's Guide to be updated with each software build delivery.
Assembled and tested WFIRST prototype GDS installed in the GDS development lab.
Action Item metrics (pertains to only those actions assigned to the contractor)
Number of actions open, closed, and planned versus actual duration to close

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

No travel is required.
Procurement to include: supporting interface software and equipment as needed.

## Procurements are to include the following:

# SES II Task Order SOWs

The ODCs below were requested in the previous mod and have been delivered. Additional ODCs are specified in separate spreadsheet. Procurement of ODCs for this mod include:
ODCs:

| |
|---|
| 1 Dell PowerEdge R740 rack mount server |
| 1 – ExpressBox 7 X8G2 PCIe expansion chassis |
| 1 - Rack |
| 1 - Keyboard, mouse and Monitor |
| 1 - KVM |
| 1 - PC for User Interface |

## Work Location

The work shall be on-site Systems Engineering.

## Reporting Requirements

### Weekly status report

The contractor shall participate in the Software Team's weekly meeting. The contractor shall report, as a minimum, a summary of the week's highlights/accomplishments, milestones/schedule/deliverables, risks, action item status assigned to the contractor and customer meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

EXAMPLE: In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2B NASA Software Engineering Requirements
GPR 7150 Goddard Software Engineering Requirements

## References

## 1023 WFIRST Software Systems Engineering support

Date: 07/10/2019
Task Monitor (TM): M. Maldonado
Contract number: NNG15CR67C
Contract SOW Reference: 4.1 Software Systems Engineering, Studies and Analysis

### Scope

Background – The WFIRST mission will study essential questions in the areas of dark energy, exoplanets and perform a high latitude survey … Launch is planned for 2025.

Science Objectives
The Wide Field Infrared Survey Telescope (WFIRST) is a NASA observatory designed to perform Wide Field imaging and surveys of the near infrared (NIR) sky. The current design of the mission makes use of an existing 2.4m telescope, which is the same size as the Hubble Space Telescope.

WFIRST is the top-ranked large space mission in the New Worlds, New Horizon Decadal Survey of Astronomy and Astrophysics. The Wide Field Instrument will provide a field of view of the sky that is 100 times larger than images provided by HST. The coronagraph (JPL) will enable astronomers to detect and measure properties of planets in other solar systems.

Summary of work – The engineer will support the WFIRST Mission Software Systems Engineer in the development of the documentation, plans and by providing software systems support. The primary responsibility of the engineer:
Supporting the Software System Engineer during Phase B by attending and supporting planning meetings, documentation development, documentation review, attend peer and informal reviews, attend Technical Interchange Meetings, working groups, teleconferences, and system and mission reviews at contractor facilities, GSFC, and instrument sites.

# SES II Task Order SOWs

Software Systems Engineering Experience. End to End data systems experience, flight, ground and science data processing systems development or test experience. Knowledge of NASA NPR7150.2a and working knowledge of modern software development process and practices is required. Knowledge of the ICESat-2 Mission and its scientific objectives. Knowledge of satellite telemetry and command creation, configuration management and use. Knowledge of NASA Phase A and mission development flow is required.

## Period of Performance

The period during which the work for this task shall be performed is from task award thru 11/18/2019.

## Subtask Description

Not Applicable

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Technical Input to S/W Status Reports | Monthly |
| 2 | Peer Review Reports | 5 working days post event |
| 3 | Performance Reports | Monthly |
| 4 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

The contractor shall reside offsite however the contractor will be required to perform duties onsite at regular intervals. For any onsite work the project will provide appropriate IT support.

Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics

The TM, based on the technical merit, will evaluate the work performed for this task. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW. Performance metrics will be:
Number of peer reviews attended versus not attended
Action Item metrics (pertains to only those actions assigned to the contractor)
Number of actions open, closed, and planned versus actual duration to close

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

No Travel will be required for Mod 4.

## Work Location

This work shall be performed partially on-site at the Goddard Space Flight Center. The majority of the work can be performed off site.

# SES II Task Order SOWs

## Reporting Requirements

### Weekly status report

The contractor shall participate in the Systems Engineering Team's weekly meeting as required by the Mission System Engineer. The contractor shall report, as a minimum, a summary of the months highlights/accomplishments, milestones/schedule/deliverables, risks, action item status assigned to the contractor and customer meetings.
The contractor shall contribute to the bi monthly Division Project Review, the overall status of the software on the WFIRST project per the DPR template.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2A NASA Software Engineering Requirements
GPR 7150 Goddard Software Engineering Requirements

## References

## 1025 PACE Dynamics Simulation Support

Date: 08-22-2019
Task Monitor (TM): Joel Gallun
Contract number: NNG15CR67C
Contract SOW: 4.1 Software Systems Engineering

### Scope

Background – The Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission will deliver the most comprehensive look at global ocean color measurements in NASA's history. Not only will PACE monitor the health of our ocean, its science data will expand atmospheric studies by sensing our skies over an exceptionally broad spectrum of wavelengths.

A strategic climate continuity mission in support of NASA's Plan for a Climate-Centric Architecture for Earth Observations and Applications from Space (2010), PACE will monitor aerosol particles, clouds, and many factors related to the marine carbon cycle including the phytoplankton pigment, chlorophyll. Moreover, PACE applications will help with many of our most pressing environmental issues such as harmful algal bloom and air quality forecasts.
Summary of work – The engineers and technician assigned to this task will support the PACE Goddard Dynamics Simulator (GDS) with the primary responsibility of:
Developing simulator software requirements, developing a design, writing and adapting heritage code, Testing the Simulator' software
Construct the GDS cabling and racks for the FSW development lab, and the Flatsat lab. Also, modify an existing I&T GDS rack to support the PACE mission.
Supporting FSW integration with the Simulator,
Assisting the FSW test engineers with simulation setup and control.
Additionally, the engineers and technician will attend and support peer reviews, Technical Interchange Meetings, working groups, weekly and monthly status meetings.

Senior Software Engineer Required skills/knowledge –

# SES II Task Order SOWs

Specialized Skills: Software Systems Engineering Experience. End to End data systems experience, flight, ground and science data processing systems development or test experience. Knowledge of NASA NPR7150.2a and working knowledge of software development process and practices is required.
Desired Skills: Experience with the GPM Goddard Dynamics Simulator highly desired.

Specialized Skills: Software Systems Engineering Experience. End to End data systems experience, flight, ground and science data processing systems development or test experience.
Desired Skills: Experience with the real-time embedded systems, MatLab and control systems highly desired.

Specialized Skills: Experience in assembling and testing of complex electronic systems including planning and documenting the assembly process and specifying sub-assemblies and parts to be procured.
Desired Skills: Experience with the Goddard Dynamics Simulator highly desired.

# SES II Task Order SOWs

## Period of Performance
The period of performance shall be September 30, 2019 to September 30, 2020.

## Subtask Description
Not Applicable

## Deliverables/Schedules/Milestones
At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Technical Input to Status Reports | Weekly, due Wednesday COB |
| 3 | Performance Reports with metrics | Monthly |
| 4 | End-of-task Report | End of task |
| | | |

## Management Approach
### Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management
Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities
The contractor shall reside onsite and the project will provide appropriate IT support.

### Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW. Performance metrics will be:
GDS Software Requirements Spec, three software build and hardware rack deliveries to support the FSW development lab, the FlatSat lab and I&T. Version Description Documents for each software build, and a PACE GDS User's Guide to be updated with each software build delivery are additional deliveries.

Action Item metrics (pertains to only those actions assigned to the contractor)
Number of actions open, closed, and planned versus actual duration to close

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

No travel is required.
Procurements to include: Hardware and software required to build and deliver a FSW development GDS Rack, a FlatSat Rack and a Spacecraft Integration & Test Rack.

## Work Location

The work shall be on-site Systems Engineering.

## Reporting Requirements

Weekly status report
The contractor shall participate in the Software Team's weekly meeting. The contractor shall report, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks, action item status assigned to the contractor and customer meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-

GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

EXAMPLE: In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2A NASA Software Engineering Requirements
GPR 7150 Goddard Software Engineering Requirements

## References

# SES II Task Order SOWs

## 1028 Multi-project Software Systems Engineering Support

Date: June 10, 2019
Task Monitor (TM: Rick Sabatino
Contract number: NNG15CR67C
Contract SOW Reference: 4.1 Software Systems Engineering, Studies and Analysis

## Scope

[redacted]

Summary of work - The engineer(s assigned to this task will support the project identified in the applicable subtask, with specific focus on the Software Systems Engineering discipline.

Required skills/knowledge - Software Systems Engineering Experience. In depth understanding of the GSFC organization and environment, and the ability to work with existing project management and diverse mission discipline engineering teams. Any additional specific skills required for each subtask are identified in that subtask's description.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through September 30, 2019.

## Subtask Description

Subtask 05: Lunar Cargo Transportation and Landing by Soft Touchdown (CATALYST) Astrobotic Core Flight System (cFS) Toolchain Development Support.

Background:
In 2014, NASA competitively selected three commercial partners to spur commercial cargo transportation capabilities to the surface of the Moon. Astrobotic is one of the three partners and they currently have a Space Act Agreement (SAA) under the NASA Lunar CATALYST program (https://www.nasa.gov/lunarcatalyst). The SAA specifies that work performed for Astrobotic must also benefit NASA. The open source cFS repository will incorporate tools developed under this task.

Systems Engineering
The staff assigned to this task will support the definition of Astrobotic cFS tools and the development of tool prototypes with the primary responsibilities of:

# SES II Task Order SOWs

Performing analysis of Astrobotic's workflows that involve the cFS. This includes the cFS build/test processes, the development of cFS add-on components, and the integration, test, and operations of the lander.
Overarching goals include automating the workflows to the greatest extent possible and leveraging open source cFS artifacts. Existing artifacts include JSC's cFS Command Data Dictionary (CCDD) and various GSFC application table generation tools.
Presenting recommendations.
Developing toolchain prototypes based on the priorities established by Astrobotic. The terms of the Lunar CATALSYST SAA dictate that NASA-sponsored work is at the discretion of the commercial partner.

## Specialized Skills/Knowledge

A broad range of skills is desirable with working knowledge in programming languages, modern development tools such as git and the cFS.

## Period of Performance

The period during which the work for this task shall be performed is from task award through September 30, 2019.

## Deliverables

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Workflow cFS tool analysis report | 7/31/19 |
| 2 | Prototype of tools identified as high priority by Astrobotic based on the workflow report | 9/30/19 |

## Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this subtask with an appropriate skill mix.

## Facilities

The contractor shall reside either off-site or on-site. For any on-site work, the project will provide appropriate IT support.

## ODC (Travel and Procurement)

There are no hardware, software, or other purchases currently planned for this task. There is no travel currently planned. Any future purchases, or travel that may be proposed for special training needs and other engineering support task activities (as directed by the Project), will be captured in a modification to this task.

## Work Location

This work shall be performed at a location that is convenient to the contractor. There is no requirement to be located on-site at the Goddard Space Flight Center.

## Security Requirements

The data handled by this subtask is unclassified.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Performance / Status Reports | Monthly |
| 2 | End-of-task Report | End of task |
| 3 | Any deliverables required for each subtask are identified in that subtask's description | Per subtask description |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with an appropriate skill mix and staffing level, as specified in each subtask's description, for the duration of this mod.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

The contractor's facility requirements are specified in each subtask's description.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risks through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on its technical merit. Technical evaluation of the task performance is based on a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

# SES II Task Order SOWs

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and any deliverable products. Applicable documents include, but are not limited to:

NPR 7120.5 NASA Space Flight Program and Project Management Requirements
NPR 7123 NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5 Goddard Systems Engineering
GPR 7150.2 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

The requirements for travel, as well as for hardware, software, and other purchases are specified in each subtask's description.

## Work Location

The contractor's work location requirements are specified in each subtask's description.

## Reporting Requirements

### Monthly Progress / Status Report

The contractor shall generate a monthly report, which adequately describes the activities of the contractor team. It shall include at a minimum, a summary of the month's highlights or accomplishments and meetings attended, as well as status on applicable milestones, schedules, deliverables, risks, and action items assigned to the contractor. The contractor shall participate in any Systems Engineering team or project meetings, as required by the TM. The contractor shall contribute overall software systems engineering status information to the project's presenter at the Code 580 Division Project Review.
This monthly reporting requirement shall be suspended when all subtasks are inactive.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.
Any requirements to handle classified data are specified in each subtask's description.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.2 NASA Software Engineering Requirements
GPR 7150.2 Goddard Software Engineering Requirements
GSFC-STD-1000 Rules for the Design, Development, Verification, & Operation of Flight Systems

## References

Not Applicable.

# SES II Task Order SOWs

## 1029 LUCY Software Systems Engineering

Date: 11-22-2019
Task Monitor (TM): D. Wilson
Contract number: NNG15CR67C
Contract SOW: 4.1 Software Systems Engineering

Scope

Lucy is a mission by NASA to tour five Jupiter Trojans, which orbit along the planet's path either ahead of or behind Jupiter. The mission is named after the iconic 'Lucy' hominin skeleton, because studying the Trojans could reveal the "fossils of planet formation" or materials that clumped together in the early history of the Solar System to form planets and other bodies.

LUCY is a mission being formulated and implemented by the National Aeronautics and Space Administration (NASA). LUCY brings together scientists from Southwest Research Industries (SwRI), Arizona State University (ASU), the Applied Physics Laboratory (APL), and NASA's Goddard Space Flight Center (GSFC). With long histories of scientific leadership and successfully delivering flight hardware for NASA flight programs; the extensive and unmatched experience of Lockheed Martin (LM) in spacecraft development and mission operations; and the mission-proven expertise of GSFC in project management, systems engineering, instrument development, and safety and mission assurance. The LUCY instruments and spacecraft are all derived from hardware that has flown previously and has high design and flight heritage. The science team includes leaders of the field who have made major contributions in these areas.

Summary of work – The software systems engineers will support the LUCY Software Systems Manager (SSM) as directed. The work items and expertise needed will be separated into two subtasks, one for software systems engineering support at the Lucy project level, and one for SIDECAR software systems engineering for the L'Ralph instrument.

### Period of Performance

The period of performance shall be December 31, 2019 to December 31, 2020

### Subtask Description

Subtask 1: Software Systems Engineering - The SWSE support shall work on tasks as designated by the SSM within the following support areas:

Attending and supporting peer reviews, Technical Interchange Meetings, working groups, weekly and monthly status meetings and system and mission reviews
Providing support to review unit level, functional and acceptance test procedures and results for the spacecraft and instrument FSW.
Provide Verification & Validation tracing of requirements.

Subtask 1: Required skills/knowledge –

Specialized Skills: Software Systems Engineering Experience. End to End data systems experience, flight, ground and science data processing systems development and test experience. Knowledge of NASA NPR 7150.2B and working knowledge of software development process and practices is required. Ground software programming and design is also required.

Subtask 2: SIDECAR Software Systems Engineering - The SWSE support shall work on tasks as designated by the SSM within the following support areas:

Attending and supporting L'Ralph SIDECAR peer reviews, system and mission reviews
Providing support to review unit level, functional and acceptance test procedures and results for the L'Ralph SIDECAR FSW.
Subtask 2: Required skills/knowledge –

Specialized Skills: High level of knowledge and experience in the programming and operation of the SIDECAR ASIC for H2RG and CCD detector readout. High level of understanding for instrumentation design and the processing of scientific exposure data.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below for subtask 1:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Technical Input to S/W Status Reports | Weekly, due FridayCOB |
| 2 | Peer Review Reports | 5 working days post event |

| | | |
|---|---|---|
| 3 | Performance Reports, to include hours worked metrics, monthly accomplishments and plans, expected time-off | Monthly, one week before PIMR (Project Monthly) |
| 4 | End-of-task Report | End of task |

At a minimum, the contractor shall deliver the items specified below for subtask 2:

| Ref# | Deliverables | Due Date |
|---|---|---|
| | DELETED | |
| 2 | Peer Review Reports | 5 working days post event |
| 3 | Performance Reports, to include hours worked metrics, monthly accomplishments and plans, expected time-off | Monthly |
| 4 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

The contractor shall reside offsite and the project will provide appropriate IT support.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics will be:
Number of peer reviews attended either in-person or via telecom versus not attended
Action Item metrics (pertains to only those actions assigned to the contractor)
Number of actions open, closed, and planned versus actual duration to close

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

Travel will be required for engineering support task activities as requested by the Software Systems Manager.

Subtask 1:

Trips per every 12 months (1 week in duration)

| Location | Greenbelt MD (L'Ralph / L'LORRI ) | Littleton CO (Spacecraft ) | Phoenix AZ (L'TES) |
|---|---|---|---|
| Number of trips | 1 engineer * 3 = 3 | 1 engineer * 6 = 6 | 1 engineer * 1 = 1 |

Subtask 2:

Total Trips

| Location | Greenbelt MD (L'Ralph) | Littleton CO (Spacecraft ) | Phoenix AZ (L'TES) |
|---|---|---|---|
| Number of trips | 0 | 0 | 0 |

## Work Location

The work shall be on-site Systems Engineering with programming work at the vendor site.

## Reporting Requirements

Weekly status report

Subtask 1: The contractor shall participate in the Software Systems Manager's weekly meeting. The contractor shall report, as a minimum, a summary of the week's hours worked, highlights/accomplishments, milestones/schedule/deliverables, risks, action item status assigned to the contractor and customer meetings.

Subtask 2: The contractor shall supply the Software Systems Manager with written status monthly on the 1st of the month. The contractor shall report, as a minimum, a summary of

the month's hours worked, highlights/accomplishments, milestones/schedule/deliverables, risks, action item status.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2B NASA Software Engineering Requirements
GPR 7150 Goddard Software Engineering Requirements

## References

# SES II Task Order SOWs

## 1031 Restore-L Software Systems Engineering Support

Date: October 25, 2019
Task Monitor (TM): Rick Sabatino
Contract number: NNG15CR67C
Contract SOW Reference: 4.1 Software Systems Engineering, Studies and Analysis

## Scope

Background – NASA's Restore-L mission is an ambitious, technology-rich endeavor to launch a robotic spacecraft in 2023 to refuel a live satellite. The mission, the first of its kind in low-Earth orbit, will demonstrate a carefully curated suite of satellite-servicing technologies. These on-orbit solutions for autonomous, on-orbit satellite rendezvous and grasping, with telerobotics-enabled refueling and satellite repositioning, could dramatically reduce or eliminate the need for crewed servicing flights from Earth. Restore-L is a Technology Demonstration Mission project, led by NASA's Goddard Space Flight Center in Greenbelt, Maryland, and funded by NASA's Space Technology Mission Directorate. Restore-L, named to highlight how proper servicing capabilities can return a satellite to its original proficiency, is a robotic spacecraft equipped with two payloads. The first, Servicing Payload, contains the tools, technologies and techniques needed to extend satellites' lifespans; even those not originally designed to be serviced on orbit. The second, SPIDER (SPace Infrastructure DExterous Robot), will demonstrate on-orbit manufacturing capabilities with the robotic processes to build and demonstrate operationally a directional beam antenna assembly. Restore-L is expected to be launched to a polar low-Earth orbit in mid-2023, where engineers will execute its flight test with the government-owned Landsat-7 client satellite.

Summary of work – This work shall support the Restore-L Mission Systems Engineering teams with specific focus on the Software Systems Engineering discipline of the Spacecraft and SPIDER payload. The primary responsibility of the engineer:
Managing the interfaces and technical details of the procured Spacecraft Bus FSW component and its interfaces.
Attending and supporting peer reviews, Technical Interchange Meetings, working groups, telecons, and system and mission reviews at contractor facilities, GSFC, and spacecraft vendor (and subcontractor) sites.
Management of Spacecraft Bus CDRLs. This entails providing technical review, management, review, and guidance to the Restore-L project as it relates to the S/C bus FSW CDRLS which have been assigned to the FSW Systems engineering lead.
Development and maintenance of project level documents as identified by the Mission and Software Systems engineering team. These may include such documents as "Restore-L Software Management Plan," "Restore-L Database Management Plan," "Restore-L RGE to S/C Data ICD", "Payload to S/C ICD", "Restore-L C&T Database", Restore-L S/C timing document, "Software Safety Plan", etc.
The task shall include the contractor providing input to and review of Project level requirements and interface documents, Concept of Operations, System and Subsystem level requirements, as well as testing and verifications, as appropriate.

The task shall include the contractor providing support to Project level reviews producing materials and actually delivering the briefings as requested by the Software, Spacecraft Systems, or Mission Systems Engineer.

Required skills/knowledge - Software Systems Engineering Experience. In depth understanding of the GSFC organization and environment, and the ability to work with existing project management and diverse mission discipline engineering teams.

Specialized Skills/Knowledge: Software Systems Engineering Experience. End to End data systems experience, flight, ground and science data processing systems development, and test experience. Knowledge of NASA NPR 7150.2, GPR 7150.2, GSFC-STD-1000, including development of Software Management Plans and other standard documentation. A working knowledge of modern software development process and practices. Knowledge of satellite telemetry and command creation, configuration management and utilization. Knowledge of mission development flow, including requirements of entry and exit criteria for milestone reviews.

## Period of Performance

The period during which the work for this task order mod shall be performed is November 01, 2019 through October 31, 2020.

## Subtask Description

Not Applicable.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|

| | | |
|---|---|---|
| 1 | Technical inputs to Software/Systems Status Reports | Monthly/as needed |
| 2 | Formal/Peer Review Reports | 5 working days post event |
| 3 | Updated Restore-L documentation as appropriate for project life cycle. Specific documentation updates may include:<br>> Restore-L Software Management Plan<br>> Restore-L RGE to S/C Data ICD<br>> Payload to S/C ICD<br>> Restore-L C&T Database Plan | Coordinated with project |
| 4 | End-Of-Task Report | End Of Task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with an appropriate skill mix and staffing level, as specified in the task's description, for the duration of this task.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

While the contractor shall reside offsite, they will be required to perform duties onsite at regular intervals. For any onsite work, the project will provide appropriate IT support.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risks through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on its technical merit. Technical evaluation of the task performance is based on a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be

maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and any deliverable products. Applicable documents include, but are not limited to:

NPR 7120.5 NASA Space Flight Program and Project Management Requirements
NPR 7123 NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5 Goddard Systems Engineering
GPR 7150.2 Goddard Software Engineering Requirements
STD 8739.8 NASA Software Assurance Standard
STD 8719.13 NASA Software Safety Standard

## ODC (Travel and Procurement)

Travel will be required for engineering support task activities as directed by the Project. Assume the following travel for the coming year:
Six four day trips to GSFC to support TIMs (Approximately every other month)
Fourteen five day trips to S/C vendor (Space Systems Loral, Palo Alto, CA) to support TIMS and Testing (Approximately once every four weeks)
One four day trip to S/C subcontractor in San Antonio, TX (02/2020)
Three four day trips to SPIDER Payload subcontractor in various locations, assume Palo Alto, CA for costing purposes (01/2020, 04/2020, and 07/2020)

## Work Location

This work shall be performed partially on-site at the Goddard Space Flight Center. The majority of the work shall be performed at the Contractor's work site.

## Reporting Requirements

Weekly / Monthly Progress / Status Report

The contractor shall generate a monthly report, which adequately describes the activities of the contractor team. It shall include at a minimum, a summary of the month's highlights or accomplishments and meetings attended, as well as status on applicable milestones, schedules, deliverables, risks, and action items assigned to the contractor. The contractor shall participate in any Systems Engineering team or project meetings, as required by the TM. The contractor shall contribute overall software systems engineering status information to the project's presenter at the Code 580 Division Project Review.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

# SES II Task Order SOWs

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.2 NASA Software Engineering Requirements

GPR 7150.2 Goddard Software Engineering Requirements

GSFC-STD-1000 Rules for the Design, Development, Verification, & Operation of Flight Systems

## References

Not Applicable.

# 1034 Detector Characterization Lab (DCL) software support for detector testing and characterization

Date: November 20, 2019
Task Monitor (TM): Laddawan Miko
Contract number: NNG15CR67C
Contract SOW Reference: 4.1 Software Systems Engineering, Studies and Analysis

## Scope

Background – Many of NASA's missions supported by the Detector Characterization Lab (DCL) utilize low-temperature, low-background detectors and require specialized custom detector electronic readout systems.

Summary of work – This task is to provide:
Develop and maintain the logic tables, timing files, and software required for detector characterization.
Develop and maintain the assembly language compilers and debug tools.
Develop and maintain the software for data acquisition .
Create the software development and management plans to support items i-iii for specific types of detectors, ground based instruments, and characterization test systems.
Document the detector operations as needed per type of detector, instrument, and characterization test system.
Document the software interfaces to the hardware in order to support operation of the Detector system.
Support validation and verification of the ground support equipment (GSE) detector software in support of instruments and missions.

Required skills/knowledge -
Detailed knowledge of software to operate Detector Read-Out Integrated Circuit (ROIC) for different types of detectors.
Proficient knowledge of assembly language.
Proficient in hardware descriptive language (HDL, Verilog, etc).
Proficient knowledge of Windows and Linux operating systems.
Familiar with the design and development requirements of the various missions to be supported in this task.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2021.

## Subtask Description

Not Applicable, as there are no subtasks.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Software Code | Five working days post-completion of acceptance test. |
| 2 | Test Report | Five working days post completion of each test activity. |
| 3 | End of task Report | No more than 10 days after task ends |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level, as specified in the task's description, for the duration of this task.

### Configuration Management

Systems and documents will be covered under the Branch Configuration Management Plan.

### Facilities

All resources required to perform the work shall be provided by the government.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Performance metrics:

Planned versus actual technical progress

Planned versus actual delivery dates

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but are not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.1B NASA Systems Engineering Processes and Requirements
GPR 7123/1B Systems Engineering
NPR 7150.2C NASA Software Engineering Requirements

## ODC (Travel and Procurement)

There is no non-local travel for this SOW.
The contractor shall purchase one (1) Multi-Control Electronics, and one (1) Timing Card.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site).

## Reporting Requirements

Weekly status report

The contractor shall generate Performance Reports every week. The report shall include, as a minimum, a summary of the week's highlights, accomplishments, milestones, scheduled activities, deliverables, risks, and customer meetings.

Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting, which adequately describes the activities of the contractor team to the TM.

The contractor shall provide no later than the 10th working day following the close of the contractor's monthly accounting period a 533M for each individual subtask and a summary 533M at the total task level. If it is not possible to provide the individual 533M at the subtask level, the contractor shall provide on the 10th working day following the close of the contractor's monthly accounting period a break out of hours and costs by subtasks to the Contract Resource Analyst, Contracting Officer, and the Task Monitor. The report shall include current period hours and costs, cumulative to date hours and costs, and cumulative costs with a one-month cost plan. When needed, the contractor shall make adjustments to the distribution of costs, layout of the report and change reportable elements as specified by the Task Monitor and/or the Contract Resource Analyst.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by the current version of NPR 2810.1, Security of Information

Technology and NPD 2810.1, NASA Information Security Policy, in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2C NASA Software Engineering Requirements
GSFC-STD-1000 Rules for the Design, Development, Verification, & Operation of Flight Systems

## References

Not Applicable.

# SES II Task Order SOWs

## 2006 WFIRST Flight Software Support

Date: 08/13/2019
Task Monitor (TM): Bruce Savadkin
Contract number: NNG15CR67C
Contract SOW Reference: 4.2 Flight Software (FSW) Systems

### Scope

Background
The Wide-Field Infrared Survey Telescope (WFIRST) spacecraft has recently entered Phase-B and has entered the preliminary design phase.
Summary of work

1) WFIRST Solid State Recorder (SSR) Preliminary Design and debug support
The contractor shall provide FSW engineering support for the WFIRST in-house SSR and C&DH FSW development effort. This includes the development of diagnostics, the SSR and C&DH FSW design, and support for HW checkout. Extensive experience with spacecraft FSW design, implementation and test is required. Experience with spacecraft SSR design, file systems, CFDP, CFS, and embedded systems programming is also required.

2) WFIRST Test Team Lead consulting
The contractor shall provide consultation support in the areas of:
FSW Test Planning
FSW Requirements Review
FSW Test Development and Execution

Skill sets and knowledge requirements:
Demonstrated skills in flight software test procedure development, execution and analysis
Demonstrated skills in flight software test planning, management and team leadership
Demonstrated skills in flight software requirements analysis
Demonstrated skills and knowledge of the ASIST spaceflight ground system
Demonstrated skills and knowledge of the Jira Software CM tool

3) WFIRST C&DH FSW architecture design, development and team lead consulting
The contractor shall provide consultation and development support in the areas of:
C&DH FSW Planning
C&DH FSW Critical Design
C&DH FSW Development, Debug and Test
C&DH and ACS FSW System architecture, conops, and fault detection and recovery design

Skill sets and knowledge requirements:
Demonstrated knowledge of C&DH and ACS flight software concepts and architectures
Demonstrated skills in the leadership of flight software development teams
Demonstrated skills in flight software development planning
Demonstrated skills in flight software test procedure development, execution and analysis

Demonstrated skills in flight software design, development, debug, integration and build delivery
Demonstrated skills with NASA/GSFC's core Flight System (cFS) flight software architecture
Demonstrated skills and knowledge in NASA/GSFC spaceflight ground systems such as ASIST or ITOS
Demonstrated skills and knowledge of software configuration management tools (version control & problem tracking)

4) WFIRST Flight Software Sustaining Engineering (FSSE) Support
The contractor shall provide FSSE services to the WFIRST FSW team. Specifically, the contractor shall:
Support the SES II Core FSSE lead in the preparation and implementation of procedures, documentation, and any other applicable products necessary for the successful planning and implementation of WFIRST FSW sustaining engineering.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through September 30, 2020.

## Subtask Description

N/A

## Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| | Monthly performance Report | monthly |
| | | |
| | | |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

The contractor shall adhere to the WFIRST Flight Software Configuration Management Plan and Procedures documentation.

### Facilities

N/A

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

EXAMPLE: Travel may be proposed for special training needs and other engineering support task activities as directed by the Project. OR

| Location | Duration | Dates |
|---|---|---|
| N/A | | |
| | | |
| | | |

## Work Location
This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements
Monthly performance report

The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

No handling of classified data is required.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

# SES II Task Order SOWs

## 2012 cFS Development

Date: 6/6/2019
Task Monitor (TM): Elizabeth Timmons
Contract number: NNG15CR67C

### I. Scope

a. Background - The Software Engineering Division (Code 580), Flight Software Systems Branch (Code 582) has developed a platform-independent, Flight Software development environment, the core Flight System (cFS). The system integrates a reusable core flight executive (cFE) and suite of applications.
There are three key aspects to the cFS architecture: a dynamic run-time environment, layered software, and a component based design. The combination of these key aspects makes it suitable for reuse on any number of NASA flight projects and/or embedded software systems at a significant cost savings. As NASA flight projects utilize the cFS to host and develop mission flight software, cFS mission specific components are created and developed. These components become candidates to be included in the suite of cFS configurable, reusable software (the cFS reuse library). Components that come out of the cFS reuse library provide a complete out of the box solution reducing Non-Recurring Engineering (NRE) up to 90%. The components are developed via NASA Software Engineering Requirements (NPR 7150.2B) processes and standards and include reusable requirements, source code, design documentation, test artifacts, user's guides, and tools. The core cFS components are being enhanced and maintained to support spacecraft technology growth. In addition, new cFS applications and tools are being developed for future technology and spacecraft support.

b. Summary of work – This task provides engineering support for cFS component requirements, design and development, verification, and maintenance efforts, as well as, multi-mission customer support. The contractor will work with the cFS Product Development Lead (PDL) in the in the Flight Software Systems Branch as part of the cFS FSW development team. The contractor will also provide software engineering support and development to all identified cFS customers on an "as identified" basis. Software development includes requirements analysis and definition, software design, code, unittest, integration testing, formal build testing, software documentation, presentations, demos, and reviews as requested by cFS PDL and/or identified cFS customers.

c. Required skills/knowledge - Competency areas include expertise with the following Flight Software areas:
- cFS programming
- Flight Software programming
- Software systems life cycle
- Requirement analysis
- Specifications and design
- Software development and integration and testing
- Communication networks

 CCSDS BP specification, including compressed bundle headers and aggregate custody signaling
 IETF RFC 5050 BP specification
 CCSDS File Delivery Protocol (CFDP)

Skill sets and knowledge requirements:

 Bachelor of Sciences degree, or equivalent experience, in computer sciences, engineering or mathematics.
 Demonstrated skills in conducting internal software design reviews and monitoring flight software development.
 Demonstrated skills in real-time and/or embedded software development using the C programming language, the Linux operating system, and real-time operating system kernels such as RTEMS or VxWorks.
 Demonstrated utilization knowledge of such Software Configuration Management Systems as the MKS and gitsuch as the Git and Jira configuration and issue tracking tools.
 Demonstrated skills in integrating software and hardware into production labs.

## II. Period of Performance

The period during which the work for this task shall be performed is from task award thru July 31, 2019.March 31, 2020.

## III. Subtask Descriptions

Subtask 1. cFS component engineering support (requirements, design and development, verification, independent testing, and maintenance efforts, as well as, multi-mission customer support)for a suite of cFS Command and Data Handling (C&DH) applications. There are 9 months of component work in this period of performance.

Subtask 2. cFS Delay Tolerant Networking (DTN) application engineering support. Work includes continuing the development of a Bundle Protocol (BP) cFS application as a proof-of-concept and integrating it into the DTN demo environment in the Communication Standards and Technology Lab (CSTL). There are 6 months of DTN work in this period of performance.

## IV. Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly/Bi-weekly |
| 2 | Performance Reports | Monthly |
| 3 | End-of-task Report | End of task |
| 4 | Design, source code, build procedure, unit test, and documentation updates for the cFS component development. | Per the PDL's established Build Schedule |
| 5 | Change sets resolving tickets against cFS applications. | By due date included in assigned ticket. |

## V. Management Approach

a. Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

b. Configuration Management

Systems and documents will be covered under the cFS Configuration Management Plan and cFS Configuration Management Procedures documents.

c. Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

d. Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW. Performance metrics include adherence to delivery dates and schedule, delivered lines of code.

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements

The contractor providing technical services shall comply with established Code 580.0 software development standards and processes during the development and sustaining software engineering associated with the cFS software products. Applicable requirements include, but not limited to:

1. NPR 7150.2B NASA Software Engineering Requirements
2. NPR 7120.5D NASA Space Flight Program and Project Management Requirements
3. NPR 7123.1A NASA Systems Engineering Processes and Requirements
4. GPR 7120.1C Project Management
5. GPR 7120.5A Systems Engineering

## VI. ODC (Travel and Procurement)

There are no ODC's or IT acquisitions for this SOW.

## VII. Work Location

This work shall be performed primarily at the contractor's facility, but the contractor may be required to attend meetings and perform some work on-site at the Goddard Space Flight Center.

## VIII. Reporting Requirements

a. Weekly or Bi-weekly status report

The contractor shall generate Performance Reports weekly. The report shall include, as a minimum, a summary of the week's highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

b. Monthly performance report

The contractor shall provide a monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## IX. Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules, regulations and agency directives. This SOW is not involved in the handling of classified data.

## X. Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## XI. Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

1. NPR 7150.2B NASA Software Engineering Requirements
2. GPR 7150 Goddard Software Engineering Requirements
3. Applicable Code 582 standards

## XII. References

# SES II Task Order SOWs

## 2015 PACE Spacecraft Flight Software

Date: 12/13/2019
Task Monitor (TM): Mike Blau
Contract number: NNG15CR67C
Contract SOW Reference: 4.2 Flight Software (FSW) Systems

### Scope

Background – The Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission is a strategic climate continuity mission that was defined in the 2010 document Responding to the Challenge of Climate and Environmental Change: NASA's Plan for Climate-Centric Architecture for Earth Observations and Applications from Space (referred to as the "Climate Initiative"). The Climate Initiative complements NASA's implementation of the National Research Council's Decadal Survey of Earth Science at NASA, NOAA, and USGS, entitled Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond.

PACE will extend the high quality ocean ecological, ocean biogeochemical, cloud, and aerosol particle data records begun by NASA in the 1990s, building on the heritage of the Sea-Viewing Wide Field-of-View Sensor (SeaWiFS), the Moderate Resolution Imaging Spectroradiometer (MODIS), the Multi-angle Imaging SpectroRadiometer (MISR), and the Visible Infrared Imaging Radiometer Suite (VIIRS). The mission will be capable of collecting radiometric and polarimetric measurements of the ocean and atmosphere, from which these biological, biogeochemical, and physical properties will be determined. PACE data products will not only add to existing critical climate and Earth system records, but also answer new and emerging advanced science questions related to Earth's changing climate.
Summary of work – The contractor will assist the PACE flight software lead in the design, development, and testing of the PACE spacecraft flight software. This work will involve all phases of the software development effort, including: system design, defining hardware/software interactions, software design, coding, test planning, test design, development of test tools, reporting test results, documentation, and preparations for post-launch transition.

Amendment 1:
This modification adds additional technical support for development/analysis of Level 5 FSW requirements and review of ICDs/HWspecs. This work will occur from the beginning of the task mod through the FSW Preliminary Design Review.
Amendment 2:
This modification adds additional technical support for software Build testing, FSW Sustaining Engineering preparations, and software configuration management. The PACE FSW team needs additional support in these areas because the appropriately qualified civil servants planned to join the team could not be identified.
Amendment 3:

# SES II Task Order SOWs

This modification extends the period of performance for an additional year (ending February 28, 2020) and adds additional technical support for software System Testing beginning in January of 2020.
Amendment 4:
This modification adds testing support for the Delay Tolerant Networking (DTN) Application in the PACE Flight Software. It changes the Build 2.0 schedule and adds an additional Build 2.5 to respond to a request from the PACE Project. It also increases the technical writing support for FSW User's Guides to include some of the Core Flight System (CFS) applications who's User Guides have not yet been written. This modification splits the work into two subtasks. The bulk of the work will be subtask 0, and the DTN testing work will be subtask 1.
Amendment 5:
This modification extends the period of performance for an additional 13 months (ending March 31, 2021). During this period the Software System Testing support added in mod 3 continues. Also during this period the SW development support begins to ramp down.

Required skills/knowledge - The engineers must have a working knowledge of the Flight Software Systems Branch policies, processes, and tools. FSW developers must thoroughly know the C language and programming for embedded spacecraft targets. FSW testers must have a thorough knowledge of ITOS, STOL, and experience with testing embedded flight software. The schedule and budget for this work have been approved by the project and they do not include any contingency for training engineers to become proficient with these skills. Therefore the development and test engineers must be experienced to the degree that they can be immediately productive.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2021.

## Subtask Description

No change in subtasks for mod 5.
Subtask 0: PACE Spacecraft Flight Software non-DTN work.
Subtask 1: PACE Spacecraft DTN FSW Testing.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below (Mod 5 changes in red):

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly |
| 2 | Performance Reports | Monthly |
| 3 | Detailed (Level 5) Requirements for PACE FSW | 6/15/2018 |
| 4 | FSW Lab Setup | 8/15/2018 |
| 5 | Integration of GDS and Avionics ETU in FSW Lab | 5/30/2018 |
| 6 | Build 1 development begins | 5/31/2018 |
| 7 | Support PACE FSW Preliminary Design Review | 7/1/2018 |

| | | |
|---|---|---|
| 8 | Build 1 FSW development complete | 12/14/2018 |
| 9 | Build 1 Verification Testing begins | 12/17/2018 |
| 9.5 | FSSE Transition Plan Draft 1 | 11/1/2018 |
| 10 | Build 1 code cleanup | 1/8/2019 |
| 11 | Build 1 Verification Testing complete | 4/30/2019 |
| 12 | Build 2 development begins | 3/15/2019 |
| 13 | FSSE Transition Plan Final (completed early) | March 2019 |
| 14 | Build 2.0 code ~~initial~~final release | June 2019 |
| 15 | Build 2.0 Verification Testing begins | June 2019 |
| 16 | Build 2.5 development begins | July 2019 |
| 16.5 | Support PACE FSW CDR | August 2019 |
| 17 | Build 2.0 Verification Testing complete | January 2020 |
| 18 | FSW User's Guide – Build 2.0 version | September 2019 |
| 19 | Build 2.5 code release | January 2020 |
| 20 | Test Plans/Procedures for the DTN FSW application | November 2019 |
| 21 | Build 2.5 Verification Testing begins | November 2019 |
| 22 | Build 3.0 development begins | February 2020 |
| 23 | DTN Application Verification Testing begins | November 2019 |
| 24 | Build 2.5 Initial Verification Testing complete | March 2020 |
| 25 | DTN Application Initial Verification Testing complete | February 2020 |
| 26 | Initial Del S/C FSW Build 2.5 to Flt Box-level I&T | March 2020 |
| 27 | Begin Preparations for FSW Systems Testing | January 2020 |
| 28 | FSW User's Guide – Build 2.5 version | March 2020 |
| 29 | Build 2.5 Verification Testing complete | June 2020 |
| 30 | Build 3.0 code release | July 2020 |
| 31 | DTN Build 3.0 Verification Testing begins | July 2020 |
| 32 | Build 3.0 Verification Testing begins | July 2020 |
| 33 | Final Build development begins | August 2020 |
| 34 | Software System Test Plan - draft | August 2020 |
| 35 | Build 3.0 Initial Verification Testing complete | September 2020 |
| 36 | DTN Build 3.0 Initial Verification Testing complete | September 2020 |
| 37 | Initial Del S/C FSW Build 3.0 to Observatory I&T | October 2020 |
| 38 | FSW User's Guide – final version | November 2020 |
| 39 | Build 3.0 Verification Testing complete | December 2020 |
| 40 | DTN Build 3.0 Verification Testing complete | December 2020 |
| 41 | Software System Test Plan - final | December 2020 |
| 42 | Software System Testing begins | January 2021 |
| 43 | Final Build code release | March 2021 |
| 44 | End-of-task Report | End of task |

Note: The contractors will be part of an integrated development team with a roughly equal number of civil servants, so not all of each of the deliverables above is the contractor's responsibility.

# SES II Task Order SOWs

Note: If the PACE mission gets continued funding in FY 2021, then this task will likely be extended and additional deliverables will be added.

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the PACE Project Configuration Management Plan.

### Facilities

Facilities for the work on this task will be provided by the government at Goddard Space Flight Center in Building 23 and/or Building 5.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics for this task will be:

- Actual Milestone Progress vs Planned/Scheduled
- Actual vs Planned Costs
- Quality of Technical Performance
- Contractor Communication
- Personnel Management

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

# SES II Task Order SOWs

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

PRs will be executed on this task only with the TM's concurrence.
There is no non-local travel for this SOW.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

### Weekly status report

The contractor shall send Performance Reports every week via e-mail to the TM. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

NOTE: There will be no handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements
Applicable Code 582 standards

## References

# SES II Task Order SOWs

## 2016 Ocean Color Instrument Flight Software Dev't & Testing

Date: 07/25/19
Task Monitor (TM): Dan Berry
Contract number: NNG15CR67C
Contract SOW Reference: 4.2 Flight Software (FSW) Systems

### Scope

Background – This task provides full-time support in all aspects of the design, development, documentation, integration, and testing of the Ocean Color instrument (OCI) flight software and any related lab and/or testbed support, including supporting project integration and testing. In addition, this task also provides engineering and software support for related OCI Payload components, such as the instrument command and data unit, mechanism control electronics, thermal control, and data acquisition unit.

Summary of work:

The contractor will assist the OCI flight software lead in:

~~The development of the OCI flight software. This work will all phases of the development effort including writing specifications, designing core flight executive/system compliant applications, integrating software with the hardware, integration testing, documentation, and design presentation. This work will also involve lab configuration, lab management support, simulator configuration, simulator development, test tool development, and documentation of products.~~

Task mod 3 is removing this effort. The job is done.

The build and system testing effort of the OCI flight software. This work will involve all phases of the test effort, including test scenario development, test implementation, test execution, test summary, test write-up, and follow up test support. This work will also involve lab configuration, lab management support, simulator configuration, simulator development, test tool development, and documentation of products.

Task mod 3 is extending this build and system test effort for 12 months (FY2020).

The build testing effort of the OCI SIDECAR flight software. This work will involve all phases of the test effort, including test scenario development, test implementation, test execution, test summary, test write-up, and follow up test support. This work will also involve lab configuration, lab management support, simulator configuration, simulator development, test tool development, and documentation of products.

Task mod 3 is extending this part time SIDECAR test effort for 12 months (FY2020).

Supporting project integration and testing. This includes box level testing and system level testing.

Participation in task reviews, mission-related meetings, branch and mission reviews, technical interface meetings, and FSW team meetings.

Present Software status at reviews as required/requested.

Required skills/knowledge: Flight Software Systems policies, processes, and tools. The FSW developer must have a

working knowledge of flight software sustaining engineering activities. FSW developer must thoroughly know the C language and programming for embedded spacecraft targets. FSW developer must have knowledge of the core flight executive/system, vxwork real-time operating system, ITOS, STOL and experience with embedded systems. FSW tester and SIDECAR tester must have a thorough knowledge of ITOS, STOL, and experience with testing embedded flight software. The schedule and budget for this work has been approved by the project and does not include any contingency for training engineers to become proficient with these skills. Therefore, the development and test engineers must be experienced to the degree that they can be immediately productive.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through September 30, 2020.

## Subtask Description

No Subtasks.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly |
| 2 | Performance Reports | Monthly |
| 3 | OCI Tester: Assigned Build 2.5 test scenarios | 06/15/2019 |
| 4 | OCI Tester: Assigned Build 2.5 test procedures | 08/31/2019 |
| 5 | OCI Tester: Assigned Build 2.5 test procedures executed | 09/05/2019 |
| 6 | OCI Tester: Assigned Build 2.5 test reports | 09/30/2019 |
| 7 | OCI Tester: Assigned Build 3.0 test scenarios (if necessary) | 01/15/2020 |
| 8 | OCI Tester: Assigned Build 3.0 test procedures | 02/15/2020 |
| 9 | OCI Tester: Assigned Build 3.0 test procedures executed | 03/15/2020 |
| 10 | OCI Tester: Assigned Build 3.0 test reports | 04/15/2020 |
| 11 | OCI Tester: Assigned System Test scenarios | 04/15/2020 |
| 12 | OCI Tester: Assigned System Test procedures | 07/31/2020 |
| 13 | OCI Tester: Assigned System Test procedures executed | 08/15/2020 |
| 14 | OCI Tester: Assigned System Test reports | 09/15/2020 |
| | | |
| 15 | SIDECAR Tester: Assigned Build 2 (ETU) test procedures | 7/30/2019 |
| 16 | SIDECAR Tester: Assigned Build 2 (ETU) test reports | 8/30/2019 |
| 17 | SIDECAR Tester: Assigned Build 2 (Flight) test procedures | 1/30/2020 |
| 18 | SIDECAR Tester: Assigned Build 2 (Flight) test reports | 2/30/2020 |
| | | |
| 19 | End-of-task Reports | End of task |

# SES II Task Order SOWs

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the PACE Project Configuration Management Plan.

### Facilities

Facilities for the work on this task will be provided by the government at Goddard Space Flight Center.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics for this task will be:

- Actual Milestone Progress vs Planned/Scheduled
- Actual vs Planned Costs
- Quality of Technical Performance
- Contractor Communication
- Personnel Management

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering

# SES II Task Order SOWs

GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

PRs will be executed on this task only with the TM's concurrence.
The SIDECAR test engineer may have travel to Space Dynamics Laboratory in Logan Utah, otherwise there is no non-local travel.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

### Weekly status report

The contractor shall send Performance Reports every week via e-mail to the TM. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. There will be no handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements
Applicable Code 582 standards

## References

# SES II Task Order SOWs

## 2017 WFIRST WFI Flight Software Support

Date: 10/03/2019
Task Monitor (TM): Nicholas Yanchik
Contract number: NNG15CR67C
Contract SOW Reference: 4.2 Flight Software (FSW) Systems

### Scope

Background – The Wide-Field Infrared Survey Telescope (WFIRST) Widefield Instrument (WFI) has recently entered Phase-B and has entered the preliminary design phase.

Summary of work –
WFIRST WFI Development Engineering support
Responsible for developing flight software on the WFI Instrument processor and developing unit tests of that flight software. The instrument processor will be a LEON4 and the environment will be an RTEMS operating system using the NASA Goddard CFS flight software architecture. The Development Engineer will be required to use the CFS, program in C, and create documentation for the software (user's guides, PDR / CDR slides, context diagrams).

WFIRST WFI Test Team Lead support
Lead the flight software test team in developing and running tests of the WFI ICDH Flight Software. The Lead will be responsible for delegating work among the test team, creating necessary documentation (Test Plan, branch status packages, etc.), presenting at Branch, Instrument, and Mission level reviews. The Lead will also be expected to develop and run tests on the flight software in the flight software lab, as well as all other responsibilities listed in the Test Engineer description.

WFIRST WFI Test Engineering support
Responsible for developing and running test for the WFI Flight Software. Testers will be required to develop RDLs, program tests in STOL, and develop test reports. Testers will also be required to use bug-tracking and CM software (GIT/Jira) to report bugs and to test bug fixes.
Required skills/knowledge –

WFIRST WFI Development Engineering support
10+ years of experience writing embedded flight software in the C language on embedded processors.
10+ years of experience working with Linux and command-line driven operating systems.
Knowledge of MAKE build automation tools is preferred.
Knowledge and experience with bootloaders, simulators, and debugging tools.
Knowledge and experience working with embedded operating systems (such as RTEMS).
Knowledge of working with 'external' pieces of hardware and software for simulation of data.
Experience with Guidance/Navigation/Control software is a plus.

# SES II Task Order SOWs

WFIRST WFI Test Team Lead support
Experience leading and managing teams.
Experience creating reports, writing and managing documentation, and presenting to large groups.
All requirements listed under WFIRST Test Engineer (3).

WFIRST WFI Test Engineering support
5+ years of testing embedded software.
5+ years of working with Linux and command-line driven operating systems.
Extensive experience using the ASIST ground station, writing RDLs, and writing test scripts in STOL.
Experience creating test reports and Requirements-To-Test Matrices.
Knowledge of working with 'external' pieces of hardware and software for simulation of data.

CFS – This is the Flight Software Branch's Core Flight System. It's our flight architecture that we have been using on all of our missions. https://cfs.gsfc.nasa.gov/
RTEMS – Yes, this is the Real Time Executive for Multiprocessor Systems. It's an embedded operating system.https://www.rtems.org/
LEON4 – The LEON4 SPARC processor. https://www.gaisler.com/index.php/products/processors/leon4
GNC (ACS/FGS) – Guidance, Navigation Control (or Attitude Control System or Fine Guidance Systems). Basically, it's the area of software/math that deals with how/where the spacecraft is pointed and what direction it is going in.
RDL – Record Definition Language - language for describing scientific data structures, part of the ASIST system (together with STOL). Testers should be familiar with ASIST/RDLs/STOL
STOL- System Test & Operations Language – It's a programming language used by the ASIST ground system to automate functions and data processing. Testers should be familiar with ASIST/RDLs/STOL
BSR – Branch Status Report. In 582, we have monthly BSRs- a meeting between projects and branch man

## Period of Performance

The period during which the work for this task order shall be performed is from task award through November 30, 2020.

## Subtask Description

N/A

## Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly |

| | | |
|---|---|---|
| 2 | Performance Reports | Monthly |
| 3 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

The contractor shall adhere to the WFIRST Flight Software Configuration Management Plan and Procedures documentation.

### Facilities

N/A

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

# SES II Task Order SOWs

## ODC (Travel and Procurement)

EXAMPLE: Travel may be proposed for special training needs and other engineering support task activities as directed by the Project. OR

| Location | Duration | Dates |
|---|---|---|
| N/A | | |
| | | |
| | | |

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

### Monthly performance report

The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

No handling of classified data is required.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

# 2018 HPSC Middleware Development Support

Date: 2/1/2019
Task Monitor (TM): Gregory Yoblin Alan Cudmore
Contract number: NNG15CR67C
Contract SOW Reference: 4.2 Flight Software (FSW) Systems

## I. Scope

a. Background

The High Performance Spacecraft Computing (HPSC) Middleware project is a software development effort to produce research and development class flight software for the upcoming HPSC processor. The HPSC Middleware runs on top of multiple embedded operating systems (Yocto Embedded Linux and the RTEMS real time operating system) on the HPSC processor (known as the "Chiplet"), HPSC Chiplet simulators, and commercial development boards that are similar to the HPSC. The HPSC Chiplet is a multi-processor and multi-core ARM flight processor that is being developed for NASA and the Air Force by Boeing. The HPSC Chiplet consists of several computing subsystems:
High Performance Processing System (HPPS) with 8 ARM A53 cores running Yocto Embedded Linux (Aarch64 architecture)
Real Time Processing System (RTPS) that consists of a single ARM A53 core and a Dual Core Lockstep ARM R52. The Single A53 operating system is TBD. The R52 operating system is RTEMS.
A System reset and power controller that consists of an ARM Cortex M4 running RTEMS. (the middleware does not run on this processor)
A wide selection of high and low speed I/O

The HPSC Middleware development is a joint development project between flight software developers at NASA/JPL and NASA/GSFC. GSFC is responsible for 4 of the 13 defined HPSC Middleware services. The HPSC Middleware is composed of a set of Middleware Service Libraries, and Middleware Service Applications. The GSFC and JPL development teams work collaboratively to develop the Middleware Service Libraries and Middleware Service Applications.

The HPSC Middleware development uses a spiral development model, with four major builds identified as follows:

1. HPSC Middleware Release 1 – Released in January 2019
2. HPSC Middleware Release 2 – Released in October 2019
3. HPSC Middleware Release 3 – Projected Release Mid 2020
4. HPSC Middleware Release 4 – Projected Release Early 2021

Note: The specific release dates for Release 3 and Release 4 are not known yet. The parent HPSC project schedule and availability of system software can cause these dates to be delayed.

b. Summary of work

o The contractor will be responsible for the following:
§ HPSC middleware requirements analysis and refinement
§ HPSC middleware software development and test for multiple middleware

services
§ HPSC middleware documentation
§ HPSC middleware demo preparation, and demo presentations
§ Installation, Configuration, and Evaluation of vendor supplied system software for the HPSC Chiplet
§ Report system software defect to the system software vendor, if necessary
§ Participation in design and requirements reviews
§ Participation in weekly status meetings, weekly design meetings
§ Participation in periodic design review meetings
§ Participation in HPSC related trade study meetings
§ Participation/Attendance in general HPSC project periodic status reviews
§ Participation in HPSC or Middleware related training, if necessary
c. Required skills/knowledge
- Embedded flight software engineer, experienced with developing flight software for real time operating systems and hardware devices
- C programming skills
- Embedded systems programming, including experience with embedded ARM processor boards (i.e. Xilinx Ultrascale+ MPSOC ZCU102)
- Linux programming experience
- Real Time Operating System programming experience (e.g. the operating system for the RTPS R52 processor is RTEMS, which is an open source real time operating system)
- Knowledge of programming embedded devices such as DMA controllers, input/output devices such as Serial Rapid IO, etc.
- Ability to collaborate with a remote team through weekly teleconferences, remote development systems, and occasional face-to-face meetings

## II. Period of Performance

The period during which the work for this task order shall be performed is from task award through January 31, 2020 March 31, 2021.

## III. Subtask Description

No Subtasks

## IV. Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:
Ref# Deliverables Due Date
1 Status Reports Weekly
2 Performance Reports Monthly
3 Input to HPSC Middleware Team for weekly status Weekly
4 Input to HPSC Management for Monthly Status reports Monthly
5 HPSC Middleware Release R1.2 R2 Design for specific middleware subsystem(s)
April 2019
6 HPSC Middleware Release R1.2 R2 Software for specific middleware subsystem(s)
June 2019
7 HPSC Middleware Release R1.2 Documentation for specific middleware subsystem(s)

July 2019
8 HPSC Middleware Release R1.2 Demonstration to Air Force Research Laboratory
July 2019
9 HPSC Middleware Release R2.1 Requirements for specific middleware subsystem(s)
August June/July 2019
10 HPSC Middleware Release R2.1 Design for specific middleware subsystem(s)
September August 2019

11 HPSC Middleware Release R2.1 Software for specific middleware subsystem(s)
November September 2019
12 HPSC Middleware Release R2.1 Documentation for specific middleware subsystem(s)
December September 2019
13 HPSC Middleware Release R2.1 Demonstration to Air Force Research Laboratory
December October 2019
14 HPSC Middleware Architecture Review December 2019
15 HPSC Middleware Release R2.23 Requirements for specific middleware subsystem(s)
February 2020
16 HPSC Middleware Release R3 Design and Software Development for specific middleware subsystems
June 2020
17 HPSC Middleware Release R3 Documentation for specific middleware subsystems
July 2020
18 HPSC Middleware Release R3 Demonstration to Air Force Research Laboratory and NASA Customers
July 2020
19 HPSC Middleware Release R4 Requirements for specific middleware subsystems
September 2020
20 HPSC Contribute to Middleware Release R4 Design, Development, and Documentation for specific middleware subsystems (note: The Middleware R4 release may be after the Contract end, so this item just includes work towards that release)
March 2021
15 End-of-task Report End of task

## V. Management Approach

a. Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

b. Configuration Management Systems and documents will be covered under the HPSC Configuration Management
Plan.

c. Facilities
Facilities for the work on this task will be provided by the government at Goddard Space Flight Center in Building 23

d. Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics for this task will be:
1. Actual Milestone Progress vs Planned/Scheduled
2. Actual vs Planned Costs
3. Quality of Technical Performance
4. Contractor Communication
5. Personnel Management

f. Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements
The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
1. NPR 7120.5E NASA Space Flight Program and Project Management Requirements
2. NPR 7123.B NASA Systems Engineering Processes and Requirements
3. GPR 7120.99 Goddard Project Management
4. GPR 7120.5A Goddard Systems Engineering
5. GPR 7150.4 Goddard Software Engineering Requirements

## VI. ODC (Travel and Procurement)

PRs will be executed on this task only with the TM's concurrence.
Travel may be proposed for special training needs and other engineering support task activities as directed by the Task Monitor. The likely location will be at JPL/Caltech.

## VII. Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## VIII. Reporting Requirements

a. Weekly status report
The contractor shall generate Performance Reports every week and send to the TM via email. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

b. Monthly performance report
The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## IX. Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.
There will be no handling of classified data.

## X. Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## XI. Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
1. NPR 7150.B NASA Software Engineering Requirements
2. GPR 7150.1 Goddard Software Engineering Requirements
3. Applicable Code 582 Standards

## XII. References

# SES II Task Order SOWs

## 2019 LOCNESS Optical Modem Software Development

Date: April 2, 2019
Task Monitor (TM): Richard Butler
Contract number: NNG15CR67C
Contract SOW Reference: 4.2 Flight Software (FSW) Systems

### Scope

Background – The Laser Optical Communications Near Earth Satellite System (LOCNESS) project will construct a payload architecture and prototype for an optical communications relay satellite.
The LOCNESS modem subsystems will convert optical signals to digital signals and vice-versa in 2 distinct regimes: Up to 10Gbps user data and up to 100Gbps relay data. Determining the exact type and quantity of modems is part of the scope of the project.
The Telecommunications Networks and Technology branch, code 566, is providing leadership on the development of the optical modem systems, defining the interfaces and performance characteristics of the modems and support integrating those modems into the larger payload system.

Summary of work – The LOCNESS Optical Modem Software Development task provides software support for the LOCNESS modem subsystems The contactor will provide technical expertise and flight software development support for optical modem development activities.

Required skills/knowledge -Experience with space/ground systems and software full life cycle development and software testing required. Optical communication experience strongly desired.

### Period of Performance

From Task Award through January 31, 2020

### Subtask Description

Subtask 01: LOCNESS Modem Flight Software Development and Test

The LOCNESS modem Flight Software Development and test subtask provides software support for the LOCNESS modem subsystems. Working knowledge and experience with system embedded software is required. Working knowledge of typical GSFC lab and testing protocols (QA, PR, WOA practices) is required. Familiarity with GSFC 580 division software tools is desirable. Institutional knowledge of the LCRD project is required. Familiarity with optical communications is required. Majority of the work will be developing, testing and documenting the software design of the LOCNESS flight modem subsystems. Contractor shall support and participate in various aspects of concept formulation, requirements development, schedule planning, production of review materials, design, implementation/verification/manufacturing planning and presentations/project meetings.

### Deliverables/Schedules/Milestones

# SES II Task Order SOWs

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | LOCNESS Status Report | Weekly |
| 2 | Monthly Financial Report | 15th of every month |
| 3 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

The contractor will reside onsite and project will provide appropriate office and workstation accommodations with IT support to maximize productivity.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

# SES II Task Order SOWs

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B. NASA Systems Engineering Processes and Requirements
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

There is no travel non-local travel required for this SOW

## Work Location

This work shall be performed on-site at the Goddard Space Flight Center.

## Reporting Requirements

Bi-weekly status report

The contractor shall generate Performance Reports every bi-weekly. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will not be any handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management

GPR 7120.5A Systems Engineering
GPR 7150.1 Goddard Software Engineering Requirements
Applicable Code 582 standards

## References

# SES II Task Order SOWs

## 2020 DTN Software Development

Date: 12/05/2019
Task Monitor (TM): Jonathan Wilmot
Contract number: NNG15CR67C
Contract SOW: 4.2 Flight Software (FSW) Systems

## Scope

Background - The Software Engineering Division (Code 580), Flight Software Systems Branch (Code 582) has developed a platform-independent, Flight Software development environment, the core Flight System (cFS). The system integrates a reusable core flight executive (cFE) and suite of applications.
Delay/Disruption Tolerant Networking (DTN) is a networking protocol suite designed for the communications signaling delays and disruptions typical in spaceflight missions. DTN is based on the store and forward Bundle protocol which allows spacecraft to forward data to the next network hop in the path to the data destination with that hop taking custody of the data. The basic protocol suite is documented in Internet Engineering Task Force (IETF) Request For Comments (RFC) 5050, Bundle Protocol Version 7 draft-ietf-dtn-bpbis-13, and Consultative Committee for Space Data Systems (CCSDS) Bundle Protocol Specification 734.2-B-1
This effort involves developing DTN applications that are compliant to the cFS architecture and associated operational interfaces with I/O performance in excess of 660 Mbps.

Summary of work – This task provides engineering support for developing CCSDS DTN Bundle Protocol and associated management applications. The applications shall be written as a set of cFS applications and associated cFS loadable libraries. Library functions shall include block level interface drivers to a Solid State Disk or Flash device subsystem. CCSDS CFDP interfaces will also be utilized as source and destination payloads within DTN protocol units.
This work is a Technology Development (TD) project with all work will be done in accordance to NPR 7120.8A NASA Research and Technology Program and Project Management Requirements

Required skills/knowledge - Competency areas include expertise with the following Flight Software areas:

cFS programming
Flight Software programming
Software systems life cycle
Requirement analysis
Specifications and design
Software development, integration and testing
Communication networks

# SES II Task Order SOWs

Flight and ground command and telemetry systems
CCSDS BP specification, including compressed bundle headers and aggregate custody signaling
IETF RFC 5050 BP specification
CCSDS File Delivery Protocol (CFDP)
Low level device driver development for Linux, and RTEMS

Skill sets and knowledge requirements:

Demonstrated skills in network protocols
Demonstrated skills in conducting internal software design reviews and monitoring flight software development.
Demonstrated skills in real-time and/or embedded software development using the C programming language, the Linux operating system, and real-time operating system kernels such as RTEMS
Demonstrated utilization knowledge of Software Configuration Management Systems as git configuration tools.
Demonstrated skills in integrating software and hardware

## Period of Performance

This modification extends the period of performance for the task order through Sept 30, 2020.

## Subtask Descriptions: There are no subtasks for the effort

## Deliverables/Schedules/Milestones

## Note: Task engineers are working with other DTN team members to meet deliverables

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly/Bi-weekly |
| 2 | Performance Reports | Monthly |
| 3 | End-of-task Report | End of task |
| 4 | Baseline block device read write interface with performance benchmark | 5/15/19 |
| 5 | Baseline command and telemetry interface with open source COSMOS test system | 6/1/19 |
| 6 | Integration of latest code from PACE BP implementation | 6/15/19 |
| 7 | DTN aggregate custody signaling with retry and lifetime timers | 7/15/19 |
| 8 | Demonstration of BP operation and performance in excess of 660Mbps | 8/30/19 |
| 9 | Documentation and minor fixes/enhancements | 9/30/19 |

| | | |
|---|---|---|
| 10 | Concepts for DTN operational interfaces | 10/15/19 |
| 11 | Prototype implementation for DTN operational interfaces | 3/25/20 |
| 12 | DTN BP requirements | 3/15/20 |
| 13 | DTN BP Implementation with requirements traceability | 8/15/20 |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the cFS Configuration Management Plan and cFS Configuration Management Procedures documents.

### Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, and meeting requirements set forth in the SOW. Performance metrics include adherence to delivery dates and schedule, and functional quality of delivered code.

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

The contractor providing technical services shall comply with established Code 580.0 software development standards and processes during the development and sustaining

software engineering associated with the cFS software products. Applicable requirements include, but not limited to:

NPR 7150.2C NASA Software Engineering Requirements
NPR 7120.8A NASA Research and Technology Program and Project Management Requirements
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

There are no ODC's or IT acquisitions for this SOW.

## Work Location

This work shall be performed primarily at the contractor's facility, but the contractor is required to attend meetings and perform some work on-site at the Goddard Space Flight Center.

## Reporting Requirements

### Weekly or Bi-weekly status report

The contractor shall generate Performance Reports weekly. The report shall include, as a minimum, a summary of the week's highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall provide a monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules, regulations and agency directives. This SOW is not involved in the handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2B NASA Software Engineering Requirements
GPR 7150 Goddard Software Engineering Requirements
Applicable Code 582 standards

## References

# SES II Task Order SOWs

## 2021 cFS Gateway Certification Effort

Date: 12/2/19
Task Monitor (TM): Jacob Hageman
Contract number: NNG15CR67C
Contract SOW Reference: 4.2 Flight Software (FSW) Systems

## I. Scope

a. Background – The objective of this project is the certification of the Core Flight Software (cFS) system as class A, safety-critical flight software, to the level as required by NASA NPR 7150.2C. The cFS certification package includes the following cFS components:

i. core Flight Executive (cFE) v6.7.0
ii. Operating System Abstraction Layer (OSAL) v5.0.0 for VxWorks 6.9
iii. Platform Support Package (PSP) for the SP0 processor
iv. CFDP App (CF), Data Store App (DS), Housekeeping App (HK), Health and Safety App (HS), File Manager App (FM), Memory Dwell App (MD)
v. Command Ingest App (CI), Telemetry Output App (TO), Input/Output Lib (IO_LIB), Protobetter Lib (PROTO_LIB), Protobetter App (PROTO_MGR), Time Triggered Scheduler (SCH_TT), Time Triggered Ethernet Lib (TTE_LIB), Time Triggered Ethernet App (TTB_MGR)

GSFC-5820 role in the Project is to deliver the cFE, OSAL, CF, DS, HK, HS, FM, MD to the project as "certifiable" class B, safety critical flight software, with all the documentation & artifacts as required by NPR7150.2C.
b. Summary of work – The contractor will assist the flight software lead in the certification of the flight software elements listed above. The contractor responsibilities are:

i. Design, develop and execute automation scripts using open source tools
ii. Analyze and develop conversion of manual tests to automated tests using open source based test framework
iii. Update processes, policies, and design documents as needed for compliance
iv. Review requirements, specifications and technical design documents to provide timely and meaningful feedback
v. Create detailed, comprehensive and well-structured test plans and test cases
vi. Estimate, prioritize, plan and coordinate testing activities
vii. Liaise with internal teams (e.g. developers and product design leads) to identify/update system requirements
viii. Track quality assurance metrics, like defect densities and open defect counts
ix. Stay up-to-date with new testing tools and test strategies

c. Required skills/knowledge - The engineers must have a working knowledge of software certification policies, processes, and tools.

i. Proven work experience in software development
ii. Proven work experience in software quality assurance
iii. Strong knowledge of software QA methodologies, tools and processes
iv. Experience in writing clear, concise and comprehensive test plans and test cases

v. Hands-on experience with automated testing tools, particularly Open Source
vi. Helpful experience - ASIST procs, NASA cFS, Flight Software

## II. Period of Performance

The period during which the work for this task order shall be performed is from task award through September 30, 2020.

## III. Subtask Description

No Subtasks.

## IV. Deliverables/Schedules/Milestones

| At a minimum, the contractor shall deliver the items specified below: Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly |
| 2 | Performance Reports | Monthly |
| 3 | Requirement Gap Analysis report - cFE and VxWorks OSAL | 3/10/2020 |
| 4 | Software Requirement Specifications (refresh of current) | 3/15/2020 |
| 5 | Software Detailed Designs (refresh of current) | 3/15/2020 |
| 6 | Developer's Guides | 3/15/2020 |
| 7 | Test Procedures | 3/15/2020 |
| 8 | Initial drop of cFE, VxWorks OSAL, DS, FM, HK, HS, MD software | 3/20/2020 |
| 9 | 2nd drop of cFE, OSAL for verification development & test | 4/15/2020 |
| 10 | Verification scenarios and tests | 5/15/2020 |
| 11 | Final drop of cFE, VxWorks OSAL, DS, FM, HK, HS, MD software | 5/15/2020 |
| 12 | Class B certification report/package | 7/15/2020 |
| 13 | Support JSC Class A certification effort | 8/1/2020 |
| 14 | End-of-task Report | End of task |

Note: The contractors will be part of an integrated development team with a roughly equal number of civil servants, so not all of each of the deliverables above is the contractor's responsibility.

Note: If the project gets continued funding in FY 2021, then this task will likely be extended and additional deliverable will be added.

## V. Management Approach

a. Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

b. Configuration Management

Systems and documents will be covered under the Gateway Certification Configuration Management Plan.

c. Facilities

Facilities for the work on this task will be provided by the government at Goddard Space Flight Center in Building 23 and/or Building 5.

d. Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics for this task will be:

1. Actual Milestone Progress vs Planned/Scheduled
2. Actual vs Planned Costs
3. Quality of Technical Performance
4. Contractor Communication
5. Personnel Management

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

1. NPR 7120.5E NASA Space Flight Program and Project Management Requirements
2. NPR 7123.B NASA Systems Engineering Processes and Requirements
3. GPR 7120.99 Goddard Project Management
4. GPR 7120.5A Goddard Systems Engineering
5. GPR 7150.4 Goddard Software Engineering Requirements

## VI. ODC (Travel and Procurement)

PRs will be executed on this task only with the TM's concurrence.
Travel for this task only with TM's concurrence (none planned).

## VII. Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## VIII. Reporting Requirements

a. Weekly status report

The contractor shall send Performance Reports every week via e-mail to the TM. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.
b. Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor shall be available to attend monthly status meetings.

## IX. Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

NOTE: There will be no handling of classified data.

## X. Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## XI. Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
1. NPR 7150.2C NASA Software Engineering Requirements

2. GPR 7150.1 Goddard Software Engineering Requirements
3. Applicable Code 582 standards

## XII. References

# SES II Task Order SOWs

## 3002 SET-1 Ground Software Systems Support

Date: July 10, 2019
Task Monitor (TM): Eve Rothenberg
Contract number: NNG15CR67C
Contract SOW Reference: 4.3 Ground Software and Systems

## Scope

Background - The Space Environment Testbeds (SET) Project is part of the Living with a Star (LWS) Program managed at NASA Goddard Space Flight Center, Code 460. The LWS Program, and the SET Project, is sponsored by NASA Headquarters Science Mission Directorate.
The objective of the SET Project is to improve the engineering approach to accommodate and/or mitigate the effect of solar variability on spacecraft design and operations so that new technologies can be infused into future space missions without adding risk. Data sets collected on flights will be used to produce data products that will improve, develop, and validate engineering environment models, tools, and databases for reliable spacecraft design and operation.
The SET-1 Payload Operations Control Center (POCC) is located in Building 5 Room N012, and will be relocated before the end of October, 2019. The SET hardware integration to the host spacecraft, Demonstration of Science Experiments (DSX), was completed in November, 2009, at the Kirtland Air Force Base. The DSX Launch, including SET, took place on June 25, 2019.
Summary of work - This task mod is to provide Ground Data System (GDS) engineering and test conductor services for the SET-1 Project during the mission operations phase.
LWS/SET GDS Systems Maintenance
Maintain and operate, all SET-1 Ground Data Systems used during SET-1 POCC Mission Operations. This is to include all upgrades and troubleshooting of ITOS, ITPS, and other GDS software, hardware, and operating systems. Systems include but not limited to:
2 ITOS, Enterprise Linux v5, thin rack-mount servers, SETGDS-5, SETGDS-6, located at the Kirtland Air Force Research Laboratory (AFRL)
1 ITOS, CentOS Linux v6.10, prime mission system, SETITOS1
1 ITOS, CentOS Linux v6.10, Back-up mission laptop, SETITOS3
1 ITOS, CentOS Linux v6.10 , CM server, SET-CM
2 Windows 10 systems, Mission Planning Systems for ITPS, Email and X-196 Patch Tool, SETPLAN1, SETPLAN2
1 Windows PR/PFR and Command Sequence Generator system, SETLAB-1, located at the Kirtland AFRL
1 Windows 10 admin system, PR/PFR and Email, ACES
Maintain, the SET-1 Flight I&T ITOS Databases, STOL procedures, and display pages.
Maintain, the SET-1 Mission Operations ITOS Databases, STOL procedures, and display pages.

LWS/SET-1 GDS Mission Operations and Troubleshooting

# SES II Task Order SOWs

Provide GDS operations/console support for mission activities for SET-1. Operations support includes, but is not limited to, receiving SET-1 data files from the DSX Data Center, processing SET-1 files into carrier and experimenter data, and processing the SET-1 carrier data through the ITPS Plotting software. In addition, operations support includes putting experiment data to Experimenters, and requesting the Experimenters to evaluate their data.
Maintain the SETPLAN1, SETITOS1, and the SETCM systems to perform backups, to their respective USB hard drives, on a daily basis.

LWS/SET-1 GDS Documentation
Maintain the following documents:
I&T Procedures/Scripts and Display Pages for SET-1 Payload
Mission Operations Procedures/Scripts and Display Pages for SET-1 Payload
LWS/SET-1 Telemetry and Command Handbook, Volume 2
LWS/SET-1 GDS System Administration Guide, configuring Red Hat Linux, installing and testing ITOS.
ITOS Operator Guides for SET-1: Mission data retrieval and processing, ITOS database maintenance, and telemetry conversions.
Contribute to updating various LWS SET-1 GDS, I&T and Mission Operations documentation including, but not limited to:
GDS Operator Guides for SET-1: SFTP server maintenance, trend plotting, data storage and distribution to Experimenters, system back-ups, system administration and contingency operations.

LWS/SET Transition Plan
Required skills / knowledge -
Operation of, and troubleshooting expertise using, the Integration Test and Operations System (ITOS) telemetry and command system
Experience with operating and testing the SET-1 carrier using ITOS
Experience with operating telemetry and command system(s) and testing spaceflight hardware and software
Experience with operating and testing ITPS
Experience with developing and wringing-out System Test and Operations Language (STOL) I&T test procedures
Experience with developing I&T telemetry display pages

## Period of Performance

The period during which the work for this task shall be performed is from task award through September 30, 2020.

## Sub -Task Description

No Sub-Tasks

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due by |
|---|---|---|
| 1 | Performance Reports | Monthly, by the 15th of the following month |
| 2 | Testconductor support: test, report and fix issues with Operating Systems updates, SET ITOS procedures, ITOS Pages, ITOS databases and ITPS Trending capabilities on the SET POCC systems | Weekly |
| 3 | Update SET1 Test Plans, Test Procedures, User Guides and ICDs. | Monthly |
| 4 | Implement and test SET1 POCC side of the SET1 POCC to DSX Data Center interface | Complete |
| 5 | Operations/Console support: verify operations requirements | Complete |
| 6 | Operations/Console support: verify receipt of SET1 mission files sent by the host spacecraft DSX | Weekly |
| 7 | Process SET1 files through ITOS and send experiment output files to the applicable SET1 Experimenters | Weekly |
| 8 | Support the Operations team with processing health and safety files through ITPS; produce and archive trending plots | Weekly |
| 9 | Ensure daily system back-ups continue to be performed | Weekly |
| 10 | Final Task Report | End of Task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the SET Project Configuration Management Plan.

### Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

# SES II Task Order SOWs

See the attached "SET-1 Ground Data System (GDS) Performance Specifications for SES II Task 3002."

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.
Government Furnished Equipment: none.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements
LWSSET-QA-0002 SET-1 Carrier/Payload Mission Assurance Requirements (MAR) Document

## ODC (Travel and Procurement)

Travel may be proposed for special training needs and other engineering support task activities as directed by the Project.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

Weekly performance report
Not required for this task due to the low level of effort needed.

Monthly performance report
The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the

contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no classified data to handle.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.2B NASA Software Engineering Requirements
GPR 7150.1 Software Project Process Initiation (version approved for Code 580 systems is located in the Software Process Improvement [SPI] Process Asset Library [PAL])
GPR 7150.2 In House Software Development and Maintenance (version approved for Code 580 systems is located in the SPI PAL)
GPR 7150.3 Software Acquisition (version approved for Code 580 systems is located in the SPI PAL)
LWSSET-QA-0002 SET-1 Carrier/Payload Mission Assurance Requirements (MAR) Document
462-RQMT-0012 SET-1 Mission Requirements Document (MRD);
462-SPEC-0018 Living with a Star (LWS) Space Environment Testbeds (SET-1) Ground Data System Ground Data System (GDS) Level 3 Requirements Specification
462-ICD-00004 DSX MOC to SET-1 POCC Interface Control Document
CD-013-1-GSFC-5001 Applied Engineering and Technology Directorate, Code 500, Lab System (Multi-program/project IT and Project Unique IT) Security Plan
LWSSET-HDBK-0001 Living with a Star (LWS) Space Environment Testbeds (SET) Telemetry and Command Handbook
462-PLAN-007 SET Project Plan
462-PLAN-0029 SET-1 Mission Readiness Test Plan
462-PLAN-0027 SET-1 Mission Operations Plan
462-PLAN-0055 SET-1 Project Transition Plan
462-UG-0009 SET-1 GDS ITOS User's Guide
462-UG-0010 SET-1 GDS System Administration Guide
462-UG-0011 SET-1 GDS User's Guide

## References

None

# SES II Task Order SOWs

## 3003 ITOS Ground Software Systems Support

Date: October 28, 2019
Task Monitor (TM): Monisha Dawson
Contract number: NNG15CR67C
Contract SOW Reference: 4.3 Ground Software and Systems

### Scope

Background - this work is both a continuation and expansion of work that has been supported since the early 1990's by a core team with extensive experience, and is occasionally supplemented by other staff for short to intermediate term tasks. It is desired to maintain the core team experience base. The Integration, Test, and Operations System (ITOS) is a software product for processing, displaying, storing, and monitoring telemetry and generating tele-commands. ITOS is the core element of a spacecraft or space instrument Ground Data System for flight operations, integration and test, and development. GSFC Code 583 manages the government version of ITOS and the Data Management System (DMS); the Hammers Company manages the commercial version of ITOS.
Summary of work - the contractor shall provide product management and development/sustaining engineering for the ITOS which will be used as the Telemetry and Command system in the I&T and operational phases for missions to be launched in 2016 and beyond.
Required skills/knowledge –
Good knowledge of the software development process
Good knowledge of MySQL and/or Oracle database
Good knowledge of XML
Good knowledge of Web service interface
Graphical user interface design and implementation experience
Strong command of Java and C/C++
Knowledge of GitHub, Gitlab and JIRA
Knowledge of Perl helpful but not required
Experience working with JNI (Java Native Interface) desired
Proficient knowledge of shell scripting language, and Linux operating system
Proficiency with an integrated development environment (IDE) such as Eclipse or NetBeans.
Requirement definition
Requirement analysis
Specifications and design
Software development, integration, and testing
Communication networks
CCSDS BP specification, including compressed bundle headers and aggregate custody signaling
CCSDS File Delivery Protocol (CFDP)

# SES II Task Order SOWs

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2021.

## Subtask Description

3003.01 – ITOS Multi-Mission Support

The contractor shall provide general ITOS support that includes activities that benefit all ITOS customers. Examples include: supporting System Testing prior to each major release, generation of release documentation, support of audits, any customer support via email, phone, meetings, etc. not specific to a subtask listed below, attending weekly developers meeting, participating in configuration management and requirements management activities, completing mandatory training, preparing status reports, presenting product demonstrations, etc.

The Contractor shall support the following customers at a low-level:

Multi-Mission Operations Center (MMOC)

Engineering/Consultation support to Advance Composition Explorer (ACE), Wind and Geotail management teams

Goddard Mission Services Evolution Center (GMSEC)

Engineering/Consultation support to GMSEC management team

Pre-Aerosol, Clouds, and ocean Ecosystem (PACE) Spacecraft (S/C) Integration & Test (I&T)

Engineering /Consultation support to PACE Spacecraft I&T

New Customers, as needed, to provide ITOS Overview and estimates to support

3003.03 – Ice, Cloud, and Land Elevation Satellite-2 (ICESat-2) Support

The contractor shall provide development and maintenance support for the ITOS product pertinent to the ICESat-2 Mission (including the ATLAS instrument. Main activities include:

Provide direct support for the ICESat-2Mission.

Support, as needed, any new development/mods to support the ISF, MOC, and backup MOC - help configure, test, etc.

Provide system administration, system engineering, and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2.

Implement new functionality, if any, based on the customer requirements (none planned initially, additional funds may be required).

3003.04 – Joint Polar Satellite System (JPSS) Support

The contractor shall provide development and maintenance support for the ITOS product pertinent to the JPSS Mission. Main activities include:

Provide direct support for the ICESat-2Mission.

Support, as needed, any new development/mods to support the ISF, MOC, and backup MOC - help configure, test, etc.

Provide system administration, system engineering, and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2.
Implement new functionality, if any, based on the customer requirements (none planned initially, additional funds may be required).

3003.05 – Laser Communications Relay Demonstration (LCRD) Support
The contractor shall provide development and maintenance support for the ITOS product pertinent to the LCRD Project. Main activities include:
Provide direct support for the LCRD Project.
Provide system administration, system engineering, and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2.
Implement new functionality, if any, based on the customer requirements (none planned, additional funds may be required).

3003.06 – Thermal Infrared Sensor - 2 (TIRS-2) Support
The contractor shall provide development and maintenance support for the ITOS product pertinent to the TIRS-2 Instrument (Landsat-9 Spacecraft). Main activities include:
Provide direct support for the TIRS-2 Project.
Provide system administration, system engineering, and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2.
Implement new functionality, if any, based on the customer requirements.
Travel to vendor facility, as needed, to support network setup activities

3003.07 – Lunar Reconnaissance Orbiter (LRO) Support
The contractor shall provide development and maintenance support for the ITOS product and the Data Management System (DMS) pertinent to the LRO Project. Main activities include:
Provide direct support for the LRO Project for ITOS and DMS.
Provide system administration, system engineering, and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2.
Implement new functionality related to the upgrade from ITOS 7.x to ITOS 9.x (latest version of ITOS).

3003.08 – Ocean Color Instrument (OCI)
The contractor shall provide development and maintenance support for the ITOS product pertinent to the OCI Instrument. Main activities include:
Provide direct support for the OCI Instrument.
Provide system administration, system engineering, and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2.
Implement new functionality, if any, based on the customer requirements.

3003.09 – STP-Sat-6 Antenna Ground Equipment (SAGE) mission
The contractor shall provide development and maintenance support for the ITOS product pertinent to the SAGE Mission. Main activities include:
Provide direct support for the SAGE Mission.
Support, as needed, any new development/mods to support the Ground System Ops

Provide system administration, system engineering, and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2.

3003.10 - Pre-Aerosol, Clouds, and ocean Ecosystem (PACE) Spacecraft (S/C) Ground System
The contractor shall provide development and maintenance support for the ITOS product pertinent to the PACE Ground System. Main activities include:
Provide direct support for the PACE Mission in response to Spacecraft Ground System customer requests.
Provide system engineering and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2.
Implement new functionality, if any, based on the customer requirements.

3003.11 - Pre-Aerosol, Clouds, and ocean Ecosystem (PACE) Spacecraft (S/C) Integration & Test (I&T)
The contractor shall provide development and maintenance support for the ITOS product pertinent to the PACE S/C Integration & Test (I&T). Main activities include:
Provide direct support for the PACE Mission in response to Spacecraft I&T and FSW customer requests.
i. Provide system administration, system engineering, and analysis of discrepancy reports or requirements; provide all required documents according to NPR 7150.2B.
Implement new functionality, if any, based on the customer requirements.

## Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Weekly Team Meeting Notes uploaded to SPACES | Weekly |
| 2 | Performance Reports | Monthly |
| 3 | Process Hour Reporting | Monthly |
| 4 | Customer Status Reports | Monthly |
| 5 | Update customer support logs. | As Required |
| 6 | Complete DMS upgrade for LRO | Thru 2020 |
| 7 | ITOS 9.8.0 Release (dev, testing, and docs) | 02/01/20 |
| 8 | ITOS 9.9.0 Release (dev, testing and docs) | 07/01/20 |
| 9 | ITOS 9.10.0 Release (dev, testing and docs) | 11/01/20 |
| 10 | ITOS 9.11.0 Release (dev, testing and docs) | 02/01/21 |
| 11 | Complete ITOS upgrade for LRO | Thru 2020 |
| 12 | New Technology Report (NTR) | As Required |
| 13 | End-of-Task Report | End-of-Task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

# SES II Task Order SOWs

Configuration Management

Systems and documents will be covered under the ITOS Configuration Management Plan, which is Section 6.2 of the ITOS Software Management Plan/Product Plan.

Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics

The TM based on the technical merit will evaluate the work performed for this task. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

NOTE: Each Task Order should have specific performance metrics and should be detailed in the SOW. Examples of performance metrics could be:

Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7123.1B Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

# SES II Task Order SOWs

## ODC (Travel and Procurement)

Travel may be proposed for special training needs and other engineering support task activities as directed by the ITOS Management. Travel expenses need to be broken out from labor expenses in the monthly performance reports.
Purchases can also be made to support requirement needs of ITOS customers. Purchase expenses need to be broken out from labor expenses in the monthly performance reports.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

### Weekly status report

The contractor shall generate Performance Reports every week. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.
The contractor shall report status in person or via teleconference to the TM or designated alternates on a monthly basis. Reports shall include informal presentation of interim results, status of development activities, and action item status. The contractor shall provide all reports at least one day in advance of the monthly meeting via email, and maintain an email distribution list with the concurrence of the TM. The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.
There will not be any handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

None

# 3004 GMSEC Ground Software Systems Support

Date: October 21, 2019
Task Monitor (TM): Barbara Medina
Contract number: NNG15CR67C
Contract SOW Reference: 4.3 Ground Software and Systems

## Scope

Background – The Goddard Mission Services Evolution Center (GMSEC) mission is an integrated effort across multiple GSFC organizations to provide GSFC mission services. GMSEC provides mission enabling, cost reducing, and risk reducing data system solutions applicable to current and future missions managed by GSFC. GMSEC will enable the continued recognition of GSFC as a leader in space mission expertise and services. GMSEC is composed of architecture, a set of core software components, and interface standards that together address many of the problems associated with developing and efficiently operating complex and long-term software systems.
Summary of work – The task is to provide sustaining engineering and development support for the GMSEC in-house components for Earth Science Mission Operations (ESMO), Space Science Mission Operations (SSMO), and the Air Force.
Required skills/knowledge –
Good knowledge of the software development process
Good knowledge of MySQL and/or Oracle database
Good knowledge of XML
Good knowledge of Web service interface
Graphical user interface design and implementation experience
Strong command of Java and C/C++
Knowledge of Perl helpful but not required
Experience working with JNI (Java Native Interface) desired
Proficient knowledge of shell scripting language, and Linux operating system
Proficiency with an integrated development environment (IDE) such as Eclipse or NetBeans.

## Period of Performance

The period during which the work for this task shall be performed is from task award through March 31, 2021.

## Subtask Description

3004.01 – GMSEC Multi-Mission Support
The contractor shall provide overall GMSEC support to all GMSEC customers. Customers include: Air Force, ESMO, and SSMO Projects. Other support includes: supporting System Testing prior to each major release, generation of release documentation, support of audits, any customer support via email, phone, meetings, etc. not specific to a subtask listed below, attending weekly developers meeting, participating in configuration management and requirements management activities, completing mandatory training, preparing status

reports, attending product demonstrations, etc. Also, at a low level, support other customers as needed and as directed by project management.

The contractor shall also provide support for systems engineering. Technology and architecture studies shall be performed to help form the future direction of GMSEC, specifically in the areas of Enterprise support and the use of Service interfaces. General inquiries as to how GMSEC could be applied to meet the needs of various groups will be answered. These studies shall typically be of short duration, typically one week or less, and shall respond to issues raised to the Project Manager level.

3004.02 – Air Force Support

Subtask ended

3004.03 – Earth Science Mission Operation (ESMO) Support

Subtask ended

3004.04 – Space Science Mission Operation (SSMO) Support

Subtask ended

3004.05 – Telemetric and Command Exchange (XTCE) Support

This area of support provides leadership support for the advancement of the CCSDS XTCE standard and the related tailoring of the standard known as XUSP or "GOVSAT". Involvement shall include participation in monthly international telecons, the completion of formal XTCE documents and their submittal to the OMG or CCSDS review system (contractors must take the CCSDS documentation process class prior to submitting any documents). Contractor shall also respond to inquiries from both internal NASA missions and external organizations for information or clarification regarding XTCE and XUSP. The contractor shall also provide development and maintenance support of XML Telemetric and Command Exchange (XTCE) tools. Main activities include analyzing discrepancy reports or requirements, generating design, implementing code fixes or enhancements, testing, and providing all required documents according to NPR 7150.2.

3004.06 – WOSS Auto Testing Support

Subtask ended

3004.07 – JPSS Trade Study Support

The Goddard Mission Services Evolution Center (GMSEC) team shall serve as subject matter experts and prototype development team members in a collaborative effort investigating specific potential benefits of applying GMSEC-based open-system concepts to the Joint Polar Satellite System (JPSS) ground system.

The goal of the effort is to support the determination, by JPSS ground system management, of the most appropriate level of component interaction and standard message exchange to potentially increase the level of ground system situational awareness and automation within the JPSS ground system. The GMSEC team will also serve as open architecture and GMSEC subject matter experts. Topics covered include the capabilities and use of the GMSEC Application Programming Interface (API) and components to meet the JPSS requirements and related experiences with other missions with similar needs.

There are no deliverables for subtask 7 for this modification.

# SES II Task Order SOWs

## Deliverables/Schedules/Milestones

| Ref# | Deliverables | Subtask, if applicable | Due Date |
|---|---|---|---|
| 1 | Status Reports | | Weekly |
| 2 | Participate in team meetings | | As required |
| 3 | Support mission studies, prototyping, and customer help requests | 1 | As required |
| 4 | Update customer support logs | 1 | As Required |
| 5 | GMSEC 2018 Fall Release (Development, Testing and Documentation) | 1 | December 2018 |
| 6 | GMSEC 2019 Spring Release (Development, Testing and Documentation) | 1 | TBD, as defined by TM |
| 7 | GMSEC 2020 Release (Development, Testing and Documentation) | 1 | TBD, as defined by TM |
| 8 | GMSEC 2021 Release (Development, Testing and Documentation) | 1 | TBD, as defined by TM |
| 9 | Patch Releases (Core, GSS, Component) | 1 | As Requested |
| 10 | New Technology Report (NTR) | 1 | As Required |
| 11 | Support GMSEC XTCE utility library | 1 | Thru end-of-task |
| 12 | The contractor is required to submit preliminary findings, discrepancy report and project specific presentation as specified in the specific testing schedule. | 1 | As Requested |
| 13 | Short Technical Studies | 1 | As needed |
| 14 | GMSEC document set update; including interface specification and architecture document | 1 | As needed |
| 15 | Public website review and update | 1 | Every 6 months |
| 16 | Update software catalog | 1 | Annually, in August |
| 17 | New component requirement development | 1 | As needed |
| 18 | GMSEC portable demo / training system update | 1 | January 2019 |
| 19 | Draft Updates to CCSDS XTCE Green Books | 5 | February 2019 |
| 20 | Final submission of CCSDS XTCE Green Books | 5 | July 2019 |
| 21 | OMG XTCE/XUSP Updates | 5 | March 2019 |
| 22 | Draft OMG XUSP Update | 5 | February 2020 |
| 23 | Final XTCE Green Book | 5 | January 2020 |

| | | | |
|---|---|---|---|
| 24 | End-of-Task Report | | End-of-Task |
| | | | |
| | | | |

## Management Approach

Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

Configuration Management
Systems and documents will be covered under the GMSEC Configuration Management Plan, which is Section 6.2 of the GMSEC Software Management Plan/Product Plan.

Facilities
Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
NOTE: Each Task Order should have specific performance metrics and should be detailed in the SOW. Examples of performance metrics could be:

- Actual Milestone Progress vs Planned/Scheduled
- Actual vs Planned Costs
- Quality of Technical Performance
- Contractor Communication
- Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

Travel may be proposed for special training needs and other engineering support task activities as directed by the GMSEC Project Management.
Possible travel of up to three GMSEC team member to Kirtland AFB (New Mexico), Colorado (Colorado Springs) or California (Los Angeles) (up to 5 days). The purposes of these trips are to support the Air Force at the identified facilities for installation, development and testing of GMSEC software.
Possible travel for up to two team members for the Object Management Group (OMG) Technical meetings in:
March 23-27, 2020, Reston, VA
Possible travel and associated conference for up to two team members for the following conferences:
Ground Systems Architecture Workshop (GSAW), March 2-5, 2020 and TBD 2021, Los Angeles, CA

Possible travel of up to 2 contractors, support subtask 0007, to Aurora, CO in June 2018. The purpose of this trip is to assist with getting prototype working at JPSS contractor facility.
Procurement to include: supporting interface hardware and equipment as needed to meet requirements.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

Weekly status report

The contractor shall generate Performance Reports every week. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall

provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.
The contractor shall report status in person or via teleconference to the TM or designated alternates on a monthly basis. Reports shall include informal presentation of interim results, status of development activities, and action item status. The contractor shall provide all reports at least one day in advance of the monthly meeting via email, and maintain an email distribution list with the concurrence of the TM. The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.
There will not be any handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

| | |
|---|---|
| NPR 7150.B | NASA Software Engineering Requirements |
| GPR 7150.1 | Goddard Software Engineering Requirements |

## References

None

## 3006 NTGSE Ground Software Systems Support

Date: August 30, 2018
Task Monitor (TM): Ryan Detter / 583
Contract number: NNG15CR67C
Contract SOW: 4.3

### Scope

Background - Over the past 15 years, the government /contractor team has developed a software tool capable of being used to test and simulate all aspects of a spacecraft. The NTGSE can be used at board level to control individual bits and signals to control power supplies and other peripheral used at this level. At box level, the NTGSE can simulate the entire spacecraft to any flight box with all the necessary interfaces and the capability to control and monitor all inputs and outputs as well as necessary peripheral, such as power supplies, load boxes, scopes, etc.

The NTGSE is a Windows PC application that provides core services which are common to all Ground Support Equipment (GSE) software applications (Bench Test, Instrument & S/C simulators). These core services include a command & telemetry database with conversion to engineering units, limit checking, multiple display pages, strip charts, event and data logging, and scripting (aka "procedures"). The NTGSE software provides the capability to create GSE application with specific Dynamic-link Library (DLL) for different interfaces (MS1553, SpaceWire, GPIB).

In addition to NTGSE, the ELVIS software is being developed to provide a similar simulator solution tailored specifically for ELC missions that will reside on the international space station.

Summary of work - The task is to provide software development and sustaining engineering support, along with technical support, pertaining to the NTGSE and ELVIS software systems to the following missions/projects: GPM, ATLAS IIS, GEDI FSW, LIC, XRISM, and ATLAS Science.
This includes:
Obtain and analyze information/products required to effectively plan development activities.
Work with the project representatives to define and understand project-specific requirements.
Work with the project team to define hardware specifications for any required hardware.
Implement, test, and deploy new features.
Provide bug fixes or additional development support for the project, as requested.
Provide NTGSE/ELVIS training, as requested.
Report and track issues pertaining to NTGSE system development.

Provide version management of NTGSE hardware, software, and associated products using the Code 580 software development environment and version management tools.
Provide support for I&T testing and verification, as requested.
Support planning, testing and operation of mission control centers and mission launch activities.
Create and update design and maintenance documentation as required.
Formal delivery of NTGSE/ELVIS releases (software and associated documentation) to Code 583 and the supported missions.
Code 583 will also be provided the NTGSE/ELVIS software source code
Missions will be only be provided the NTGSE/ELVIS executable software
Support required NTGSE/ELVIS related project meetings.
Software to be compliance with NASA Procedural Requirements NPR-7150.2A.
Establish and update NTGSE/ELVIS software configuration management (CM) procedures
The contractor shall participate in customer meetings and reviews as necessary.

Required skills/knowledge
Good knowledge of the NTGSE/ELVIS Ground Software System, including the architecture, the software structures and the internals.
Proficient knowledge of the Windows operating system.
Proficient knowledge of the C computer language.
Familiar with the design and development requirements of the various missions to be supported in this task.

## Period of Performance

The period during which the work for this task shall be performed is from task award through November 30, 2019.

## Subtask Description

3006.0001 – Multi-Mission Support
The contractor shall provide general NTGSE/ELVIS support that includes activities that benefit all NTGSE/ELVIS customers. Examples include: supporting System Testing prior to each major release, generation of release documentation, support of audits, any customer support via email, phone, meetings, etc. not specific to a subtask listed below, attending weekly developers meeting, participating in configuration management and requirements management activities, completing mandatory training, preparing status reports, attending product demonstrations, etc.

3006.0002 –GPM Support
The contractor shall provide NTGSE/ELVIS engineering and user support to the various Global Precipitation Measurement (GPM) Labs and to support GPM I&T activities. Main activities include the delivery of NTGSE/ELVIS workstations, configuration of such workstations, and help desk support involving the usage of the NTGSE/ELVIS software. Post launch support will continue for the flight software lab and FLATSAT.

# SES II Task Order SOWs

3006.0003 –MMS Support
The contractor shall provide NTGSE/ELVIS engineering and user support to the various Magnetospheric Multiscale (MMS) Mission (MMS) Labs and to support MMS I&T activities. Main activities include the delivery of NTGSE/ELVIS workstations, configuration of such workstations, and help desk support involving the usage of the NTGSE/ELVIS software. Post launch support will continue for the flight software lab and FLATSAT.

3006.0005 – ICESat-2/ATLAS Simulator Support
The contractor shall provide NTGSE engineering and user support to the Ice, Cloud, and land Elevation Satellite-2 (ICESat-2) - ATLAS Instrument Interface Simulator project. Main activities include the delivery of NTGSE workstations, configuration of such workstations, and help desk support involving the usage of the NTGSE software. It's required that the staff provided have intimate knowledge of the systems that ATLAS uses, how they're used, and any specialized code or applications required within ATLAS.

3006.0006 –SDO Support
The contractor shall provide NTGSE/ELVIS engineering and user support to the various Solar Dynamic Observatory (SDO) Labs and to support SDO I&T activities. Main activities include the delivery of NTGSE/ELVIS workstations, configuration of such workstations, and help desk support involving the usage of the NTGSE/ELVIS software. Post launch support will continue for the flight software lab and FLATSAT.

3006.0007 – GEDI FSW Support
The contractor shall provide ELVIS engineering and user support to Global Ecosystem Dynamics Investigation Lidar (GEDI) FSW lab. Main activities include developing and testing ELVIS Software updates, the delivery of ELVIS workstations and/or racks, configuration of such workstations, and help desk support involving the usage of the ELVIS software.

3006.0008 – LIC Support
The contractor shall provide NTGSE engineering and user support to the Lunar IceCube (LIC) project. Main activities include the delivery of NTGSE workstations, configuration of such workstations, and help desk support involving the usage of the NTGSE software.

3006.0010 – RRM3 Support
The contractor shall provide ELVIS engineering and user support to Robot Refueling Mission 3 (RRM3). Main activities include developing and testing ELVIS Software updates, the delivery of ELVIS workstations and/or racks, configuration of such workstations, and help desk support involving the usage of the ELVIS software.

3006.0011 – XRISM Support
The contractor shall provide GSE (NTGSE) engineering and user support to X-ray Astronomy Recovery Mission (XRISM). Main activities include developing and testing NTGSE Software updates, the delivery of NTGSE workstations and/or racks, configuration of such workstations, and help desk support involving the usage of the NTGSE software.

# SES II Task Order SOWs

3006.0012 – ATLAS Science Support
The contractor shall provide GSE (NTGSE) engineering and user support to the ATLAS IIS Science team. Main activities include developing and testing NTGSE Software updates, the delivery of NTGSE workstations and/or racks, configuration of such workstations, and help desk support involving the usage of the NTGSE software

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| | Provide ongoing support for GPM | November 2019 |
| | Provide ongoing support for the ATLAS IIS | November 2019 |
| | Provide ongoing support for GEDI FSW | November 2019 |
| | Provide ongoing support for LIC | November 2019 |
| | Provide ongoing support for XRISM | November 2019 |
| | Provide ongoing support for the ATLAS Science | November 2019 |
| | Status Reports | Weekly |
| | Performance Reports | Monthly |
| | End-of-task Report | End of task |
| | Report customer support logs with LOE | Monthly |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. The skill mix should consist of software engineers that have a good working knowledge of the NTGSE/ELVIS systems and some actual experience with mission support in the area of component development, integration and test. Due to the amount of work to be done in the coming year, it is anticipated that it will require a staffing profile to be a combination of Senior and Junior Software Engineer(s).

### Configuration Management

Systems and documents will be covered under the Branch Configuration Management Plan.

### Facilities

The main facilities for this task are Building 23 Room E-441 and Building 23 Room E-218. However, due to cost considerations when there is no flight hardware available for testing, for certain deliveries end-to-end testing will occur at the customer's site.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the NASA Technical Monitor and will be based on technical merit. The following performance metrics shall be used in the technical evaluation of task performance:
Functionality
Number of software requirements
Number of requirements in completed releases (planned vs. actual)
Quality
Status of requirements validation
Number of DR/ERs (new, open, closed, severity)
Progress
Software delivery dates (planned vs. actual)
Software characteristics
Project name
Language
Number of source lines of code (SLOC) (new, modified, reused)
Support
The amount of time spent on help desk / trouble shooting / anomaly analysis support.

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

For ATLAS IIS, possible travel of one or two NTGSE team member to Orbital Sciences Corporation in Gilbert Arizona in January 2019 (5 days), and May 2019 (5 days). The purposes of these trips are for installation of software updates, and supporting interface testing.

## Work Location

This work shall be performed primarily on-site at the Goddard Space Flight Center. Software development activities will be performed at the facilities mentioned above. Various support/maintenance activities will be performed at various labs for each supported mission as specified in Subtask section.

# SES II Task Order SOWs

## Reporting Requirements

### Weekly status report

The contractor shall generate weekly Performance Reports. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall report status in person or via teleconference to the TM or designated alternates on a monthly basis. Reports shall include informal presentation of interim results, status of development activities, and action item status. The contractor shall provide all reports at least one day in advance of the monthly meeting via email, and maintain an email distribution list with the concurrence of the TM. The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

None

# SES II Task Order SOWs

## 3007 ASIST/FEDS/NTGSE Ground Software Systems Support

Date: November 5, 2019
Task Monitor (TM): Ryan Detter
Contract number: NNG15CR67C
Contract SOW Reference: 4.3 Ground Software and Systems

### Scope

Background – The Advanced Spacecraft Integration and System Test (ASIST)/ Front End Data System (FEDS) ground system was developed at the Goddard Space Flight Center in the early 1990's, initially to support the XTE and TRMM missions during the Integration and Test (I & T) phase of the missions. Since then it has been used as the Telemetry and Command (T & C) system for the FUSE, IMAGE, EO-1, MAP and ST-5 missions, not only for I & T but also for operations.

The NTGSE is a Windows PC application that provides core services which are common to all Ground Support Equipment (GSE) software applications (Bench Test, Instrument & S/C simulators). These core services include a command & telemetry database with conversion to engineering units, limit checking, multiple display pages, strip charts, event and data logging, and scripting (aka "procedures"). The NTGSE software provides the capability to create GSE application with specific Dynamic-link Library (DLL) for different interfaces (MS1553, SpaceWire, GPIB).

In addition to NTGSE, the ELVIS software is being developed to provide a similar simulator solution tailored specifically for ELC missions that will reside on the international space station.

Summary of work – The contractor is to provide technical and developmental support pertaining to the ASIST/FEDS Telemetry and Command (T & C) system and NTGSE product to the following missions: RESTORE-L, SDO, JWST, GPM, MMS, WFIRST, GEDI, XRISM, PACE/OCI, and WFIRST MOC.
Required skills/knowledge -
Good knowledge of the ASIST/FEDS Ground Software System and NTGSE, including the architectures, the software structures and the internals.
Proficient knowledge of the Linux and Windows operating systems.
Proficient knowledge of the C and Java computer languages.
Familiar with the design and development requirements of the various missions to be supported in this task.

### Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2021.

# SES II Task Order SOWs

## Subtask Description

3007.0001 – Multi-Mission Support
The contractor shall provide general ASIST/FEDS/NTGSE support. Examples include: supporting System Testing prior to each major release, generation of release documentation, support of audits, any customer support via email, phone, meetings, etc. not specific to a subtask listed below, attending weekly developers meeting, participating in configuration management and requirements management activities, completing mandatory training, preparing status reports, attending product demonstrations, etc.

3007.0002 – RESTORE-L FSW
The contractor shall provide ASIST ground system engineering and user support for, the RESTORE-L FSW lab. Main activities include the delivery of ASIST workstations, configuration of such workstations, and help desk support involving the usage of the ASIST ground system.

3007.0003 – SDO Support
The contractor shall provide ASIST ground system engineering and user support for the Solar Dynamics Observatory (SDO) project on a maintenance basis – providing help desk support such as anomaly analysis and software updates to address user problems.

3007.0004 – JWST Support
The contractor shall provide ASIST ground system engineering and user support for the James Webb Space Telescope (JWST) project on a maintenance basis, mainly help desk and anomaly analysis for the JWST FSW Lab, the JWST ICDH Lab, the JWST OSIM Lab and the JWST SIDECAR Lab.

3007.0007 – GPM Operations Support
The contractor shall provide ASIST/FEDS ground system engineering and user support for GPM Operations with regard to resolution of anomalies, addressing discrepancy reports, enhancement requests and the automation of operations.

3007.0008 – MMS Operations Support
The contractor shall provide ASIST/FEDS ground system engineering and user support for MMS Operations.

3007.0014 – WFIRST Support
The contractor shall provide ASIST ground system engineering and user support for development for spacecraft subsystems and hardware (e.g. FPGA development) for the WFIRST Project.

3007.0018 – PACE/OCI
The contractor shall provide ASIST ground system engineering and user support for PACE/OCI. Main activities include the delivery of ASIST workstations, configuration of such workstations, and help desk support involving the usage of the ASIST ground system.

# SES II Task Order SOWs

3007.0019 – WFIRST MOC
The contractor shall provide ASIST ground system engineering and user support for WFIRST MOC. Main activities include analysis of requirements, the delivery of ASIST workstations, configuration of such workstations, and help desk support involving the usage of the ASIST ground system.

## Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports (Given Orally at the Weekly ASIST/NTGSE Status Meetings) | Weekly |
| 2 | Performance Reports | Monthly |
| 3 | FEDS 12.0 – General Release (Development, Testing and Documentation) | December 2019 |
| 4 | ASIST 21.1 – General Release (Development, Testing and Documentation) | March 2020 |
| 5 | FEDS 12.1 – General Release (Development, Testing and Documentation) | July 2020 |
| 6 | ASIST 21.2 – General Release (Development, Testing and Documentation) | November 2020 |
| 7 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. The skill mix should consist of software engineers that have a good working knowledge of the ASIST/FEDS/NTGSE systems and some actual experience with mission support in the area of component development, integration and test, and operations. Since ASIST, FEDS , and NTGSE are multi-process software systems, expertise of the Linux and Windows operating systems down to the driver level are required, as some of the missions supported are state-of-the-art technologies such as data rate of Gigabits per second and huge searchable spacecraft telemetry archives.

### Configuration Management
Systems and documents will be covered under the ASIST Configuration Management Plan, which is Section 6.2 of the ASIST Software Management Plan/Product Plan.

### Facilities
The main facility for this task is the ASIST Development Lab, Bldg 23, C-246. However, due to cost considerations, there are no flight hardware in the ASIST Lab, so for certain deliveries, end-to-end testing will occur at the customer's site instead of the ASIST Development Lab. For example, end-to-end testing of software delivered to a Flatsat Facility will need to be run on the receiving Flatsat Facility, or testing with the Deep Space Network (DSN) of JPL must necessarily be performed at the Missions Operations Centers where there is a direct connection to the DSN.

# SES II Task Order SOWs

Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM. Some of the supported missions have deadlines such as launch dates and shipping of hardware from GSFC to external facilities so any failure to deliver ASIST/FEDS/NTGSE technical support will have disastrous results causing possible missing project milestones or causing budget over-runs.

Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW. The main performance metrics will be the delivery of the following software deliveries: (1) FEDS 12.0; (2) ASIST 21.1, (3) FEDS 12.1, (4) ASIST 21.2 and (5) WFIRST HSDI software updates. Each of the releases will be graded separately as to the promptness of deliveries, the success/failure in addressing outstanding software bugs, and overall customer satisfaction.

ASIST users can submit User Problem Reports (UPR's) via the Code 580 JIRA website. Metrics for the number of UPR's submitted, the number of UPR's being fixed and the number of UPR's pending resolutions will be kept on a monthly basis.

Since some missions have evolving requirements, we will keep track of requirement changes on a quarterly basis.

For new missions, the number of ASIST, FEDS, NTGSE or DHDS workstations delivered to those missions will be tracked as a performance metric.

Since ASIST/NTGSE are using the Maintenance Life Cycle, significant amount of effort is expended on help desk / trouble-shooting / anomaly analysis support. The amount of time spent on such maintenance effort will be a monthly metric.

Government Furnished Facilities, Equipment, Software and Other Resources

The government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

# SES II Task Order SOWs

ASIST-SAP-001 The ASIST Software Assurance Plan

## ODC (Travel and Procurement)

In general the missions that ASIST/NTGSE support purchase their own hardware and software. The ASIST Team usually provides consultant support to the missions on exactly what hardware and software to purchase; it is not anticipated that hardware or software utilizing the SES II Contract will be needed.

## Work Location

The work shall be performed exclusively on-site at the Goddard Space Flight Center, including the ASIST Lab (Building 23, Room C246), various labs of the missions that the ASIST Team supports, as well as on-site offices provided to the ASIST Team.

## Reporting Requirements

### Weekly status report

The contractor shall report orally the status of the task every week during the weekly ASIST/NTGSE Status Meeting. The report shall include a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks, customer meetings and any outstanding issues, which will be captured in the meeting minutes.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in via the 533M Report. The contractor, including subcontractors, shall be available to attend weekly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPR 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will not be any handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.2A NASA Software Engineering Requirements

GPR 7150 Goddard Software Engineering Requirements

ASIST-SMP-001 The Advanced Spacecraft Integration and System Test (ASIST) Software Management Plan / Product Plan (SMP/PP)

## References

None.

## 3012 EGSE Software Support for WFIRST

Date: August 28, 2019
Task Monitor (TM): Andrew Aylward
Contract number: NNG15CR67C
Contract SOW Reference: 4.3 Ground Software and Systems

### Scope

Background - this task provides software engineering labor to support the development, test, and delivery of the Electrical Ground Support Equipment (EGSE) for the WFIRST Project. This task also a person to serve as the WFIRST liaison to the NCCS group that will be responsible for science data storage and distribution
Summary of work – this task provides labor to cover software engineering support during the Period of Performance
Required skills/knowledge
General
Experience with Linux Operating Systems
Experience with the development of EGSE to support flight system testing
Experience with Subsystem and Observatory I&T
Subtask 0
Experience with C programming
Knowledge of MIL-STD-1553 and SpaceWire
Experience with ASIST Ground System
Subtask 1
Experience with GIT and Ansible for maintaining configuration management of the EGSE Software
Experience with Linux OS
Knowledge of GSFC on-center network architecture

### Period of Performance

The period during which the work for this task shall be performed is from task award through September 30, 2020.

### Subtask Description

Subtask 0: Development of EGSE Software that will serve as the application software for all EGSE deliverables used on the WFIRST Project

Subtask 1:
Serve as the WFIRST liaison to the NCCS group that will be responsible for science data storage and distribution:

# SES II Task Order SOWs

Data Transport - monitor the transfer of data from the DCL into the storage on ADAPT that the WFIRST project is purchasing.

Data Management - management of data generated by the scientists/engineers. NCCS and WFIRST support staff will work together on a Data Management plan, particularly for data resident at NCCS (how long are the various kinds of data kept, on what kind of storage, and where/how the data would be transferred elsewhere as the project ends).

Virtual machines - work with WFIRST scientists/engineers to determine requirements for potential tailoring of WFIRST VM environments, and with NCCS on the solutions to implement them.

Application support - like the Virtual machines support, work with WFIRST scientists/engineers to determine what packages are needed, and help support them. E.g., build packages that can be done by non-privileged users, and help users with the packages, related trouble-shooting, etc.

Work with the WFIRST EGSE Software development team to configure and maintain systems that are part of the EGSE deliverables to the project

## Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly/Bi-weekly |
| 2 | Performance Reports | Monthly |
| 3 | End-of-task Report | End of task |
| 4 | Software for the WFIRST C&DH EGSE which supports:<br>ASIST Interface software – Be able to support multiple connections and protocols<br>FEDS Interface Software<br>VISA Interface Software for controls of all power supplies or misc GSE though Ethernet or USB | End of Period of Performance |
| 5 | Software for the SpW EGSE for L3 Harris | Spring 2020 |
| 5 | Software for the WFIRST WFI FPS EGSE | End of Period of Performance |
| 6 | Software for the WFIRST WFI IC&DH EGSE & FSW Test Strings | End of Period of Performance |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

# SES II Task Order SOWs

## Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan

## Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

## Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

## Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Performance metrics shall include:
Percent completion of subtask
Planned versus actual
Delivery dates

## Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

## Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

| Location | Duration | Number of People | Frequency |
|---|---|---|---|
| JPL for WPC EGSE Delivery Support | 5 days | 1 | Once |
| L3 Harris (Rochester, NY) for SpW EGSE Support | 5 days | 1 | Once |

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

### Weekly or Bi-weekly status report

The contractor shall generate Performance Reports every week or bi-weekly. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall report status in person or via teleconference to the TM or designated alternates on a monthly basis. Reports shall include informal presentation of interim results, status of development activities, and action item status. The contractor shall provide all reports at least one day in advance of the monthly meeting via email, and maintain an email distribution list with the concurrence of the TM. The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. There will not be any handling of classified data.

# SES II Task Order SOWs

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

# SES II Task Order SOWs

## 3014 General Mission Analysis Tool (GMAT) Development

Date: 11/22/19
Task Monitor (TM): Steven Cooley
Contract number: NNG15CR67C
Contract SOW Reference: 4.3 Ground Software and Systems

## Scope

Background – As described on the project Wiki, http://gmatcentral.org/, the General Mission Analysis Tool (GMAT) is a comprehensive ground navigation and mission design software tool. This statement of work describes support for testing, documentation, systems engineering support, and software development for GMAT.
Summary of work – New GMAT features will be developed or enhanced and selected bugs will be fixed.
Required skills/knowledge
Navigation Software Development Subtask: This sub-task shall be staffed with personnel that have advanced working knowledge of C++ and software engineering practice and have experience in flight dynamics and navigation.
API Development and Build System Maintenance Subtasks: This sub-task shall be staffed with personnel that have advanced working knowledge of C++ and software engineering practice.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2021.

## Subtask Descriptions

### Sub-Task 0: Navigation Software Development

The main focus of this subtask is to enhance the GMAT navigation software in preparation for operational use by the Fermi mission. For this subtask, the contractor shall
Develop GMAT s/w as described in the Deliverable section
Support development of GMAT documentation as needed
Provide C++ code walk-throughs and tutorials of the code developed as needed
Develop unit and regression tests for GMAT code as needed.
Support development of ongoing LRO OD enhancements needed during LRO operations using GMAT
Support Navigation refactorization effort
Support Kalman Filter (KF) and smoother development
Support the Fermi Gamma-ray Space Telescope use of GMAT for operational OD.
Support development of additional measurement data types as needed
Support development of additional measurement and process noise models as needed.
Support the use of GMAT for atmospheric density research.

# SES II Task Order SOWs

Support the development of improved GMAT SRP and drag models.
Develop a batch estimation capability for GMAT to perform OD for a data arc that includes maneuvers or other orbital perturbations. This shall include ability a stop/re-start integration capability for the time contained in the thrust history file.
Support SPAD long-term maintenance effort. Civil service personnel will provide support to describe the current operation of the SPAD software.
For this subtask, the contractor shall use processes defined in the GMAT Product Plan. In addition, the contractor will attend weekly GMAT Navigation meetings.

Subtask 1: N/A (no subtask 1)

Sub-Task 2: API Development

For this subtask, the contractor shall support integration of Monte and GMAT and development of the GMAT API. Under this task, those systems shall share key data, including ephemerides, covariance, and maneuver solutions, among others. GMAT developers will perform the majority of integration between GMAT and Monte, but will work with Monte developers for training and guidance. Note, the product of this work will not be used in the operational tool chain for O-REx; it will be used in shadow mode only. This effort will not affect the O-REx schedule of operations. Scope of the integration tasks are as follows
OREx Use Case Definition
MONTE Setup and Learning
MONTE GMAT Interface Definition
Data Interface Layer Definition and Coding
Test and Debug of initial interfaces
Ephemeris Sharing
GMAT → MONTE
MONTE → GMAT
Maneuver Plan Sharing
Covariance Sharing
OREx Demonstration
Agile high value features
Critical bug fixes
Documentation and Delivery Packaging

For this subtask, the contractor shall use processes defined in the GMAT Product Plan.

Sub-Task 3: Build System Maintenance

For this subtask, the contractor shall provide critical support of the build system as needed.
For this subtask, the contractor shall use processes defined in the GMAT Product Plan.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified, listed below by sub-task:

Sub-Task 1: Navigation Software Development

# SES II Task Order SOWs

| Ref# | Deliverables | Description/Comments | Due Date |
|---|---|---|---|
| 1 | Status Reports | Informal emails are acceptable. | Weekly |
| 2 | End-of-subtask Report | Written report. | End of task |
| 3 | Smoother | Code delivery of basic Fraser-Potter EKF smoother | 12/30/19 |
| 4 | Coeff. of Drag FOGM model | Code delivery of First Order Gauss Markov (FOGM) model including associated process noise | 2/30/20 |
| 5 | Coeff. of Drag Vasicek model | Code delivery of Vasicek model including associated process noise | 3/30/20 |
| 6 | High need features | Code delivery of high need features identified during 60 day Fermi OD comparison runs | 7/30/20 |
| 7 | Fermi Parallel ops build | Code delivery of build to use for Fermi parallel ops testing | 10/10/20 |
| 8 | Final Fermi build | Code delivery of build to use for Fermi operations | 11/10/20 |
| 9 | Support s/w bug fix and enhancements needed for LRO, Fermi, and other missions OD | Ongoing as issues arise during project support. | 3/31/21 |
| 10 | EKFS Code | Nav refactorization and EKFS code delivery | 3/31/21 |

Sub-Task 2: API Development

| Ref# | Deliverables | Description/Comments | Due Date |
|---|---|---|---|
| 1 | Status Reports | Informal emails are acceptable. | Weekly |
| 2 | End-of-subtask Report | Written report. | End of task |
| 3 | NESC Status Briefing | Prepare material for presentation with at least ephemeris sharing capability implemented. | 04/30/20 |
| 4 | Monte Data Interfaces | GMAT - Monte Data Interfaces Complete | 7/31/20 |

| | | | |
|---|---|---|---|
| 5 | NESC Status Briefing | Prepare material for presentation with data-level integration complete. | 8/31/20 |
| 6 | NESC Status Briefing | Prepare material for presentation. | 2/28/21 |

Sub-Task 3: Build System Maintenance

| Ref# | Deliverables | Description/Comments | Due Date |
|---|---|---|---|
| 1 | Status Reports | Informal emails are acceptable. | monthly |
| 2 | End-of-subtask Report | Written report. | End of task |
| 3 | Periodic Build System Updates as directed | Provide critical updates to Cmake files and dependency management scripts. | Ongoing |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

As mentioned in Section I, the Software Development sub-task will be staffed with personnel that have advanced working knowledge of C++ and software engineering practice and have experience in flight dynamics and navigation.

### Configuration Management

The contractor shall use the CM processes defined in the GMAT Product Plan.

### Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

### Government Furnished Facilities, Equipment, Software and Other Resources

None.

### Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products.

## ODC (Travel and Procurement)

There is no non-local travel for this SOW. Any required PRs for this work will be executed only with TM concurrence.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site) but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

The contractor shall report status on a weekly basis via updating appropriate JIRA tickets and via weekly emails. Reports shall include informal presentation of interim results, status of development activities, and status of risks, issues, and other action items. The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports. The contractor shall deliver all documents by committing them to the appropriate location in project version control systems. All bugs and software defects found during testing will be reported in the project's JIRA database.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will not be any handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract. In addition, the contractor shall adhere to the RIGHTS IN DATA – special works (FAR 52.227-17) as modified by NFS 1852.227-17. The contractor shall assign copyright to the U.S. Government for all source code contributions to allow the government to release that source code under Apache License 2.0.

## Applicable Documents

GMAT Product Plan
GMAT Test Plan
GMAT Functional Specifications

## References

None.

## 3015 BP Ground Node Software Systems Support

Date: October 4, 2019
Task Monitor (TM): Susanne Strege
Contract number: NNG15CR67C
Contract SOW Reference: 4.3 Ground Software and Systems

### Scope

Background – The Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission is implementing Delay Tolerant Networking (DTN) as a technology advancement and infusion effort. DTN Bundle Protocol (BP) will be the primary protocol available for the use in transmitting recorded Housekeeping (HK) data via S-band to the ground. DTN will also be used in the terrestrial transmissions of the Ka-band science data. DTN BP will be used to encapsulate the CCSDS File Delivery Protocol (CFDP) traffic for robust transmission.

The purpose of the DTN BP protocol is to provide an efficient and reliable means for implementation end-to-end communication across a network of nodes. BP operates above the data transport services provided by links or networks accessed via the Convergence Layer Adapters (CLAs) and forming a store-and-forward network. Key capabilities of the Bundle Protocol include:

Ability to cope with intermittent connectivity
Ability to take advantage of scheduled and opportunistic connectivity (in addition to 'always up' connectivity)
Custody transfer
Late binding of names to addresses

PACE will utilize Message Protocol Data Units (M_PDUs) as an encapsulation network stack layer beneath the DTN BP. The DTN BP layer will encapsulate CFDP PDUs, to maintain usage of CFDP for file reconstruction.

The Software Engineering Division (Code 580), Ground Software Systems Branch (Code 583) is developing a BP Ground Node to support the development, integration, and operations of NASA agency spacecraft and instruments that use BP such as the PACE mission. The Code 583 BP Ground Agent will serve as a bundle node. The CCSDS BP standard defines a bundle node as "any entity that can send and/or receive bundles." The Code 583 BP Ground Agent will provide the full set of bundle node capabilities to send and/or receive bundles in development labs, integration facilities, mission operation centers, and ground stations. The Code 583 BP Ground Agent will be composed of the three conceptual components that make up a bundle node:

Bundle Protocol Agent

# SES II Task Order SOWs

A set of zero or more convergence layer adaptors

Application Agent

PACE is the first flight mission to use BP at GSFC and is therefore the first targeted user of the Code 583 BP Ground Node. The Code 583 BP Ground Node must meet the needs of the PACE project while also providing a generic solution that can be used on future NASA missions.

Summary of work - the contractor shall provide ground systems and software engineering support for the Code 583 BP Ground Node requirements, design and development, verification, documentation, and maintenance efforts as well as customer support. The Code 583 BP Ground Node will be used as the bundle node in the PACE mission FSW development lab, I&T facilities, Mission Operations Center (MOC), and Near Earth Network Ground Stations. In addition the BP Ground Node will be used as the bundle node for future missions using BP.

The contractor will work with the BP Ground Node Product Development Lead (PDL) in the in the Ground Software Systems Branch as part of the BP Ground Node development team. The contractors will also provide software engineering support and development to all identified BP Ground Node customers on an "as identified" basis. Software development includes systems engineering, requirements analysis and definition, software design, code, unit-test, functional testing, integration test support, formal build testing, software documentation, presentations, demos, and reviews as requested by BP Node Agent PDL and/or identified BP Ground Node customers.

The contractor shall provide development support for the Code 583 BP Ground Node interfaces, including the interface to ITOS and NEN Programmable Telemetry Processor (PTP) and Monitor & Control (M&C) systems pertinent to the PACE Spacecraft. Main activities include:

Provide system administration and system engineering in accordance to NPR 7150.2B for the following:
BP Ground Agent Requirements Definition and Analysis
BP Ground Agent Detailed Design
BP Ground Agent Software Development
BP Ground Agent Testing
BP Ground Agent Integration
Provide software engineering support for BP Ground Node Build 2 implementations and testing based on customer requirements

Required skills/knowledge –
Good knowledge of the software development process and lifecycle
Good knowledge of XML
Good knowledge of JSON
Good knowledge of Web service interfaces

Graphical user interface design and implementation experience
Strong command of Java and C/C++
Proficient knowledge of shell scripting languages. Knowledge of Perl helpful but not required
Proficient knowledge of JIRA
Proficient knowledge of GitLab
Proficient knowledge of Linux operating systems i.e. Ubuntu, CentOS, and RedHat
Proficiency with an integrated development environment (IDE) such as Eclipse or NetBeans.
Requirement definition
Requirement analysis
Specifications and design
Software development, integration, and testing
Communication networks
CCSDS BP specification, including compressed bundle headers and aggregate custody signaling
CCSDS File Delivery Protocol (CFDP)
Interplanetary Overlay Network (ION)
Technical writing

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2021.

## Subtask Description

At this time there are no sub-tasks for this SOW.

## Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Working Group Team Meeting Inputs and Notes | As Required |
| 2 | Daily Standup Team Meeting Inputs and Notes | Daily |
| 3 | Performance Reports | Monthly |
| 4 | Assist PDL in build planning and scheduling | As Required |
| 5 | BP Ground Node Build 2 Sprint 2 Release (dev, testing, and docs) | 10/11/19 |
| 6 | BP Ground Node Build 2 Sprint 3 Release (dev, testing, and docs) | 11/1/19 |
| 7 | BP Ground Node Build 2 Sprint 4 Release (dev, testing, and docs) | 11/15/19 |
| 8 | BP Ground Node Build 2 Sprint 5 Release (dev, testing, and docs) | 11/29/19 |
| 9 | BP Ground Node Build 2 Sprint 6 Release (dev, testing, and docs) | 12/13/19 |

| | | |
|---|---|---|
| 10 | BP Ground Node Build 2 Sprint 7 Release (dev, testing, and docs) | 1/3/20 |
| 11 | BP Ground Node Build 2 Sprint 8 Release (dev, testing, and docs) | 1/17/20 |
| 12 | BP Ground Node Build 2 Sprint 9 Release (dev, testing, and docs) | 1/31/20 |
| 13 | BP Ground Node User's Guide Draft | 1/31/20 |
| 14 | BP Ground Node Build 2 Release (dev, testing, and docs) | 2/28/20 |
| 15 | BP Ground Node User's Guide Final | 2/28/20 |
| 16 | BP Ground Node Build 2.1 Release (dev, testing, and docs) | 3/31/20 |
| 17 | BP Ground Node Build 2.2 Release (dev, testing, and docs) | 4/30/20 |
| 18 | BP Ground Node User's Guide Updates | As Required |
| 19 | BP Ground Node Build 2 Requirement Updates | As Required |
| 20 | BP Ground Node Post Build 2 Maintenance | As Required |
| 21 | Support TEMPO DTN CDR EPR | 1/15/20 |
| 22 | Support PACE DTN CDR | 2/27/20 |
| 23 | Provide BP Ground Node Training | As Required |
| 24 | New Technology Report (NTR) | As Required |
| 25 | End-of-Task Report | End-of-Task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the BP Ground Agent Configuration Management Plan as defined in the BP Ground Agent Product Plan.

### Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The TM based on the technical merit will evaluate the work performed for this task. Technical evaluation of the task performance is a subjective combination of performance

metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW. Performance metrics include:

Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7150.2A NASA Software Engineering Requirements
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

There are no ODC's or IT acquisitions for this SOW.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

Weekly status report

The contractor shall generate Performance Reports every week. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

The contractor shall report status in person or via teleconference to the TM or designated alternates on a monthly basis. Reports shall include informal presentation of interim results, status of development activities, and action item status. The contractor shall

provide all reports at least one day in advance of the monthly meeting via email, and maintain an email distribution list with the concurrence of the TM. The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. This SOW is not involved in the handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements
Applicable Code 583 standards

## References

None

# SES II Task Order SOWs

## 4001 GOES N/O/P Project Mission Operations Services

Date: February 7, 2018
Task Monitor (TM): Steve Odendahl/584
Contract number: NNG15CR67C
Contract SOW Reference: 4.4 Flight System Verification, and Validation

| Mod # | Start | End | Brief Description |
|---|---|---|---|
| 0 | 4/1/2016 | 3/31/2017 | Initial Task Order Statement of Work |
| 1 | 4/1/2017 | 3/31/2018 | Extension of the Period of Performance, reduction in scope |
| 2 | 4/1/2017 | 3/31/2018 | Add in Hardware/Software ODCs, Replan Task |
| 3 | 4/1/2018 | 3/31/2019 | Extension of the Period of Performance no change in scope. |
| 4 | 8/16/2018 | 3/31/2019 | Admin mod to insert Ed Hicks as BH in TOMS |
| 5 | 4/1/2019 | 3/31/2020 | Extension of the Period of Performance; Change in scope. New TM inserted. |

### Scope

Background
The Contractor has established a support team at an offsite facility to provide services to the GOES Project at the NASA/Goddard Space Flight Center in conducting the GOES N-P Missions. The Contractor shall provide expertise in performing systems engineering services to sustain GOES N through P (N-P) operations. The Contractor shall use the computing resources of the Satellite Operations Control Center (SOCC) at NOAA in Suitland, Maryland, to support mission operations. The task activities are described below.
Summary of work
Key GOES N-P mission operations support tasks that shall be performed include, but are not limited to:
GOES N-P mission utilities development, training, and transition to the NOAA Office of Satellites and Product Operations (OSPO).
Anomaly and special event surge support.
Development of engineering procedures, user's manuals, and maintenance manuals for MOST provided tools.
Provide technical information transfer to NOAA O&M as necessary.
Training of NOAA OSPO operations and engineering personnel.
The Contractor shall provide personnel and facilities to perform the following functions:
Mission Operations Services Function: The Contractor shall provide personnel and facilities to perform the following functions.
Documentation Services
Produce and deliver Revised Training Plan as required
Training
Provide training on use of GOES Utilities Software Tools as required

# SES II Task Order SOWs

Deliverables/Milestones
GOES Tasks
Monthly status e-mail to the GOES Project ATR/TM.
GOES Architecture and System Engineering Support Function: This function includes the definition of potential architecture and mission ops evolution from the GOES N-P missions to the GOES R, as required.
Systems Engineering Function: The Contractor shall provide technical assistance to the NOAA Operations and Maintenance (O&M) team. The contractor shall perform all activities noted above, but will focus on the tasks listed below:
Continue knowledge transfer to NOAA O&M
Provide technical assistance to operation tools and maintenance.
Support the development of standard engineering procedures
Provide value added testing and training to the NOAA OSO Operations and Engineering group. This will strengthen the effectiveness of the operations branch.
Deliverables as required
Ground Systems Engineering Function: The Ground Systems Engineer (GSE) will provide support to transition software and tool maintenance to the NOAA Systems branch and continue to develop and integrate tools that are necessary to the operations of the GOES-NOP satellite constellation:
IGOES (Improved GOES MOST Utilities) – IGOES is the GOES-IM/NOP scripting and CCR tool that was developed by MOST. The GSE will continue ongoing maintenance and training. The GSE will develop a new Excel spreadsheet tool to replace the existing IGOES tool for future scripts generation.
Deliverables
Fix errors as required
Suggest modifications as required
Support development and testing as required
IGOES Replacement User's Manual
IGOES Replacement Software Development/Maintenance documentation
Flight Operations and Engineering Function: The contractor shall perform all functions mentioned in the summary, with an emphasis on the key tasks below:
Provide surge support for special events and anomalies
Continue knowledge transfer to the NOAA O&M team
Deliverables
Engineering plans and procedures - as required
Required skills/knowledge
In order to provide the system engineering and mission operations support the Contractor shall provide personnel with general knowledge and experience in mission systems engineering and mission operations for orbiting spacecraft. In addition the Contractor shall provide personnel with specific knowledge and experience with the GOES N-P mission systems engineering, mission operations, ground systems, and GOES N-P subsystems and instruments.

## Period of Performance

# SES II Task Order SOWs

The period during which the work for this task order shall be performed is from task award through March 31, 2020.

## Subtask Description

Not Applicable (No Sub-Tasks)

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Bi-Weekly Status Report - as a minimum, a summary of the weeks' highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings. | C.O.B. Tuesday every 2 weeks |
| 2 | Monthly Status Report-- Technical Accomplishments<br>Risk/problems and possible corrective actions<br>Special activities description for month<br>Summary of Mission activities, Operations Change Requests and Anomaly Summary | No later than the 15th day following the calendar month being reported |
| 3 | Monthly Financial Report-- Summary of Monthly Financial Status Corrective actions/Lessons Learned | No later than the 15th day following the calendar month being reported |
| 4 | Semi Annual Performance Reports --<br>Comprehensive explanation of 6 month results<br>Task order Cost Status | To coincide with 6 month Performance Period |
| 5 | Any Trip Reports | Monthly as Appropriate |
| 6 | Memoranda (white papers) to the GOES Project and ETD discipline organizations (as appropriate) providing detailed assessment of specific subsystem issues. | Monthly as Appropriate |
| 7 | Fast response memos/e-mails to the GOES Project and ETD discipline organizations providing summations of urgent subsystem issues. | As required on delivery |
| 8 | Revisions to Control Room Operations Handbook | As Required |
| 9 | Documentation Services | As Required |
| 10 | Training | As Required |
| 11 | End of Task Report | 5 days after completion/expiration of task |

## Management Approach

# SES II Task Order SOWs

Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

Configuration Management
Systems and documents will be covered under the Project Configuration Management Plan.

Facilities
Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics include:
Promptness of Deliveries
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management

# SES II Task Order SOWs

GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

| Location | Duration | Dates |
|---|---|---|
| Local Travel to NOAA Spacecraft Operations Facility (NSOF), Suitland, MD | N/A | N/A |
| Non-Local Travel as Requested by TM | As directed | TBD |
| Software license renewals as approved by TM | N/A | N/A |
| Contractor Office supplies and document reproduction while at the NOAA Spacecraft Operations Facility | N/A | N/A |
| Hardware/Software for use at the NOAA Spacecraft Operations Facility as approved by TM | As directed | TBD |

## Work Location

This work shall be performed at the contractor's facility and the NOAA Spacecraft Operations Control Center, Suitland MD. The Contractor may be required to perform some work at the Goddard Space Flight Center.

## Reporting Requirements

### Weekly or Bi-weekly status report

The contractor shall generate Status/Highlights Reports bi-weekly. The report shall include, as a minimum, a brief summary of the period's highlights and accomplishments, milestones achieved, schedule and deliverables status, risks, and customer meetings.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. There will be no handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

# SES II Task Order SOWs

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements
GOES N-P Mission Operations Plan
GOES N-P Spacecraft Operations Handbook

## References

None

# 4002 EOS AURA OMI Sustaining Engineering & Mission Operations

Date: August 1st, 2019
Task Monitor (TM): Johnny Medina
Contract number: NNG15CR67C
Contract SOW: 4.4 Flight System Verification and Validation

## Scope

Background

The purpose of this task is to continue the sustaining engineering support for the on-going instrument operation for the Ozone Monitoring Instrument (OMI) on the EOS Aura satellite. This task also defines systems engineering support to ESMO including anomaly resolution activities and special activities for the EOS Aura mission.

Summary of work

The purpose of this task is to provide contractor personnel, as needed, to support the on-going sustaining engineering efforts for the Ozone Monitoring Instrument System (OMIS) on the EOS Aura spacecraft during on-orbit operations. The OMIS consists of the foreign government-provided Ozone Monitoring Instrument (OMI) and the OMI Interface Adapter Module (OMI IAM).

Required skills/knowledge

Experience with end-to-end Ozone Monitoring Instrument System (OMIS) operational support.
Experience with OMIS instrument and mission operations support in the EOS Aura environment.
Experience with Interface Adaptor Module (IAM) design, operations, and ground support test equipment.
Experience with OMIS science instrument system and subsystem design, interface requirements, fabrication, and requirements analysis.
Experience with OMIS science data processing requirements and capabilities.
Experience with OMIS Stored Instruction Sequences (SIS)
Experience with the requirements and operations concept for the OMIS.

## Period of Performance

The performance period of this task is to start September 1st, 2019 and continue for 12 months to end on August 31st, 2020.

## Subtask Description—Not Applicable

## Deliverables/Schedules/Milestones

At a minimum, the contractor/sub-contractor team shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Bi-weekly Status Reports; Anomaly Reports (as needed) | Status bi-weekly via email to NASA TM; anomaly reports via phone/email |

| | | |
|---|---|---|
| | | ASAP to NASA TM |
| 2 | Performance and Status Reports | Monthly via email |
| 3 | Monthly IAM Performance Trend Charts/Report | Monthly via email |
| 4 | Monthly Financial (533) and Technical Progress Report | Monthly via email and presentation |
| 5. | Updated OMI SIS Tool & SIS Log Viewer databases | February, 2020 |

Bi-weekly Status Report (via E-mail); anomaly reports (as needed)
Monthly Performance/Status report, including instrument activity highlights, anomalies for the past month, and planned activities for the next month, including progress of system upgrade (any problems encountered/resolved, schedule, etc.)
Monthly IAM Performance Trend Charts/Report
d. Monthly Financial (533) and Technical Progress Report

## Management Approach

Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. See Section Ic above.

Configuration Management
Systems and documents will be covered under the NASA GSFC Code 428 EOS Mission Operations (ESMO) Project Configuration Management Plan.

Facilities
1. Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The NASA TM will evaluate the work performed for this task based on technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance

is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished instrument workstations. It shall be the contractor's responsibility to complete any GSFC- required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

There is no non-local travel anticipated for this task. However, travel may be proposed for special instrument interface engineering support task activities as directed by the TM

There is no procurement activity required for this period.

## Work Location

This work shall be performed primarily at the contractor's facility, but the contractor may be required to perform some work at the Goddard Space Flight Center.

## Reporting Requirements

Weekly or Bi-weekly status report

The contractor shall generate Performance Reports every week or bi-weekly and deliver to NASA via email. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

Anomalies: Contact NASA TM via phone/email ASAP, after the anomaly (on-orbit or ground system) is identified.

Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM, and deliver to the NASA TM via email by the 25$^{th}$ day of the month. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend status meetings, as directed by the TM.

The contractor shall also support the TM in the preparation of status reviews for internal funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports.

Monthly IAM Trend Reports

The contractor shall deliver monthly IAM performance trend reports to NASA TM via email.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall be knowledgeable and familiar with EOS Aura, OMI, and OMIIAM documentation and shall provide access to the OMI IAM documentation that was generated in support of Aura and OMI IAM development, testing, integration, and launch and on-orbit phases.

NPR 7150.2A NASA Software Engineering Requirements
GPR 7150 Goddard Software Engineering Requirements
NPG 2810.1A
TRW 026458: STORED INSTRUCTION SEQUENCE DESIGN DESCRIPTION DOCUMENT, LATEST REVISION
TRW 026478: INTERFACE CONTROL DOCUMENT FOR THE OZONE MONITORING INSTRUMENT (OMI) SYSTEM EOS COMMON SPACECRAFT PROJECT, LATEST REVISION
FOKKER SPACE RP-OMIE-OOOO-FS-119: OZONE MONITORING INSTRUMENT (OMI) COMMAND AND TELEMETRY HANDBOOK, LATEST REVISION
FOKKER SPACE RP·OMIE-OOOO-FS-096: OMI ELECTRICAL SPACECRAFT INTERFACE FUNCTIONS
FOKKER SPACE RP-OMIE-OOOO-FS-124: OMI OPERATIONS MODES DESCRIPTION REPORT
LITTON ADVANCED SYSTEMS 990639: EOS OZONE MONITORING INSTRUMENT {OMI) TO INTERFACE ADAPTER MODULE (OMI-lAM) INTERFACE CONTROL DOCUMENT (ICD), LATEST REVISION
LITTON ADVANCED SYSTEMS 990640: OMI SYSTEM COMMAND AND TELEMETRY HANDBOOK
LITTON ADVANCED SYSTEMS AM149-0215 (155): OMI SYSTEM OPERATIONS CONCEPTS DOCUMENT

GSFC 424-28-28-02: UNIQUE INSTRUMENT INTERFACE DOCUMENT (UIID) FOR THE OZONE MONITORING INSTRUMENT (OMI) SYSTEM - EOS CHEMISTRY PROJECT, LATEST REVISION

## References

EOS Aura, OMI, and OMI IAM Documents.
GSFC 420-05-04: Earth Observing System (EOS) Performance Assurance Requirements for EOS Common Spacecraft, January 3,1994
GSFC 424-11-13-06: MISSION ASSURANCE REQUIREMENTS FOR THE OMI IAM. LATEST REVISION
CCSDS 701.0-B-2: CONSULTATIVE COMMITIEE FOR SPACE DATA SYSTEMS (CCSDS) RECOMMENDATIONS FOR ADVANCED ORBITING SYSTEMS (AOS), NETWORKS AND DATALINKS: ARCHITECTURAL SPECIFICATION, NOVEMBER 1992.
MIL-STD- 1553B: MILITARY STANDARD DIGITAL TIME DIVISION COMMAND/RESPONSE MULTIPLEX DATA BUS, NOTICE 2, SEPTEMBER 8, 1986.
CCSOS 301.0-B-2: CONSULTATIVE COMMITIEE FOR SPACE DATA SYSTEMS (CCSDS) RECOMMENDATIONS FOR SPACE DATA SYSTEM STANDARDS, TIME CODE FORMATS, BLUE BOOK, APRIL 1990.
TIA/EIA-422- B: ELECTRICAL CHARACTERISTICS OF BALANCED VOLTAGE DIGITAL INTERFACE CIRCUITS, MAY 1994.
TRW C326377: MECHANICAL INTERFACE DRAWING (MID), EOS CHEM-1- OMI, LATEST REVISION.
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## 4004 LCRD Mission Support

Date: 09/11/2019
Task Monitor (TM): Glenn Jackson
Contract number: NNG15CR67C
Contract SOW Reference: 4.1 Software Systems Engineering, Studies and Analysis, 4.4 Flight System Verification, and Validation.

### Scope

Background – The Laser Communications Relay Demonstration (LCRD) mission will demonstrate optical communications relay services between GEO and Earth over an extended period. The mission will demonstrate optical communications technologies, concepts of operations, and advanced networking technologies applicable to both near earth and deep space missions; gain knowledge and experience base that will enable NASA to design, procure, and operate cost-effective future optical communications systems and relay networks. LCRD is considered a critical step of providing an optical communications service on Next Generation Tracking and Data Relay Satellites. The LCRD team is led by NASA's Goddard Space Flight Center and partners include JPL and MIT Lincoln Lab. LCRD will fly as a hosted payload.
The LCRD Project, Code 451 is responsible for the Mission Level Verification, and Validation of the LCRD payload and ground components. This includes operational concepts analysis, requirements, plans, schedules, and documentation for planning, conducting, and evaluating spacecraft operations. The planning, coordination of end-to-end testing. The Pre-Launch end-to-end simulations of Launch and early Orbit Scenarios, as well as ensure launch readiness of ground and flight systems.

Summary of work
The contractor shall provide support for the Mission Level Verification, Validation testing effort through out the LCRD life cycle. Assume 10% Extended Work (overtime) as approved by the Technical Monitor. This includes:
Support Payload and Ground Segment's Verification and Validation testing. This includes operating the LCRD Ground Support Equipment (GSE), as required. A working knowledge of the LCRD GSE is required. Help configure and maintain the LCRD test areas (for ex. attention to lab space configurations, ESD control etc.), and ensure all personnel training certifications are up to date as required by the project. Assist in the staging and configuring of LCRD GSE and LCRD Software systems (flight and ground). Write, maintain, and close, as appropriate, all required documentation (ex. test plans, test procedures, logs, discrepancy reports, WOAs etc.). This involves work in secure government facilities.
Serve as Test Conductors (TC's) / Operators for LCRD. This includes define, write, and modify STOL procedures (and non-STOL procedures such as: MatLab, LabView, Perl, and Python), command and telemetry databases, page displays, and other workstation and operations software, as required. Maintain LCRD scripts and STOL procedures configuration management. This involves work in secure government facilities.
Provide LCRD Network support. This includes assist in establishing and maintaining the LCRD networks, as required, securing IP addresses, configuring the test network and the

GSE to the network, and serving as the network administrator. This involves work in secure government facilities.
Provide engineering support for LCRD. Provide support for the various reviews, as required (for ex. Critical Design Review, Pre-Environmental Review, Pre-Ship Review, and Mission Readiness Reviews). Provide engineering support for Mission Level Verification, and Validation of the LCRD payload and ground components (Payload expertise, Ground expertise, spacecraft operations, operational concepts, mission readiness tests, end-to-end testing, Pre-Launch, Launch and early Orbit support). This involves work in secure government facilities.

Required skills/knowledge –

## Period of Performance

June 1 2019 to May 31, 2020.

## Subt Task Description

4004 Main Task 0001 – Verification and Validation Support
~~The V~~erification and Validation Support subtask provides Payload and Ground ~~Segment's support, Test~~ Conductors (TC's) / Operators, network systems administration, and engineering support during the period of Payload & Ground testing, through Mission testing and Launch preparations phase.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified here:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Report | Weekly |
| 2 | Progress Report | Monthly |
| 3 | Monthly Financial Report | Monthly |
| 4 | End of Task Report | End of Task |
| 5 | STOL procedures, other procedures, other documentation (test plans, test reports etc.) | 2 weeks prior to need date (per LCRD schedule) |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

Facilities
The contractor will reside onsite and project will provide appropriate office and workstation accommodations with IT support to maximize productivity.

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics:
Planned versus actual progress
Delivery dates

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.
The contractor shall provide IT system administration services for the desktop computers utilized by the on-site contractor personnel assigned to this task.

Quality Assurance Requirements

The contractor providing technical services shall comply with all processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering
LCRD-SMA-REQ-0015 LCRD Payload Mission Assurance Requirements

## ODC (Travel and Procurement)

| Location | Duration | Dates |
|---|---|---|
| Las Cruces, NM [White Sands] | 10 days | 6/4/19 - 6/15/19 |
| Las Cruces, NM [White Sands] | 10 days | 7/5/19 – 7/15/19 |

| | | |
|---|---|---|
| Las Cruces, NM [White Sands] | 5 days | 10/5/19-10/10/19 |
| Dulles, VA [NGIS SV I&T] | 10 days | 8/6/19 – 8/17/19 |
| Dulles, VA [NGIS SV I&T] | 10 days | September 2019 |
| Maui, Hawaii | 12 days | Sept Oct 2019 |
| Dulles, VA [NGIS SV I&T] | 5 days | October 2019 |
| Dulles, VA [NGIS SV I&T] | 5 days | November 2019 |
| Dulles, VA [NGIS SV I&T] | 5 days | December 2019 |
| Dulles, VA [NGIS SV I&T] | 5 days | January 2020 |
| Dulles, VA [NGIS SV I&T] | 5 days | February 2020 |
| Dulles, VA [NGIS SV I&T] | 5 days | March 2020 |
| Dulles, VA [NGIS SV I&T] | 5 days | April 2020 |
| Dulles, VA [NGIS SV I&T] | 5 days | May 2020 |

Note: Travel dates and durations may vary per the LCRD Project Schedule.

## Work Location

The work shall be performed primarily on-site at the Goddard Space Flight Center, but the contractor may be required to perform some work at the contractor's facility, and other LCRD test sites such as White Sands NM and NGIS, Dulles VA.

## Reporting Requirements

The contractor shall provide weekly technical and monthly cost progress reporting to the TM in accordance with the WBS. See items reporting specified in section IV above.
Weekly status report - The contractor shall generate performance reports every week to the TM. The report shall include, as a minimum, a summary of the week's highlights and accomplishments, milestones/schedule/deliverables, future plans, and risks.
Monthly Progress Reports - The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.
The Contractor shall adhere to project requirements regarding ITAR related information, as controlled by the ITAR, 22 CFR 120-130, by the U.S. Department of State. Any transfer of controlled information to a foreign person or entity requires an export license issued by the U.S. Department of State or an ITAR exemption to the license requirement prior to the export or transfer.
Ability to handle classified material up to the Secret Security Clearance level, or above will be required.

# SES II Task Order SOWs

Some of the Contractors will require Secret Collateral Level Security Clearance or higher (TS/SCI clearance) with COMSEC and CRYPTO clearances.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

| | |
|---|---|
| LCRD-SMA-REQ-0015 | LCRD Mission Assurance Requirements |
| LCRD-PYLD-PROC-0020 | LCRD Configuration Management Procedure |
| LCRD-MINT-PLAN-0011 | LCRD Mission Integration & Test (MI&T) Plan |

## References

None

# SES II Task Order SOWs

## 4005 GOES-R Series Mission Operations Support Team

Date: December 21, 2018
Task Monitor (TM): Christopher Wheeler
Contract number: NNG15CR67C

### Scope

Background – The National Oceanic and Atmospheric Administration (NOAA) operates a system of Geostationary Operational Environmental Satellites (GOES) to provide continuous weather imagery and monitoring of meteorological and space environment data to protect life and property across the United States. The GOES-R series is the next generation of satellites within the GOES Mission and consists of the GOES-R/S/T/U satellites and ground systems. The GOES-R Program has established two projects; the Flight Project manages the Space Segment and the Ground Segment Project manages the Ground Segment. Additionally, the Government has formed a dedicated team focused on all aspects of missions operations, from pre-launch planning and development, through launch and orbit raising, post-launch test, and transition to sustaining operations. The Mission Operations Support Team (MOST) will consist of personnel from both Projects and be led by the GOES-R Series Mission Operations Manager (MOM).
Summary of work – The contractor shall provide engineering, analysis, and operations services to the GOES-R Series MOST in support of the GOES-R Flight Project at the NASA/Goddard Space Flight Center (GSFC) in conducting the GOES R/S/T/U missions. These services shall be provided at multiple locations that include contractor's facilities, GSFC, NOAA Satellite Operations Facilities (NSOF) and GOES-R system vendors' facilities as required. The MOST shall provide expertise in performing systems engineering services; provide technical expertise for the GOES R through U (R-U) instruments (Advanced Baseline Imager, Geostationary Lightning Mapper, Solar Ultra-Violet Imager, Extreme UV / X-Ray Irradiance Sensor, Space Environment In-Situ Sensor Suite, and Magnetometer), spacecraft, ground systems, and instruments of opportunity. The MOST will use the computing resources of the NOAA Satellite Operations Facility (NSOF) in Suitland, Maryland, to support mission operations.

Mission Operations Support Tasks – The MOST shall provide personnel and facilities to perform the following functions. Some travel is required to the spacecraft contractor's and instrument plants for conducting/participating in reviews, tests, etc.

Launch Preparation and Operations:
Develop and maintain Command Procedures
Develop and maintain Ground System Operating Procedures
Develop and maintain Telemetry Display Pages.
Develop Real-time plots on an as needed basis.
Develop and maintain pseudo telemetry definitions on an as needed basis.
Develop and maintain test and on-orbit scripts.
Develop and maintain Contingency Operations Procedures.
Develop Post-Launch Test (PLT) plans and scripts.
Plan and conduct mission simulations, rehearsals and training.
Conduct around-the-clock engineering and mission operations services during launch, orbit rising, and PLT and Post-Launch Product Testing (PLPT) operations.

# SES II Task Order SOWs

Provide engineering services in conducting PLT and PLPT test data analysis.
Provide cognizant engineering support for spacecraft subsystems supporting operations including the communication, power, thermal, instruments, image navigation and registration, telemetry and command, propulsion, and guidance, navigation, and control subsystems.
Provide sustaining engineering support to NOAA for on-orbit operations anomalies and special tests as required.
Provide on-console operations support to NOAA during the post-handover period

Spacecraft and Ground System Testing:
Plan and conduct GOES-R/S/T/U ground system end-to-end (ETE) tests with the spacecraft using the NSOF SOCC to send commands and process telemetry including developing the test plan, generating and validating the test script, configuring the Ground System, and directing the execution of the test.
Assist in integration, testing, and validating changes to the GOES-R Ground system.
Coordinate the use of ground system resources.
Perform Telemetry and Command Database Validation.

Operations Reviews and Working Groups Services/Coordination:
Participate in and coordinate Mission Readiness Working Group (MRWG).
Participate in and coordinate Operational Readiness Reviews (ORR).
Participate in and coordinate MOST inputs to External Independent Readiness Review (EIRR), if required.
Participate in MOST inputs to Network Operations Working Groups (NOWG).
Participate in and coordinate MOST inputs to Mission Operations Working Groups (MOWG).
Participate in and coordinate MOST inputs for all other reviews/working groups as needed.
Participate and coordinate MOST inputs for all End-to-End (ETE) Working Groups.
Participate and coordinate MOST inputs for all PLT Working Groups.
Participate and coordinate MOST inputs for all Project Monthly Status Reports (MSR) when scheduled.
Participate and coordinate MOST inputs for all COP Working Groups.
Participate as required in both the Spacecraft and Ground System GIR Board meetings.

Documentation Services
Produce and deliver mission operations procedures (CPs, scripts).
Produce and deliver operations review packages.
Produce and deliver Command Procedures Guidelines.
Produce and deliver a MOST Training and Certification Plan.
Produce and deliver Control Room Ops Handbook; Draft and Final.
Produce and deliver Post-Launch Test (PLT) Plan; Draft and Revision.
Produce and deliver spacecraft Contingency Operating Procedures (COPs)
Produce and deliver Post-Launch Test (PLT) Report
Produce and deliver a MOST Configuration Management (CM) Plan

Training
Provide training on spacecraft and instrument emulators to NOAA personnel.

# SES II Task Order SOWs

GOES Instruments and Spacecraft Subsystems Support: this function includes technical monitoring, engineering evaluations/analyses, problem resolution, development of on-orbit test sequences and methodologies, data gathering and analyses, data trending, document preparation/review, and attendance at meetings and reviews.

Provide technical support for the Advanced Baseline Imager Instrument.
This effort includes participation in anomaly resolutions; development and review of operations procedures, on-orbit data analysis, and development of post-launch test documentation.

Provide technical support for the Solar Ultra-Violet Imager (SUVI) Instrument.
This effort includes participation in anomaly resolutions; development and review of operations procedures, on-orbit data analysis, and development of post-launch test documentation.

Provide technical support for the Extreme Ultra-Violet (EUV) / X-Ray Sensor (XRS) Irradiance Sensors (EXIS) Instrument
This effort includes participation in anomaly resolutions; development and review of operations procedures, on-orbit data analysis, and development of post-launch test documentation.

Provide technical support for the Geostationary Lightning Mapper (GLM) Instrument
This effort includes participation in anomaly resolutions; development and review of operations procedures, on-orbit data analysis, and development of post-launch test documentation.

Provide technical support for the ensemble of Space Environment In-Situ Suite (SEISS) Instruments.
This effort includes participation in anomaly resolutions; development and review of operations procedures, on-orbit data analysis, and development of post-launch test documentation.

Provide systems engineering support for the On-Orbit Operations of the GOES Observatories (R/S/T/U). In conjunction with Mission Operations Lead and Systems Engineering, develop and maintain the Post-Launch Test (PLT) Plan(s) for the on-orbit commissioning of the GOES R/S/T/U Observatories. Monitor instrument, spacecraft and ground systems performance to assess and assure compliance with the GOES-R Series Performance Specification.
This effort includes participation in anomaly resolutions; review of operations procedures, on-orbit data analysis, and post-launch test documentation; and tracking and reporting verification compliance status.

Monitor, review and provide consultation for the Guidance, Navigation, and Control (GN&C) designs.
Provide consultation for the GN&C design with respect to orbit raising, on-orbit operations, storage and safe hold modes.

Provide support at GOES-R Program meetings both scheduled and ad hoc and present subsystem issues as appropriate.

# SES II Task Order SOWs

GOES Architecture and System Engineering Support: this function includes the definition of potential architecture and mission ops evolution from the GOES N-P missions to the GOES R.

GOES Engineering Analysis and Trending Tool Development: this function includes the development of a GOES-R Engineering Analysis and Trending (GREAT) Tool and integration into the operational GOES-R ground system. The GREAT Tool shall provide the following capabilities:

Generate and report spacecraft and instrument performance trends based on collected engineering telemetry
Trend satellite life-limited resources for the life of the mission
Compute statistical data based on engineering telemetry
Provide the capability to use operator defined mathematical functions on engineering telemetry
Store operator defined mathematical functions
Provide the capability to select, display, and store parameters for engineering analysis
Generate spacecraft and instrument performance trend analyses using stored telemetry
Provide the capability to export data in a non-proprietary format

Specific support shall include:

Development and integration of the GREAT (CASSIE) tool into the GOES-R operational ground system
Training of mission operations personnel in the GREAT tool operation and maintenance.
Support GREAT integration and test activities at the ground system contractor off-site facility (Melbourne, FL)
Provide GREAT Tool (CASSIE) Users Guide and Maintenance Manual documentation

Communications Security (COMSEC) Advocate: The contractor shall provide a Certified Security Advocate under the NSA Certified Module Embedment Discipline to support the evaluation of the GOES-R security architecture and COMEC CDRL documentation. The Certified Security Advocate shall perform the following responsibilities, upon request from the Government:
Review and monitor the project schedule
Review, comment, and provide approval recommendations for spacecraft vendor-developed COMSEC CDRL documentation, including the Security Verification Report and COMSEC Security Plan.
Review, comment, and provide approval recommendation for updates to the GOES-R System Key Management Plan (SKMP), if any.
Support meetings and teleconferences relating to GOES-R COMSEC issues, incidents, and/or ground system architecture upgrades.

Required skills/knowledge – In order to provide the system engineering and mission operations support the contractor shall provide personnel with general knowledge and experience in mission systems engineering and mission operations for orbiting spacecraft. Positions need to be time filled based on program requirements and may include people with the following skill mix:

| | | |
|---|---|---|
| Systems Engineer | GN&C Engineer | Flight Software Engineer |
| MOST Team Lead | GN&C Engineer/Mechanism | C&DH / COMM Engineer |
| Spacecraft Manager | Navigation Engineer | EPS Engineer |
| Contingency Manager | GLM/SEISS Engineer | Thermal Engineer |
| Flight Director | Instrument Engineer | Bus Engineer |
| ABI Engineer | SUVI Engineer | CASSIE Software |
| Database Administration | Mission | Ops Tool Development |
| COMSEC Security Advocate | SEISS Engineer | EXIS Engineer |
| Ground System Engineer | Configuration Management | Mission Readiness |

GOES-R Program Resource Planning

The contractor shall assist the GOES-R Deputy System Program Director for Resources in the formulation and execution planning of future mission activity.

GOES N-P Contingency Reach-Back Support

The contractor shall provide off-line support for GOES N-P legacy missions, as requested by the Government, to troubleshoot, analyze, and resolve on-orbit anomalies. Support shall be provided for GOES N-P spacecraft and instruments.

## Period of Performance

The period during which the work for this task order shall be performed is precisely on 1/12/2019 through February 29, 2020.

## Subtask Description

Not Applicable

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Progress Reports and CTRs | Monthly |
| 2 | Trip reports summarizing travel details, action items, discussions, and recommendations to the GOES-R Flight Project. | As requested by TM |
| 3 | Memoranda (white papers) to the GOES-R Flight Project and discipline organizations (as appropriate) providing detailed assessment of specific subsystem issues. | As requested by TM |
| 4 | Fast response memos/e-mails to the GOES-R Flight Project and discipline organizations providing summations of urgent subsystem issues. | As requested by TM |
| 5 | Post-launch checkout final reports by subsystem | Per program schedule |
| 6 | Development of operations procedures | As required |
| 7 | Development of Operator Displays | As required |

| | | |
|---|---|---|
| 8 | Update to MOST Training and Certification Plan | Launch – 12M |
| 9 | Updates to the GOES-R Series Engineering Analysis and Trending System (CASSIE) tool | As required |
| 10 | Updates to the GOES-R Series Sequence of Events, Tracking, Execution, and Monitor Tool (STEMpy) tool | As required |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Mission operations products and documents will be covered under the MOST Configuration Management Plan. Changes to operational systems will adhere to the Operations Configuration Control Board (OCCB) process.

### Facilities

The GOES-R Flight Project will provide laptop computers and work spaces (cubicles) for task personnel located at the NOAA Satellite Operations Facility (NSOF).

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

(See Clause H.12 1852.216-80 TASK ORDERING PROCEDURE d(4) and QA plan)

The contractor shall comply with the GOES-R Flight Project's Quality Assurance Plan, attached to this task order.

## ODC (Travel and Procurement)

(See H.12 1852.216-80 TASK ORDERING PROCEDURE b(3), please provide a BOE for all proposed ODC's to determine the reasonableness)

Estimated Travel:

| Location | Duration | Dates |
|---|---|---|
| Denver CO | 5 days | 2/month |
| Melbourne FL | 5 days | 2/month |
| Wallops VA | 4 days | 2/month |
| Fairmont WV | 4 days | 2/month |

## Work Location

This work shall be performed primarily at the NOAA Satellite Operations Facility in Suitland, MD; however, some work will be required at the Goddard Space Flight Center.

## Reporting Requirements

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend weekly mission operations status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPR 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

None

## References

None

# SES II Task Order SOWs

## 5001 IT Engineering and Security

Date: February 12, 2019
Task Monitor (TM): Sergio McKenzie
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

## Scope

Background – The Cybersecurity Services and Integration Division (CSID) is responsible for the Center's Cybersecurity Program meant to apply the technologies, policies, security concepts, security safeguards, guidelines, risk management approaches, actions, training, assurance, processes and practices designed to protect Center networks, computers, programs and data from attack, damage or unauthorized access. CSID activities are consistent with Agency guidance, Federal directives and other government-wide laws, regulations, and industry Best Business Practices. CSID strives to ensure the acquisition and maintenance of the security controls for the organization and user's assets against relevant security risks in our computing environment. Primary cybersecurity objectives include:
Availability – To ensure assets and information are available to GSFC customer as applicable and appropriate
Supports business continuity and disaster recovery efforts
Integrity – which includes authentication and non-repudiation services.
Confidentiality – To manage access to information and assets
To protect Personal Identifiable Information (PII).
CSID supports functions are paramount to the overall development and implementation of the Center's IT Strategic Plan and supports leadership at all levels with tactical and strategic decision-making affecting critical Center-wide programs and services

Summary of work –
The Information Technology and Communications Directorate (ITCD), Code 700, Cybersecurity Services and Integration Division (CSID) is in need of technical services to support NASA Agency-wide and GSFC initiatives that have a cross-cutting effect on Agency and Center operations. This task provides support to the Center for project management, system integration, engineering, and security. The primary objectives are to provide – Project Management, system engineering, service management, and Security Support to enhance IT support services for engineering and business communication services. Support to develop and maintain streamlined communication process(es) in support of operational requirements that are in line with Directorate goals and objectives.

Required skills/knowledge –
Scope of these services includes the ability to provide technical expertise across a wide range of Division-level initiatives, including Network Engineering, IT security, system integration, requirement analysis, financial services, IT communications, and Network Re-architecture. Competency areas include expertise with the following:

# SES II Task Order SOWs

Network, Voice, and Video infrastructures, both within the Greenbelt campus and across Goddard's various facilities
Systems administration across multiple platforms
NASA's IT security framework within the context of the Federal Information Security Management Act (FISMA)
National Institute of Standards and Technology (NIST)
NASA's enterprise architecture framework within the context of the Federal Enterprise Architecture (FEA)
Requirements of HSPD-12 for personal identity verification
Goddard's diversity, in terms of mission, infrastructure, IT service provision, as well as its unique customer base.
Significant knowledge of and experience with operating systems is required in order to be effective on this task.
Knowledge and prior experience with security alerts and notifications of scan reports (must know GSFC/NASA procedures for GITSVST, special scans, compromises, IPAMS, etc.);
Must have complete knowledge and experience with GSFC and FPD procedures/processes for reporting and mitigation;
Must have knowledge and experience with Nessus, ISS and/or Retina scanning tools
Working knowledge of various NASA/GSFC IT Security Documents such as NPR 2810 and various SOPs, NITR 2810-1, NITR 2810-2, NITR 2810-5, etc.
Must possess an understanding of NASA's new FDCC Benchmarking approach.
Service and Project Management through standard framework such as ITIL, 7120, etc.
Basic business skills to include budgeting and financing, research competence, the ability to measure the success of the proposed advertising/marketing/communication plan, and be aware of modern trends in technology and how the application of new services would best compliment the team and its customer.
Ability to communicate ideas and research both in writing and orally to team members and customers. Must be proactive and quick to respond to customer requests.
Must be able to observe several streams of data to determine the demographics and trends of current and potential customers.
Must be able to understand and process data so that it showcases the capabilities of the organization, while also remaining flexible to modifications in the overall plan.
Must have strong organizational skills, both analytical and problem solving, and the ability to work with sensitive information.
Must have strong capability to learn new software tools and systems quickly and independently.

The contractor must also demonstrate strong leadership and organizational qualities in the performance of this task. The contractor is expected to keep themselves and GSFC IT personnel fully knowledgeable of NIST, Agency and industry technical guidance and tools that GSFC can use to implement the array of ongoing and upcoming projects. The contractor may also be required to communicate with organizations that do business with GSFC to ensure their software and hardware systems are compatible and configured properly and to disseminate information concerning IT services, systems, and programs. Strong oral and written communication skills are a must!

# SES II Task Order SOWs

The task will require extensive knowledge of the NASA services, Code 700 Engineering and Security policies and practices in support of mission-critical systems, and GSFC/WFF Infrastructure architectures. This task will also require working with the NASA I3P contractors and interfacing and using ITIL processes.
The ability to obtain Top Secret/SCI clearance is required for certain positions but not all.

Period of Performance
The period during which the work for this task shall be performed is from Apr 1, 2019 – March 31, 2020.

## Subtask Description

Subtask 0001 – GSFC IT Communication and Security Support to Mission Services
The contractor shall take a lead role and assist the engineers and other IT professionals in leading GSFC to deploy IT systems, IT services, and to improve the Agency's IT management services by ensuring the security of communication services. The contractor will have a major role in planning, deploying, and maintaining the vulnerability management service for deployed and soon to be deployed IT systems, including but not limited to being a subject matter expert and an accessible information resource to the IT professionals and customers of the division.
Contractor will be required to provide system integration services for IT projects and programs. Coordination with other GSFC contractors will be required in order to coordinate project milestones and activities. The contractor must serve as a GSFC expert on the requirements of and deployment of these projects as well as being in capacity to conduct analytical work in support of IT programs.
The Contractor shall provide IT security support to communication systems as needed and serve as a lead technical resource to Information System Security Officer(s) (ISSO) and other IT professionals. The contractor will provide technical guidance to address the adequacy and effectiveness of information security policies, procedures, and practices. The ISSO serves as the principal advisor to the Authorizing Official (AO), Information System Owner (ISO), or the CAO, and/or Information Technology Security Manager (ITSM) on all matters (technical and otherwise) involving the security of the information system.
Within the scope of these duties, the contractor will provide –
Document Writing and Development: The contractor shall assist in the development and updating of the following: System Security Plan, Contingency Plan, Disaster Recovery Plans, Risk Assessment Report, Local Operating Procedures (LOP), work instructions, policies, and procedural guides affecting the overall IT and security posture of the environment.
Security Operations: The contractor will assist with the management of the security aspects of the information systems and the day-to-day security operations
Assistance: The contractor will assist with physical security, personnel security, incident handling, and training
Authorization and Accreditation: Support the Authorization and Accreditation (A&A) process as required to include preparing associated documentation, building and tracking Plan of Action and Milestones (POA&M), and monitoring A&A activities.

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The contractor shall support mission services that will focus on executing communication strategies, create and administer surveys or focus groups, quickly disseminate information to customers, and help the team best market products and services. This work involves support as follows –
Marketing of new services: To work with project and program managers to design, promote, restore, or execute marketing and communication plans that effectively promote new products and services. Lead the planning, development, and implementation of outreach/communication activities, both internal and external to encourage targeted messages to participants.
Outage notifications: Support the rapid dissemination of information concerning activities that have impacted operational services.
Surveying: Cover elements of the customer experience, including their ratings of the quality and speed of delivery of the product as well as the pricing and any problems or complaints that they have. Surveying may include focus groups, visitations, interviews, and other communication strategies.
Capturing historical data: To be able to capture and understand collected data and any trends that may arise during the process. Identify methods to effectively monitor and measure the product or service through compiling, tracking, reporting, and evaluating data. Work with leadership team to review collected data in order to convey lessons learned and also recommendations to be incorporated into a final report that determines the effectiveness of the product and its efforts. Capturing information, data, highlights of pass activities for the purpose of archiving, review, and dissemination.
Performance write-ups within context: document and highlight achievements associated with implementation of services or application of communication strategies.

Subtask 0002 – Strategy and Task Planning and Management
The contractor shall provide expert leadership as a member of the division staff in overseeing, leading, guiding, and/or managing strategic direction and staff of the division. The contractor is expected to add strong business acumen to division level requirements to include strongly supporting establishment and maintenance of division mission and vision statements, developing and managing strategic objectives and performance measures, and developing and overseeing get-well plans for items that fall below stated strategic objectives. The contractor is expected to be self-directed based on general guidance from the Government; the contractor will demonstrate subject matter expertise by converting general guidance into actions and providing counsel to other task leads. It is expected that the contractor will serve as a thought leader counterpart to the Cybersecurity management team, including the CISO, D/CISO, and other task leads and service owners within the division. The following duties apply to the above:
Leadership and Task Management: The contractor must demonstrate strong leadership and organizational qualities in the performance of this task. The contractor must facilitate work and ensure all contractors working on all tasks have clear direction and instructions. The contractor will also be depended on to manage several aspects of the division office.
Skill Level Maintenance: The contractor is expected to keep themselves and GSFC IT personnel fully knowledgeable of NIST, Agency and industry technical guidance and tools that GSFC can use to implement the array of ongoing and upcoming projects. If a member of the task is not adequately skilled in a specific knowledge area, the contractor will work

through the appropriate management structure to ensure staff receives the needed training to be successful. Contractor will also lead Division level training programs meant to increase business, professionalism, and customer service acumen.

Reporting: The contractor is responsible for generating internal and external reports while coordinating reporting requirements in and out of the division. Reports may include but not limited to status updates, executive briefings, invoices, statements of work issued to customers, and other division level requirements. All reports must provide insight to the security posture through data capture and trend analysis. As necessary or requested, the IT professionals will provision reports of specific areas of interest or noted vulnerability.

Communication and Outreach: The contractor will manage the Division's communication and outreach program focusing on the analysis of operational requirements at the directorate, Center, and multi-facility level to develop and execute security and communication strategies, create and administer surveys or focus groups, quickly disseminate information to customers, and help the team best market products and services. This work involves coordinating with groups in/out of the division at multiple levels of the organization, capturing and documenting performance information on groups, projects, and individuals, and facilitating/coordinating major engagements such as security expositions, roadshows, retreats, conferences, division level training (e.g. customer service training), and other important venues.

Subtask 0003 – Cybersecurity Case Managers

The contractor will support newly developed Security Management programs in Cybersecurity Services & Integration (CSID). Contractor shall have the following responsibilities:

Assist the incident response team and processes in various initiatives concerning the development of new Incident Response process flows, business and configuration management activities as well as any new program updates.

Communicate directly with customers, security system analysts, risk management managers, information system security officials and other communities to assist in the restoration of compromised devices and/or disseminate information relevant to the provision of security services.

Interface and cultivate relationships with various officials to promote the advancement of new Security initiatives.

Provide direct project support (coordinate meetings, agendas, and monthly status reports).

Prepare presentational materials and circulate artifacts for signature relevant to security processes and operations.

Juggle multiple projects and assessments while organizing and determining high priority tasks.

Provide technical writing services for ongoing projects and initiatives within the division.

Subtask 0004- Program Strategic Analysis Support

The contractors will provide program strategic analysis support to the GSFC CISO, GSFC CIO, and the GSFC CSID. The primary functional areas include Strategic Threat Analysis, Information System Security Engineering Support, Information System Security Officer (ISSO) support, and Identity, Credential, and Access Management (ICAM) Support.

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Strategic Threat Analysis- This functional area covers the integration and synthesis of threat information and ongoing security incident information with existing and in-development capabilities to protect NASA information and information systems. The primary objective is to ensure NASA is aware of specific threats causing impact to NASA (e.g., through intrusions or attacks on information systems), identify high-probability technical threats that are expected to affect NASA (e.g., from ongoing situational awareness of intrusions against other Federal Agencies, existing intelligence such as National Intelligence Estimates), and effectively communicate this information to a variety of audiences, both technical and managerial. The intended outcome is to ensure NASA missions are well prepared to proactively address the identified threats, and able to ameliorate any impacts through timely reaction to new information.
Information System Security Engineering –

Information system security engineering (ISSE) capabilities help us better address vulnerable flight and science data operations infrastructure, better configure and apply software patches required to address today's dynamic threats and resultant critical vulnerabilities, and among other things help minimize significant technical and cost risks to our environment. ISSE is needed in order to support the changes in our environment including the application of Big Data, technological advancements in engineering to include support for high-speed state-of-the-art networks, robustness's of our end users stations, and continued maturation of cloud services it is critical to mature this critical service to not only protect but to enable GSFC's continued drive into the 21st century. The contractor shall will mature the division's engineering skillsets and acquire tools, processes, and procedures to help enhance engineering practices. ISSE will focus on 3 primary areas – Mature the security engineering practice, including an alignment of security engineering activities and artifacts with NASA's well established system engineering practices and processes. The resulting diagrams, guidance documents, templates, and examples will be shared across all missions, projects, and initiatives to ensure that requirements specify the appropriate security tasks and schedules. Within this scope the contractor shall perform outreach functions, educating mission planners, project managers, engineers, and developers on:
Security activities required during their system engineering processes.
Available Agency, Center, and network infrastructure security solutions to avoid duplication.
Successful technologies, techniques, and trends for mission-unique security solutions.
Upcoming requirements, directives, and standards.
Engage all missions and Center-level project in development and every new mission appropriately to ensure the protection of all GSFC assets. The contractor shall participate in design discussions and milestone reviews. For mission projects electing a fully embedded security engineering service, the contractor shall coordinate all security activities. Specifically, the contractor shall:
Support all project meetings.
Form, lead, or otherwise participate in security working groups and IPTs.
Participate in all system engineering milestone reviews.

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Facilitate risk-based determinations of "appropriate security" for every mission segment, element, component, and system that balances standard policy & guidance with reduced threats and other compensating controls.
Prepare draft justifications for exemptions, waiver, and risk acceptance where appropriate.
Accept tasking from project and system managers.
Meet with project engineers and developers to determine solutions and responses.
Perform appropriate research and contribute sound security solution recommendations consistent with Federal and Agency guidance.
Track all security-related requests and activities through completion – no balls dropped.
Review mission documents and related artifacts, providing feedback from a security perspective.
Liaise with the Authorizing Officials (AO), with their Designated Representatives (AODR), and with the assessment team to ensure a smooth surprise-free path to a full Authority to Operate (ATO) determination.

Information System Security Officer (ISSO) support - This functional area provides specific guidance on what information security policies, standards, guidelines and procedures are, the differences between each and how they fit together to form an information security policy framework. This framework will then be used to develop a comprehensive IT Security Plan. The Contractor shall provide IT security support to systems on Goddard Space Flight Center facilities by serving as the lead technical resource to the Information System Security Officer (ISSO) and other IT professionals. The contractor will provide technical guidance to address the adequacy and effectiveness of information security policies, procedures, and practices. The ISSO serves as the principal advisor to the Authorizing Official (AO), Information System Owner (ISO), or the CAO, and/or Information Technology Security Manager (ITSM) on all matters (technical and otherwise) involving the security of the information system
Identity, Credential, and Access Management (ICAM) Support- This functional area covers ICAM services for the ICAM Program. The primary objective of this functional area is to consult, test, evaluate and enable ICAM integrations including both NASA identities & reimbursable identities such as USGS and NOAA.
~~Subtask 0005- IT Program, Service Management, and Configuration Management Capabilities~~
~~The contractor will provide programmatic and service management focused support to Center agency level IT Security Services mostly focused on advanced and next generation security technologies, policy management, and audit management services. The contractor will be responsible for implementing an Agency-directed plan under the supervision of an Agency appointed Program Manager. The primary services of this subtask will be for project/program management, customer support, and configuration management, with the services expected are as follows:~~

~~Project/Program Management: Provide support for planning all efforts and projects within the scope of the Agency level security service delivery requirement. All projects and efforts within the scope of the work must be tracked through the project lifecycle. Schedules must be managed and tracked to ensure timely deliverables.~~

~~Document management: The contractor shall implement standardized document and records management tools to sustain operations within the program. Recording and maintaining a centralized electronic location of all completed project and effort deliverables. The contractor shall be responsible for the development and implementation of documentation templates, and ensure the proper usage of each template. The status of each document must be tracked with proper tracking techniques, such as document tracking numbers, being implemented. Secure, NASA-approved on-site/off-site repositories for physical copies and electronic copies of all signed documentation must be in place.~~
~~Project Support: Provide direct project support (coordinate meetings, agendas, and monthly status reports) to staff.~~
~~Customer Service: Provide direct customer support to customers, ensuring that customer is treated well and expeditiously, and providing "warm hand-offs" to other members of the staff.~~
~~Configuration Management Services: The contractor shall assist in establishing and maintaining consistency on project and effort outputs that comply with requirements for the project or effort. The contractor shall provide centralized data tracking and reporting capabilities for all projects and efforts to measure this. All configuration management packages must be made available electronically to the appropriate people.~~
~~System Engineering Services: Help in the analysis and successful deployment of systems based on Agency requirements and GSFC ITCD guidance.~~

~~Subtask 0006- HQ CISO/SAISO Support~~
~~The contractors will provide program strategic analysis support to HQ CISO/SAISO for IT Security. The primary functional areas include Information System Security Engineering Support, and Identity, Credential, and Access Management (ICAM) Support. The contractor must provide advice and insight into new cyber technologies or supporting systems to ensure all controls are met. Risks must be limited by the contractor, with effective risk management solutions provided by the contractor. The contractor must be able to be incorporated fully into a customer's project team, embedding security into system design from inception and providing insight throughout project lifecycle. The following duties apply to the above:~~
~~Information System Security Engineering Support- This functional area provides specific guidance on what information security policies, standards, guidelines and procedures are, the differences between each and how they fit together to form an information security policy framework. This framework will then be used to develop a comprehensive IT Security Plan.~~
~~Identity, Credential, and Access Management (ICAM) Support- This functional area covers ICAM services for the ICAM Program. The primary objective of this functional area is to consult, test, evaluate and enable ICAM integrations including both NASA identities & reimbursable identities such as USGS and NOAA.~~

Subtask 0007-PIV Mandatory Support Services

The contractor will provide programmatic, service management, and technical support focused on establishing new or improved Center and Agency authentication services

through the creation and/or deployment of user directory services, configuration management toolkits, two-factor authentication, and other identities, credentials, and access control systems that support agency enterprise requirements. At minimum the task will support proof-of-concept testing within an operational environment(s) against an enterprise-defined set of evaluation criteria, develop service models to provide capabilities to support deployed services, and deploy control systems as developed.

Project/Program Management: Provide support for planning and executing projects and activities within the scope of the subtask. All projects and efforts within the scope of the work must be tracked through the project lifecycle. Schedules must be managed and tracked to ensure timely deliverables.
Project Support: Provide direct project support (coordinate meetings, agendas, and monthly status reports) in execution of the project to include ensuring that the vast amount of technical data that is produced is catalogued, archived, and in many cases translated for non-technical staff. In addition, project support will help with organizing, scheduling, creating user lists, managing training requirements, etc.
Customer Service: Provide direct customer support to project customers, ensuring that customer is treated well and expeditiously, and providing "warm hand-offs" to other members of the staff.
Configuration Management Services: The contractor shall assist in establishing and maintaining consistency on project and effort outputs that comply with requirements for the project or effort. The contractor shall provide centralized data tracking and reporting capabilities for all projects and efforts to measure this. All configuration management packages must be made available electronically to the appropriate people.
System Engineering and Administration Services: Help in the analysis and successful deployment of systems based on Agency requirements as well as supporting technical requirements for studied or deployed tool sets.

~~Subtask 0008- IT Security Supply Chain Risk Management Tools~~

~~The contractor will provide a Supply Chain Risk Management platform in order to deliver eco-system monitoring, supplier Risk Assessments (RA) and Continuous Monitoring (CM) for Supply Chain Risk Management (SCRM).~~
~~The platform shall:~~
~~Provide risk assessments and continuous monitoring for 150 suppliers and their products/services. The companies will be identified by NASA and will be provided to the Contractor in a list that does not have to describe the companies' association with a particular NASA system. The risk assessments shall include information about the identified companies sufficient to enable NASA to assess risk across a twelve-risk factor model. The risk assessments shall:~~
~~Identify sources where contractor obtained information was used to assess risk~~
~~Include sources accessed dates~~
~~Include the Contractor's level of confidence in the veracity of the information obtained.~~
~~Provide continuous monitoring for 100 suppliers and their products/services being provided to and identified by NASA. The companies will be identified by NASA and will be provided to the Contractor in a list that does not have to describe the companies'~~

~~association with a particular NASA system. The continuous monitoring shall include near real time information of ongoing supplier risk concerns that are prioritized by NASA. Provide a specialized cyber data feed from BitSight Technologies for 250 suppliers' cyber risk rating based on externally observable data mapped to the assessed entity to enable continuous monitoring and measurement of the assessed entity's security performance. The companies will be identified by NASA and will be provided to the Contractor in a list that does not have to describe the companies' association with a particular NASA system.~~

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified on the table below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Monthly Progress Reports | Monthly, by the last day of the month |
| 2 | Monthly Financial reports | Monthly, by the 15th |
| 6 | Compliance Data Report using existing GSFC and agency information systems, security tools, and/or by personal contact. Summary Reports organized by GSFC Directorate and/or IT Security Plan. | As required |
| 7 | Weekly reports denoting completion of major activities as appropriate | Every Tuesday |
| 9 | Create and/or update websites information in support of division and branch requirements | Updated as required |
| 10 | Develops required documents and presentations according to the approved project framework | As determined on the project schedule |
| 11 | Presentation Materials for Major Project Reviews | As requested: 10 days prior to review |
| 12 | End of Task Report | 30 days after task ends or at a mutually agreeable date |
| 13 | Project Plan(s) – per Division, Directorate, and Agency standards provide project plans for every assigned project | 30 days upon assignment of every project/effort/task |
| 14 | Integrated schedule of activities across operational areas | Every 30 days |
| 15 | Monthly metric reports to track adherence to established Service Level Agreements (SLA) | Every 30 days |
| 16 | Division Level Communication Plan | 30 days upon start and quarterly review |
| 17 | System Security Control Assessment Status Reports to include status on overall posture, Risk Based Decisions, and Plan of Action and Milestones | Every 30 days |
| ~~18~~ | ~~Supply chain risk management products as identified in subtask 8 (e.g. risk assessments, continuous monitoring reports, etc.)~~ | ~~As required~~ |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

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Configuration Management
Systems and documents will be covered under the appropriate Division Configuration Management Plan.

Facilities
Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. Performance metrics shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW. Performance metrics for this task include –
Planned versus actual costs within 4% (TM approved changes not withstanding)
90% of Project milestones met on time and within budget
Attendance to engineering reviews – 95% attendance expected
90% of requested reports, studies, engineering plans, and other written analyses completed within agreed-upon established schedule
Submitted deliverables are accurate and with no more than a 5% margin of error

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D; NASA Space Flight Program and Project Management Requirements
NPR 7123.1A; NASA Systems Engineering Processes and Requirements
GPR 7120.1C; Project Management

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GPR 7120.7; Project Management
GPR 7120.5A; Systems Engineering

## ODC (Travel and Procurement)

| Location | Duration | Dates |
|---|---|---|
| Subordinate and sister Facilities to include GISS, WFF, WSC, IV&V, and other Centers. | 1 – 5 days | Occasionally, as requested |
| Security & Service Management Workshops/Conference | 1 – 5 days | Annually, as requested |
| Communication Workshops/Conference | 1 – 5 days | Annually, as requested |
| Security Workshops to other NASA Centers | 1 – 5 days | Monthly |

Local Travel – To vendor facilities in the local commuting area. Other travel may be proposed for special training needs and other engineering or cybersecurity support task activities as directed by the TM.

## Work Location

This work shall be performed at Goddard Space Flight Center unless otherwise coordinated with contractor and government management.

## Reporting Requirements

Weekly status report

The contractor shall provide input to program managers for generating weekly reports and other formal operational status updates.

Monthly performance report

The contractor shall report status in person or via teleconference to the TM or designated alternates on a monthly basis. Reports shall include informal presentation of interim results, status of development activities, and action item status. The contractor shall provide all reports at least one day in advance of the monthly meeting via email, and maintain an email distribution list with the concurrence of the TM. The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. As part of this task there will not be any handling of classified data.

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## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC
52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 1600.1, 3 Nov 2004, NASA Security Program Procedural Requirements
NPD 1600.2D, 28 Apr 2004, NASA Security Policy
NPR 1620.3, 12 Aug 2004, Physical Security Requirements for NASA Facilities and Property
NPR 2800.1, Change 1, 17 Sep 03, Managing Information Technology
NPD 2800.1A, 18 Aug 2004, Managing Information Technology
NPR 2570.1, 24 Apr 2003, NASA Radio Frequency (RF) Spectrum Management Manual
NPD 2570.5D, 17 October 2005, NASA Electromagnetic (EM) Spectrum Management
NPR 2810.1, 26 Aug 99, Security of Information Technology, Revalidated 8/12/04
NPD 2810.1C, 7 April 2004, NASA Information Security Policy
NITR 2810-1, 15 Sep 2003, Wireless Requirements
NITR 2810-2, 28 Jun 2004, Information Technology (IT) System Security Requirements

## References

# 5002 Information System Governance & Risk Mgmt (GRM)

Date: February 14, 2019
Task Monitor (TM): Sergio McKenzie, Code 710
Contract number: NNG15CR67C
Contract SOW Reference: 4.5.1 Supporting Services

Scope

The Cybersecurity Services and Integration Division (CSID) is responsible for the Center's Cybersecurity Program meant to apply the technologies, policies, security concepts, security safeguards, guidelines, risk management approaches, actions, training, assurance, processes and practices designed to protect Center networks, computers, programs and data from attack, damage or unauthorized access. CSID activities are consistent with Agency guidance, Federal directives and other government-wide laws, regulations, and industry Best Business Practices. CSID strives to ensure the acquisition and maintenance of the security controls for the organization and user's assets against relevant security risks in our computing environment. Primary cybersecurity objectivesinclude:
Availability –
To ensure assets and information are available to GSFC customer as applicable and appropriate
Supports business continuity and disaster recovery efforts
Integrity – which includes authentication and non-repudiation services.
Confidentiality –
To manage access to information and assets
To protect Personal Identifiable Information (PII).
CSID supports functions are paramount to the overall development and implementation of the Center's IT Strategic Plan and supports leadership at all levels with tactical and strategic decision-making affecting critical Center-wide programs and services.

IS-GRM is about establishing an appropriate balance between business reward and risk. The maturity of IS-GRM practices for managing reward and risk has a direct impact on the Enterprise and encompasses the practices for delivering:

Greater business value from strategy, investment and alignment,
Significantly reduced business and financial risk from the use of information systems, and
Conformance with policies of the organization and its external legal and regulatory compliance mandates.

An effective IS-GRM strategy helps the Enterprise adapt to change, manage risk, and effectively comply with the regulations that affect business processes, while ensuring ability to meet new challenges. Success comes from managing risk and achieving compliance in an ever-changing environment while reducing costs and improving corporate performance every day.

The IS-GRM program requires skills, knowledge, and support to meet the requirements mandated by the Federal Information Security Modernization Act (FISMA) 2014 (Public Law

113-283). The IS-GRM program is a highly visible within the CSIG. It requires coordination with the Chief Information Officer (CIO), Chief Information Security Officer (CISO), Security Operations leads, various information system owners (ISOs), information systems security officials (ISSOs), other contractors and vendors at GSFC, and Agency stakeholders. The tasks outlined below respond to and implement relevant strategies and objectives as dictated by the Office of Management and Budget (OMB), the Department of Homeland Security (DHS), and are set forth in NASA's procedural directives, requirements and handbooks. The GSFC CISO serves as the focal point for ensuring and employing a strategic organization-wide defense-in-breadth approach for information assurance and security at GSFC. The Deputy CISO (D-CISO) is responsible for developing and implementing an IS-GRM program for all of GSFC's systems and responsible for reporting on their status annually. The D-CISO has the responsibility to ensure that the application of a balanced set of management, operational, and technical safeguards and countermeasures to organizational information systems are employed and captured in system security plans and other relevant documentation. The assessment of policies, security controls, asset management, vulnerability management, and the maintenance of system security documentation plays a critical role in risk mitigation for the entire Enterprise.

Through this contract, the Contractor shall support the CSID of the Information Technology and Communications Directorate (ITCD) in the mission to provide an effective and comprehensive IS-GRM program for all of GSFC's systems. Successful execution of this Statement of Work (SOW) will assist GSFC's CSID with establishing and implementing the program, plans, policies, and procedures that will aid in ensuring an effective IS-GRM program that meets the annual reporting goals.

Period of Performance

The period during which the work for this task shall be performed is from April 1, 2019 – March 31, 2020.

Subtask Description

All work under this SOW will be performed under Subtask 1, Assessment and Authorization (A&A), with the following functional areas of support:

Functional Area One – Task Administration and Status Reporting

This subtask covers overall administration, coordination, and status reporting. The Contractor shall establish a task management approach to ensure all activities are being conducted effectively and efficiently, how the technical management will be performed, how personnel and physical resources will be managed, identify the mechanisms to be used for cost and schedule control, ensure all deliverables are on-schedule, ensure risks and opportunities are promptly raised for attention, and ensure all status reports are promptly delivered. The task management approach shall be documented in a Task Implementation Plan (TIP) submitted for review and concurrence by the Government (Deliverable 1.0).

The Contractor shall prepare and present Weekly and Monthly Status Reports (Deliverables 1.4 and 1.5), which will address the progress/status of tasks (described in Section VIII).

At the end of task, the contractor shall submit an end of task report (described in Section VIII, Deliverable 1.7).

The Contractor is expected to attend and participate in enough of the following routine meetings to maintain an effective awareness of evolving changes to Federal, NASA, and GSFC information security guidance:

(Monthly) GSFC Information Security Forum (reporting of process updates, status)
(Monthly) Agency Information Security telecom
(Weekly) Agency Assessment and Authorization telecon
(Bi-weekly) Status briefing to the Center CIO
(as scheduled) Planning and coordination meetings as directed by the TM

The Contractor shall annually certify staff (via Deliverable 1.6):

Are qualified to perform the job tasks covered within this SOW, including a summary of the support personnel qualifications,
Have received annual ethics awareness training, including Federal ethics requirements,
Have completed NASA-specific mandatory training requirements (e.g., annual security awareness training) as directed by the Government,
Are fully compliant and current with all background investigation or clearance requirements, and
Are subject to the Contract clauses regarding the use and handling of sensitive and proprietary information, including information providing an unfair competitive advantage.

Additional activities, consistent with the general work performed in this area, may be required that result in additional ad-hoc deliverables (tracked as Deliverable 1.7). The Contractor is expected to address these requests in a reasonable timeframe as directed by the TM. The Contractor shall proactively identify priority or resource conflicts.

Functional Area Two – Governance and Enterprise Risk Management

The Contractor shall assist the D-CISO in the identification, development and maintenance of Center-specific, risk-based, cost-effective information security policies, procedures, and control techniques to address all applicable requirements throughout the life cycle of each Center information system to ensure compliance with applicable requirements and the confidentiality, integrity, and availability of resources. Includes, but not limited to, analyses of Agency, Center, OMB, DHS and NIST directives, guidelines, polices and regulations and their effect on the GSFC risk management processes.

In performance of this contract, the Contractor shall:

Assist in the development of engagement strategies with Agency and Center governance boards.
Facilitate review and dissemination of Agency policies, procedures and standards.
Develop and disseminate Center policies, procedures and standards.

Streamline processes via templates and reusable artifacts.
Establish a forum for Mission/Project advisory services.
Develop guidance on emerging technologies.

Risk management is a comprehensive process that requires organizations to: (i) frame risk (i.e., establish the context for risk-based decisions); (ii) assess risk; (iii) respond to risk once determined; and (iv) monitor risk on an ongoing basis using effective organizational communications and a feedback loop for continuous improvement in the risk-related activities of organizations. Risk management is carried out as a holistic, organization-wide activity that addresses risk from the strategic level to the tactical level, ensuring that risk-based decision making is integrated into every aspect of the organization.

In performance of this contract, the Contractor shall:

Assist in the development of an Enterprise risk management strategy.
Assist ISOs and ISSOs in the performance of information system- and application-level risk assessments.
Ensure security requirements are known, understood and incorporated into system design.
Provide security configuration guidance to pilots and proof of concepts.
Monitor system-level and Enterprise wide risks
Support external audit engagements (e.g. GAO, OIG)

Functional Area Three – Assessment and Authorization (A&A)

The Center's D-CISO is responsible for developing, updating, implementing, and reporting to the Agency the status of the Center's system security documentation and risk mitigation efforts. The contractor will be responsible for assisting with implementing a process for risk assessment, change management using security and business impact assessments, vulnerability management of system security plans, and identification of asset management areas. This contract supports these responsibilities required to achieve continuous diagnostics and mitigation for an information system. The Contractor shall ensure that improvements to the A&A process are developed, implemented, and executed in a timely fashion. These responsibilities require a series of activities to ensure a comprehensive approach to A&A.

Risk Management is the ongoing process of identification, analysis, remediation, tracking and communication of risks. Security risk management is the process that allows Information Technology (IT) managers to balance the operational and economic costs of protective measures and achieve gains in mission capability by protecting the IT systems and data that support their organization's mission. The overall goal is to take a comprehensive risk management approach to information security by identifying vulnerabilities and threats that are most likely to occur throughout the System Development Life Cycle (SDLC), quantifying the potential harm to the agency and working with Information System Owners (ISOs) and Authorizing Officials (AOs) to develop mitigation plans that are expected to achieve an acceptable level of risk.

The Security Assessment and Authorization (SA&A) process is designed to ensure that an information system will operate with the appropriate management review, that ongoing

monitoring of security controls exists and an assessment of risk occurs periodically. The GSFC SA&A process is applied to all FISMA reportable General Support System (GSS) and Major Applications (MA).

In performance of this contract, the Contractor shall:

Develop and perform near real-time continuous monitoring capabilities consistent with the Department of Homeland Security Continuous Diagnostics and Mitigation (CDM) Program
Facilitate continuous monitoring and enhance risk mitigation and vulnerability management by ensuring system security plan vulnerability scans are run in accordance with the Centers vulnerability remediation program; coordinating the findings with the ISOs and ISSOs and conduct an iterative process until all high and moderate vulnerabilities are mitigated or reduced on a schedule with COR concurrence.
Conduct event driven and/or ad hoc, in-depth vulnerability assessments to identify the vulnerability of GSFC systems, websites and applications to attacks (spoofing, tampering, repudiation, information disclosure, denial of service, and elevation of privilege) from both inside and outside the Center.
Identify and develop Center Vulnerability Block Criteria based upon known weaknesses and threats to IT, information and infrastructure resources
Provide business unit(s), ISOs and GSFC Employees information and mitigation strategies on software and hardware vulnerabilities impacting the GSFC Enterprise.
Maintain GSFC's portion of the Agency's authoritative repository
Engage with ISOs and ISSOs to maintain and keep current system security plan documentation natively in the Agency's authoritative repository.
Engage with ISOs and ISSOs to update and close their Plan of Actions and Milestones (POA&M) items using the Agency's authoritative repository.
Engage with ISOs and ISSOs to actively execute their configuration management plans and submit security and business impact analyses when changes occur.
Coordinate with the government to make recommendations for Asset Identification and maintenance.
Lead and assist in the performance of security control assessments.
Assist ISOs and ISSOs with the preparation of Agency forms and classification of information types.
Partner with the Enterprise Architect to automate and enhance Business Impact Analysis (BIA) efforts in support of Information System Contingency Planning (ISCP) and Disaster Recovery
Provide assistance to all information system stakeholders to identify business processes, sub-processes, dependencies, and their criticality to enable prioritization for recovery and funding based on mission criticality.
Improve the GSFC's security posture and situational awareness:
Review programs/projects for alignment with the Security Architecture of the GSFC's Enterprise Architecture
Ensure GSFC programs/projects comply with the OMB, DHS, NIST, NASA and GSFC security requirements in their architectures, designs and implementations
Review submitted system security plans, risk assessments, contingency plans, contingency test plans, configuration management plans, incident response plans, continuous monitoring plans

and inter-agency agreements or memorandums of understandings to ensure compliance with Federal and Agency regulations and policies.
Perform security assessments on Low-, Moderate-, or High-categorized systems upon written request and authorization by the CIO, CISO or customer. This includes GSFC systems, as well as systems located at other Centers.
Prepare all formal documentation for the assessment to include the Security Assessment Plan & Procedures, an in-brief, out-brief and the Security Assessment Report (SAR) to document findings and recommendations.
Conduct external system assessments at contractor sites housing or processing, transmitting and/or storing non-public NASA information.
Conduct event-driven SCA requests to include static code analysis and Web Application assessments
In coordination with the ISOs, ISSOs, network providers and external Federal partners, conduct network and system-level security testing during which evaluators mimic real-world attacks in an attempt to identify ways to circumvent the security features of an application, system, or network. Penetration testing often involves real attacks on real systems and data, using the same tools and techniques used by actual attackers.
Assist ISOs in ensuring security-related activities and costs are considered during all phases of the investment lifecycle as directed by OMB.
Develop repeatable Fee-for-Service Cost Model based upon FIPS 199 Impact Level and complexity of information systems
Increase transparency and visibility with security costing and general investment costing as related to systems in the GSFC FISMA inventory

Delivery mechanisms may include presentations and seminars, handouts and quick reference guides, e-mail newsletters, and web page content for the ITCD website.

Deliverables/Schedules/Milestones

| Task# | Deliverable Title | Due Date/Periodicity |
|---|---|---|
| Subtask 1 | | |
| 1.0 | Task Implementation Plan | Update 30 days after award; updated annually |
| 1.1 | Information Technology Security Management Plan (ITSMP) | Update 30 days after award; updated annually |
| 1.2 | GSFC Risk Management and A&A Education and Awareness Plan | Update 45 days after award |
| Functional Area One | | |
| 1.3 | GSFC Risk Management Strategy | Update 90 days after award |
| 1.4 | IS-GRM Program Weekly Status Report | Weekly; every Monday |
| 1.5 | IS-GRM Program Monthly Status Report | Monthly; 15th of every month |

# SES II Task Order SOWs

| Task# | Deliverable Title | Due Date/Periodicity |
|---|---|---|
| 1.6 | Annual Compliance Certification | Due within 30 business days of SOW start or personnel change, and annually thereafter |
| 1.7 | End of Task Report | At end of task |
| 1.8 | Ad-hoc Requests | As directed |
| Functional Area Two | | |
| 2.1 | Vulnerability Management Block List Criteria | Monthly |
| 2.2 | Monthly POA&M and FISMA Inventory Status report of Center's progress | As Determined by GSFC's report date to Headquarters (HQ) |
| 2.3 | Trend Report per system of Vulnerability Mitigation and Management | Quarterly |
| 2.4 | Trend Report per system of Incident Response and Management | Quarterly |
| 2.5 | Risk Management and A&A Frequently Asked Questions (FAQ) | Quarterly |
| 2.6 | Maintenance of Information Security SharePoint | Quarterly |
| 2.7 | Ad-hoc Requests | As directed |
| Functional Area Three | | |
| 3.1 | GSFC Information System Inventory A&A Schedule | Bi-weekly |
| 3.2 | Security Control Assessor Implementation Plan | Due within 10 business days of award |
| 3.3 | Security Control Assessment Templates | Due within 15 business days of award |
| 3.4 | Security Assessment Plan & Procedures (SAPP) Document | Per assessment, immediately prior to initiation of the individual assessment engagement |
| 3.5 | Security Control Assessment On-Site Engagement Daily Summary | Per assessment, daily during on-site assessment activities |
| 3.6 | Security Control Assessment Engagement Out-brief | Per assessment, at end of on-site assessment activities |
| 3.7 | Security Assessment Report (SAR) | Per assessment, within five business days of assessment completion |
| 3.8 | Security Assessment Supplemental Artifacts | Per assessment, within five business days of assessment completion |

| Task# | Deliverable Title | Due Date/Periodicity |
|---|---|---|
| 3.9 | Security Assessment Formal Recommendation Memo | Per assessment, within five business days of assessment completion |
| 3.10 | Security authorization documentation for GSFC Systems | IAW GSFC A&A Schedule |
| 3.11 | Ad-hoc Requests | As directed |

The scheduling of some deliverables will be dependent on evolving deadlines associated with the FISMA reporting process, established by the Agency's Chief Information Officer.

Management Approach

Staff Allocation, Expertise, and Skill Mix

The Contractor personnel shall possess the following skills and qualifications.

Master's degree in Computer Information Management or related Computer Technology field or equivalent work experience;
Strong communications skills, both written and oral;
Solid knowledge of information security principles and practices;
Understanding of advanced security protocols and standards;
Ability to understand information security laws and regulations in sufficient detail to ensure that appropriate safeguards are in place and enforced
Secret clearance that meets Defense Investigative Service (DIS) security requirements;
Experience with preparing for and conducting security control assessments;
Certification in one or more of the following:
Certified Information System Security Professional (CISSP)
Certified Information Security Manager (CISM)
Certified Information Security Auditor (CISA)
Certified Authorization Professional (CAP)

The following skills and qualifications are considered an added-value.

Project Management Professional (PMP) certification
Experience working within the NASA environment
Familiarity with government audit processes

Configuration Management

The Contractor shall determine the project organization and overall management to accomplish the work, how the technical management will be performed, how personnel and physical resources will be managed, and what mechanisms will be used for cost and schedule control. The Contractor shall provide the planning, direction, coordination, and control necessary to accomplish all work requirements.

# SES II Task Order SOWs

The contractor shall prepare a Task Implementation Plan (TIP) describing the technical approach, organizational resources and management controls to be employed to meet the cost, performance and schedule requirements throughout TO execution. The Contractor shall prepare and present Weekly and Monthly Status Reports, which will address the progress/status of tasks, including quality assurance information. Within the Weekly Status Reports, the Contractor shall provide the following information:

Tasks worked, hours expended on tasks and labor categories used per task;
Status of ongoing activities;
Upcoming activities;
Identification of problem areas with recommended remedial actions

Within the Monthly Status Reports, the Contractor shall provide the following information:

Tasks worked, hours expended on tasks and labor categories used per task;
An overview of work completed, in progress, and planned for each task;
Identification of problem areas with recommended remedial actions;
Summary of resource expenditures;
Status of all issues identified during the course of the last review;
Other than direct costs (ODCs).

Facilities

On site at GSFC

Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics

Performance evaluation will be based on the compliance with the task requirements and the timeliness, accuracy, completeness, and quality of all deliverables.
Errors, misleading or unclear statements, incomplete or irrelevant information, and or excessive rhetoric, repetition, and “padding”, shall be considered deficiencies and shall require rework and will be evaluated as such.
Unless otherwise indicated, the government will require 10 workdays to review and comment on deliverables. If the deliverable does not meet the criteria, the Government will return it for rework and will evaluate performance accordingly.
Deliverables requiring rework shall be updated/corrected and delivered within 10 workdays after receipt of Government comments.

Upon re-submission by the contractor, the Government will reapply the same evaluation criteria. If the deliverable does not meet the criteria a second time, the Government might consider the contractor as having deficient performance with respect to the subject task.

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations.

Quality Assurance Requirements

The IS-GRM program requires skills, knowledge, and support to meet the requirements mandated by the E-Government Act of 2002 (Public Law 107-347), Title III, known as the Federal Information Security Management Act (FISMA). The IS-GRM program is a highly visible within the Strategy and Planning Office. It requires coordination with the Chief Information Officer (CIO), Chief Information Security Officer (CISO), Security Operations leads, various information system owners (ISOs), information systems security officials (ISSOs), other contractors and vendors at GSFC, and Agency stakeholders. The tasks outlined below respond to and implement relevant strategies and objectives as dictated by the Office of Management and Budget (OMB), the Department of Homeland Security (DHS), and are set forth in NASA's procedural directives, requirements and handbooks. The GSFC CISO serves as the focal point for ensuring and employing a strategic organization-wide defense-in-breadth approach for information assurance and security at GSFC. The Deputy CISO (D-CISO) is responsible for developing and implementing an IS-GRM program for all of GSFC's systems and responsible for reporting on their status annually. The D-CISO has the responsibility to ensure that the application of a balanced set of management, operational, and technical safeguards and countermeasures to organizational information systems are employed and captured in system security plans and other relevant documentation. The assessment of policies, security controls, asset management, vulnerability management, and the maintenance of system security documentation plays a critical role in risk mitigation for the entire Enterprise.

ODC (Travel and Procurement)

Special Requirements.

Contractor leading and those supporting the effort shall have expert knowledge of the Agency's authoritative repository, and are very familiar with the NIST, FISMA, and OMB requirements.

Intellectual Property Rights.

All specified draft and final deliverables become the property of the Government. The system security documentation, tools, studies, data, data schema, including any source and compiled scripts that the contractor may develop under this contract shall become the property of the Government. All providers' proprietary data shall be used solely for official government purposes.

Travel.

The contractor may be required to travel during the period of performance of this TO. The travel will be in support of participation in A&A assessments, meetings, conferences, and planning activities. Travel outside of the Greenbelt, MD area will be conducted with prior coordination and concurrence of the TM.

Material / Other Direct Cost (ODC).

The Contractor shall propose all Materials/ODCs required for performance of this task.

Work Location

Work under this TO shall be performed at the Government facilities. Goddard Space Flight Center.

Reporting Requirements

Weekly Status Report (Deliverable 1.2)
The contractor shall generate Performance Reports weekly. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings, and identification of problem or opportunity areas with recommended actions. The report shall be delivered to the TM via email in a standard electronic office document format.

Monthly Performance Report (Deliverable 1.3)
The contractor shall report status in person or via teleconference to the TM or designated alternates on a monthly basis. Reports shall include informal presentation of interim results, status of development activities, and action item status. The contractor shall provide all reports at least one day in advance of the monthly meeting via email, and maintain an email distribution list with the concurrence of the TM. The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports. The report shall be delivered to the TM via email in a standard electronic office document format.

Within the Monthly Status Reports, the Contractor shall provide the following information:
For each Subtask, an overview of work completed, in progress, and planned;
For each Subtask an ad-hoc estimated hours worked report for that sub-task;
An ad-hoc estimated hours worked report for each assessment engagement;
Identification of problem areas with recommended remedial actions;
Summary of resource expenditures;
Status of all issues identified during the course of the last review;
Other than direct costs (ODCs).

End of Task Report (Deliverable 1.4)
The Contractor shall provide an end of task report when the task is ends. The report shall review the major accomplishments of the Contractor over the full task period of performance, identify

the location of all outstanding work products within the Government information repositories or provide the latest working copies in a standard electronic office document format, and any other information necessary for a smooth transition of task responsibilities to the Government or Government-designated successor contract.

Security Control Assessment On-Site Daily Summary (Deliverable 3.5)

During security control assessments, the contractor shall provide a written daily summary. The summary shall be delivered to the site assessment point of contact and the TM via email. The summary shall describe the portions of the assessment activities completed during the day, general activities planned for the next day, a draft rolling list of identified areas of excellence, a draft rolling list of findings and recommendations, and a rolling list of all outstanding actions or requests (e.g., requested documentation). The daily summary shall be delivered via email to the ISO, ISSO, and TM in a standard electronic office document format.

Performance evaluation will be based on the compliance with the task requirements and the timeliness, accuracy, completeness, and quality of all deliverables.

Errors, misleading or unclear statements, incomplete or irrelevant information, and or excessive rhetoric, repetition, and "padding", shall be considered deficiencies and shall require rework and will be evaluated as such.

Unless otherwise indicated, the government will require 10 workdays to review and comment on deliverables. If the deliverable does not meet the criteria, the Government will return it for rework and will evaluate performance accordingly.

Deliverables requiring rework shall be updated/corrected and delivered within 10 workdays after receipt of Government comments.

Upon re-submission by the contractor, the Government will reapply the same evaluation criteria. If the deliverable does not meet the criteria a second time, the Government might consider the contractor as having deficient performance with respect to the subject task.

Security Requirements

The IS-GRM program requires skills, knowledge, and support to meet the requirements mandated by the E-Government Act of 2002 (Public Law 107-347), Title III, known as the Federal Information Security Management Act (FISMA). The IS-GRM program is a highly visible within the Strategy and Planning Office. It requires coordination with the Chief Information Officer (CIO), Chief Information Security Officer (CISO), Security Operations leads, various information system owners (ISOs), information systems security officials (ISSOs), other contractors and vendors at GSFC, and Agency stakeholders. The tasks outlined below respond to and implement relevant strategies and objectives as dictated by the Office of Management and Budget (OMB), the Department of Homeland Security (DHS), and are set forth in NASA's procedural directives, requirements and handbooks. The GSFC CISO serves as the focal point for ensuring and employing a strategic organization-wide defense-in-breadth approach for information assurance and security at GSFC. The Deputy CISO (D-CISO) is responsible for developing and implementing an IS-GRM program for all of GSFC's systems and responsible for reporting on their status annually. The D-CISO has the responsibility to ensure that the application of a balanced set of management, operational, and technical safeguards and countermeasures to organizational information systems are employed and captured in system security plans and other relevant documentation. The assessment of policies,

security controls, asset management, vulnerability management, and the maintenance of system security documentation plays a critical role in risk mitigation for the entire Enterprise. Handling sensitive data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

Documents applicable to the successful implementation of this SOW can be found on the Agency Office of the CIO (OCIO) website:
http://www.nasa.gov/offices/ocio/itsecurity/index.html.

Additionally, Special Publications, published by the National Institute of Standards and Technology (NIST) shall serve as guidelines in the implementation of this task
http://csrc.nist.gov/publications/PubsSPs.html.

## References

The following sections are incorporated through reference into this Task Order above.
NPR 1600.1 NASA Security Program Procedural Requirements
Requirements related to the protection of personnel and facilities.
NID 1600-55 Sensitive But Unclassified (SBU) Controlled Information
Requirements for handling SBU information.
NPR 2810.1 Security of Information Technology
Requirements for information security.
NPR 7120.7 NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements
Requirements for IT project management at NASA
GPR 1410.1 Directives Management
Requirements for establishing formal policy, process, and instruction guidance
GPR 7120.1 Project Management
Requirements for project management at GSFC

# 5004 Logistics Support Services

Date: October 9, 2019
Task Monitor (TM): Carlos Dutan
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

## Scope

Background
The Software Engineering Division (SED) is responsible for the engineering of software and information systems throughout all phases (formulation through on-orbit operations) of NASA programs and projects. These systems include flight, ground, and science data software for spacecraft monitoring, control, on-orbit performance management and operations; spacecraft data processing and analysis, and information management; and science data analysis and management. The SED focuses on the development of reusable flight and ground architectures and frameworks to reduce mission cost, decrease development time, minimize customer risk, and increase the scientific value of information products. The SED provides expertise in software systems engineering, secure environments, and the software product development lifecycle to ensure the delivery of reliable software and information systems solutions.
Summary of work
The Software Engineering Division (SED) is in need of logistic and administrative services to support several GSFC organizations, projects, and missions. This task is to obtain support services to cover the following functions:
Perform logistics, communications, tracking and documentation support
Perform website development and maintenance support
Provide technical writer/presentation support

Required skills/knowledge
The operations contractor shall have operations experience working with software development facilities. Experience with NASA facility and property management and tracking systems is required.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2021.

## Subtask Description

Subtask 0001 - General Project & Mission Support
The logistics administrator support includes:
Perform logistics, communications, tracking and documentation support:
Provide logistics support for internal and external meetings, reviews and conference/symposiums and poster session organization.

Develop and disseminate common materials to the task teams; including but not limited to meeting minutes, review materials, call for proposals.
Organize GMSEC-wide materials for management reporting and program-level tracking.
Work with the individual task teams to develop data sheets, GMSEC overview materials, documentation, and possibly posters highlighting the features of the GMSEC program.
Perform website development and maintenance support
Maintain the existing internal and public GMSEC websites
Provide website design and development for the Goddard Technology Management Office (GTMO) while continuing sustaining engineering on existing website within the division.
Provide technical writer/presentation support
Support the development, preparation and reproduction of Project review material for GSFC Missions that include but not limited to LANDSAT 9, JPSS and GMSEC.
Prepare the GSFC Internal Research and Development (IRAD) Core Capabilities (CC) Program Call for Proposals and Proposal submission
Support may include brochure preparation and graphics/poster design

Subtask 0002 - LCRD Project Support
The logistics administrator support includes:
Perform logistics, communications, tracking and documentation support:
Provide logistics support for internal and external meetings, reviews and conference/symposiums and poster session organization.
Develop and disseminate common materials to the task teams; including but not limited to meeting minutes, review materials, call for proposals.
Provide technical writer/presentation support
Support the development, preparation and reproduction of Project review material
Support may include brochure preparation and graphics/poster design

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status / Performance Reports | Monthly |
| 2 | End-of-task Report | End of task |

## Management Approach

Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

Configuration Management
Any Systems and documents will be covered under the Software Engineering Division Configuration Management Plan.

Facilities
The contractor shall reside onsite and the contractor shall provide appropriate IT support.

Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

There is no non-local travel for this SOW.
Procure logistic materials and supplies as directed by the Project.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

Contractors working under this task will be required to handle SBU and ITAR data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

# SES II Task Order SOWs

## 5005 Web Development and Support

Date: October 25, 2019
Task Monitor (TM): Malinda Hammond
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

### Scope

Background –
The Computing Environments and Collaborative Technologies Branch (Code 585) provides a diverse variety of services and tools in support of activities within the Software Engineering Division (SED) and Engineering and Technology Directorate (ETD). One function of the Branch is to develop web based collaborative and knowledge management systems, while deploying prototypes to foster the adoption of these systems in partnership with customer groups. Code 585 has a large customer base including other branches within SED, ETD, and other directorates outside of ETD. The web applications developed support both institutional and technical needs of the customers.

Summary of work –
The Computing Environments and Collaborative Technologies Branch (Code 585) is in need of technical services to support the development and maintenance of web applications. This task provides support to Code 585 for the entire life cycle of web application development:
Stakeholder Communications and Planning
Concept Development / Requirements / Prototyping
System Requirements Review
IT Security Application Review
Development and Internal Testing
Beta Testing
Operational Readiness Review
Application Release
Application Maintenance / Updates

Required skills/knowledge –
The contractor shall have experience in web development technologies as well as demonstrate effective communication, organizational, and teamwork qualities. Competency areas include but are not limited to experience with the following:
Web programming languages: PHP, Python, Java, HTML, HTML5, C++, JavaScript, JQuery, ColdFusion
Database technologies: SQL, MySQL
Web server technologies: Apache HTTP Server, IIS Server, Apache Tomcat
Collaboration Software: Confluence, JIRA
Multimedia and Graphic Design: Flash, ActionScript, Photoshop, Facebook programming
Mobile development: iOS and Android programming
Version control / code repository technologies: Git, Subversion

# SES II Task Order SOWs

Technical writing

## Period of Performance

The period during which the work for this task shall be performed is from October 1, 2019 through September 30, 2020.

## Subtask Description

### Subtask 0001 – Web Development and Maintenance

The contractor shall support the development and maintenance of new and existing web applications throughout the entire life cycle for customers of Code 585. There are many applications that Code 585 has developed and released in the past – these applications require occasional maintenance for bugs that are reported or for enhancement requests. There are also times when hardware and/or software must be updated that could require some additional updates to these existing applications to be sure that they will still function as desired. Code 585 also receives several new application requests from customers throughout the year. The contractor is expected to be involved in the entire life cycle of the application development – from requirements gathering, to deployment and maintenance. In addition to in-house web applications, the contractor shall also assist in the maintenance and customer support of commercial tools that are provided within Code 585. Confluence and JIRA are commercial tools that Code 585 provides as a service to customers that assist with team collaboration and issue tracking.

During the development and active maintenance of an application, the contractor will present status at bi-weekly Branch Status Reviews (BSR). The contractor is also expected to attend monthly Web Developer meetings where various technical topics are presented to the entire web development team.

(Currently, there are no more subtasks).

## Deliverables/Schedules/Milestones

### Subtask 0001

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Action Items Maintenance | As needed |
| 2 | Weekly Tool Maintenance | As needed |
| 4 | LQMS Module Maintenance | As needed |
| 3 | IDC Portal Maintenance | As needed |
| 4 | Confluence / JIRA Upgrades and Maintenance | As needed |
| 5 | FSB Website Maintenance | As needed |
| 6 | LIT Application Maintenance | As needed |
| 7 | Branch Status Review (BSR) Reports | Bi-weekly |
| 8 | End-of-task Report | End of task |

# SES II Task Order SOWs

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Software Engineering Division Configuration Management Plan.

### Facilities

The contractor shall reside onsite at GSFC and the contractor shall provide appropriate IT support.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

# SES II Task Order SOWs

## ODC (Travel and Procurement)

Subtask 0001

Procure software/hardware as directed by the Project

## Work Location

This work shall be performed at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

Contractors working under this task will be required to handle SBU and ITAR data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

| | |
|---|---|
| NPR 7150.B | NASA Software Engineering Requirements |
| GPR 7150.1 | Goddard Software Engineering Requirements |

## References

## 5006 EOS Operations Center Systems and Software Engineering

Date: July 31st , 2018
Task Monitor (TM): Johnny Medina
Contract number: NNG15CR67C
Contract SOW: 4.5 Supporting Services

### Scope

Background – This Task Order is established to provide ground system support to the Earth Observing System (EOS) Program primarily supporting the Earth Science Mission Operations (ESMO) Project and some shared support to the Earth Science Data Information Systems (ESDIS) Project. The Aqua, Aura and Terra missions are supported by the EOS Operations Center (EOC) in Bldg 32 and the Backup EOC (BEOC) in Building 13. The EOC ground system was initially designed for the Terra spacecraft launch in 1999, and was then evolved for the Aqua, and then the Aura missions. From approximately 2008 through 2011, the ground system went through a modernization effort. The ground system is now in a continuous update cycle to ensure security and maintainability. This Task Order will also support IT security Engineering support to the EOS Ground Systems, GPM Ground System, IceSat-2 Ground System, and the PACE Ground System.
The Constellation Coordination System (CCS) receives regular releases based on feedback from the user community at Mission Operations Working Group (MOWG) meetings. This task will have a member from the user community to provide constellation analysis, provide user perspective and algorithm development to the requirements for the new features and provide evaluation and user acceptance testing of the new features prior to operational deployment.
This task extends the work previously performed on the SES task 1006 with a re-organization of the subtask structure.
Summary of work – The Contractor shall perform software engineering, system administration, network administration, system engineering, and configuration management activities for the EOC, BEOC, IceSat-2 MOC and BMOC, and PACE MOC and bMOC ground systems. This support falls primarily under the Software Engineering Support (SES) Statement of Work (SOW) section 1.3 Ground Software and Systems, and secondarily under section 1.1 Software Systems Engineering, Studies and Analysis.
Detailed descriptions of the services required for the Terra, Aqua and Aura missions are:

Development support to the modernization and maintenance of the EOS Mission Operations System (EMOS) Mission Management System (MMS). The contractor shall participate in a combined contractor and government team to continue to maintain and modernize the MMS system.

Software activities in support of the ongoing Reengineering efforts of ESMO missions (TRMM, IST Reengineering, MMS Reengineering, EOS Automation, and Security Reengineering) which include arranging vendor maintenance agreements for Commercial

Off The Shelf (COTS) products, supporting test and integration of new or modified software, documenting system changes and problems, maintenance of operational parameter databases, and configuration control of software system configurations.

Sustain and provide engineering analysis of the Aqua, Aura and Terra Mission Planning Tool (AMPT/TMPT). The contractor shall determine what enhancements and potentially augment this tool in support of Automation.

System administration activities include providing support for maintaining the ground system software/firmware, COTS, network security and compliance, and custom applications in authorized system configurations. Database administration activities include system configurations and software configurations.

Configuration management activities include maintaining the COTS licenses for EMOS, responding to GSMO contractor renewal notices, providing updates to renewal specifications, directly contacting vendor for technical support services, notifying GSMO personnel for any equipment updates (changes in location & new system installation), and providing engineering drawing updates (network & configuration) to GSMO contractor.

The contractor shall provide on-site ground-system engineering support to operations, including simulations and special operations activities. The contractor shall provide systems engineering services in support of EOC automation activities.

The contractor shall provide LAN management for the following systems:

EOC
BEOC
IST
EOS Automation
MMS Development/ Sustaining Lab

Required skills/knowledge – The Contractor shall provide staff with the skills to perform in the areas of software development, system administration, system engineering, network engineering, and configuration management. The experience level on this task should range from senior level staff (to handle modernization designs, technical staff coordination and planning, and technical anomaly resolution) to junior staff including interns to support routine activities with progressing level of technical duties. Certain specified positions on this Task Order may require the ability to obtain Secret Clearance or above, at the direction of the Task Monitor, for continued support on this Task Order.

## Period of Performance

The period of performance of this task is 11 months starting October 1st, 2019 going to August 31st, 2020.

## Subtask Description

This task will provide the Systems Administration, Networking Engineering and IT Security oversight, and Mission Systems Engineering for ESMO (Earth Science Mission Operations) Systems. This task will be broken down into respective Subtasks, which may be lead by other contractors on other contracts.

EOS Mission Operations Systems (EMOS)

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The Contractor shall provide the system administration and engineering leadership for all Terra, Aqua and Aura EMOS components located in the EOC in Building 32, the BEOC located in Building 13, EMOS Development and Test Facility (EDTF) also located in Building 13, and the Integration and Test Facility in Building 32. The EMOS includes all components on the Open and Closed EBNet and the M&O networks necessary for the operation of:
OnLine command and telemetry
Analysis data trending using ITPS (SA support also provided on GSMO TO 8)
Mission Management System (MMS)
EOS Real-time Processing System (ERPS) (SA support provided on GSMO TO 8)
Scalable, Integrated, Multi-mission Simulation Suite (SIMSS) environment for Terra (SA support provided on GSMO TO 8)
Multimode Portable Simulator (MPS) environments (SA support provided on GSMO TO 8)
Tools and data interfaces including (but not limited to) the Mission Planning Tools, Scenario Scheduler, Pass Plan Formatter (PPF), Data Distribution System (DDS), and the Instrument Support Toolkit (IST)
The Contractor shall provide system administration (SA) and system engineering (SE) staff that provides:
Services for system maintenance including on-call support 24 by 7
Coordination of routine system updates and deployments to the EOC and BEOC associated with the automation initiatives and maintenance activities
Identify, plan installation, and apply security Patches for Terra, Aqua and Aura as needed in response to “Critical” and “High” Security Bulletin Notifications. The contractor shall coordinate integration and test of all security patches.
Upgrade and test Configuration Management (CM) procedures, scripts and processes in support of the Flight Operation Team Infrastructure (FOTI) and the Backup EOC (BEOC) ESMO Modernization Plans (EMPs).

The Contractor shall provide Configuration Management support to the ESMO Project in reviewing ESMO process compliance with the changes to NASA and GSFC Procedures Requirements and Directives.

The Contractor shall provide system account management for all users, including the external Instrument Operations Teams (IOTs). Since some of the IOTs are located internationally and are staffed with foreign nationals the SAs and SEs supporting this task shall be covered by a contractor Technical Assistance Agreement (TAA).
The contract shall provide software development and maintenance support for the Mission Management System (MMS) that consists of three subsystems: Planning and Scheduling (PAS), Command Management System (CMS), and Data Management System (DMS).
EMOS File Transfer Anywhere (EFTA) is responsible for the archival of EMOS and spacecraft data to the Distributed Active Archive Center (DAAC), as well as housekeeping of data from the EMOS. EMOS Retrieval (ERVL) system handles the retrieval of various data types following archival.
The contractor shall provide support for MMS and the EFTA and ERVL in support of MMS files. The contractor shall work in conjunction with GSMO contractor support teams in software sustaining of the MMS. Duties include the following:
Software test and integration in support of Discrepancy Reports (DR) resolutions.

Documentation in support of software, security patches and hardware/software upgrades. Identify, document and trouble-shoot MMS operational errors, configuration changes and software discrepancies.
Support the upgrades of MMS to address technical, maintainability, and operational deficiencies.
The contract shall provide software sustaining of ESMO operations and analysis tools and utilities that include but not necessarily limited to the following items:

1. Multi-Mission Planning Tool (MMPT)
2. Mission Impact Report (MIR)
3. MMS Support Scripts and Tools
a. MMS_ALL Tool
b. SE Tool – tool similar to MMS_All but for SEs
c. MMS Daily Alarms scripts
d. Resource Model Startup/Shutdown Scripts
e. Process Monitor scripts (workstations, servers, EFTA)
f. Database maintenance scripts
g. DASM Scheduling script
h. SSH Connection Test script – used to verify connectivity after network work
i. Several others
4. Pass Plan Formatter (PPF)
5. Scenario Scheduler (SS)
6. ITPS Support Scripts (i.e. Daily Status Scripts)
7. MODIS Compare Script
8. EMOS Trouble Ticket System
9. Shift Handover Web Log (Aqua/Aura/Terra)
10. Planning and Scheduling (PAS) Status Report (Aqua/Aura/Terra)
11. Automated Signoff sheets for PAS
12. Port Report
13. AOS/LOS Clock
14. FOT CM Support Scripts and Tools
a. CM Submit script
b. CM Ingest and Deliver scripts (Online/ITPS/MMS)
c. Audit scripts
d. PDB Capture script
e. Document capture and delivery scripts
f. Several others
15. Online Support Scripts
a. MLS Proton Alert scripts
b. Online Interfaces Monitor scripts

Mission Systems

The Contractor shall provide Mission Systems Engineering support to the Earth Science Constellation Mission Operations Manager (MOM). The Contractor shall support the maintenance of the Constellation documents, including but not limited to the Constellation Operations Coordination Plan. The Contractor shall support the development and/or

maintenance of the Constellation interface control documents (ICDs) between the ESMO Constellation Coordination System (CCS) and the various mission control centers including the French Space Agency (CNES) CALIPSO control center, the LaRC Mission Operations Center (CALIPSO), the EOS Aqua and Aura Operations Center, the CloudSat control center at the Kirtland Air Force Base, the OCO-2 control centers, and the JAXA GCOM-W1 control center in Japan. The Contractor shall support the activities conducted by the Constellation MOM, including the EOS Mission Operations Working Group (MOWG) meetings/telecons and Technical Interchange Meetings (TIMs). The Contractor shall facilitate and document communications among members of the MOWG, generate and distribute meeting minutes, track and report on action items, and support the editing and review of Constellation documents. For new missions joining the Constellation, the contractor shall monitor Constellation–related pre-launch testing, data flows, and simulations, and integrate mission schedules with the Constellation schedule.

In addition, the Contractor shall support Constellation Coordination System (CCS) meetings and reviews. This includes review and evaluation of CCS requirements and design, testing plans and results, and coordination of questions/concerns from member missions with the Flight Dynamics and CCS teams. The Contractor shall also respond to spacecraft and/or instrument team inquiries, as directed by the MOM.

The contractor shall provide technical support to the enhancement of future releases of the CCS. The activities shall include:

Conceive and develop new CCS requirements that will enhance the utility of CCS for the Morning and Afternoon Constellation users by working with A-Train mission teams to understand and integrate their requirements

Identify improvements or enhancements to existing or planned CCS capabilities

Independent evaluation of the implementation of the new capabilities in CCS builds

Assist CCS development team with algorithm development and modeling analysis, as necessary

Perform other analysis needed for supporting A-Train mission teams, as directed by the Constellation MOM

Networks & IT Security Support

The contractor shall provide planning, installation, and maintenance of the EOS Backbone network (EBNet) infrastructure, and recommend solutions when technical or schedule problems arise. The contractor shall work with the EOS security representative to ensure GSFC security policies are followed. The contractor shall support Strategic planning activities, which include capacity management, security strategies, security procedures, and evaluating emerging network infrastructure technologies.

Duties shall include:

Setup and configure network architecture and networking infrastructure that will become sustaining responsibilities for ESMO and ESDIS

Maintain Network configuration information/diagrams

Provide firewall and maintenance support to evolving and reengineered network , including development of rulesets

Provide secure (two factor) authentication services and support

Support Certification and Accreditation (C&A) or related security assessment efforts for EOS

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Develop tools for security compliance, asset change alerting and tracking, and migration to the Tufin SecureChange system
Deploy COTS products to provide for the automation of systems management tasks for network devices and firewalls
Support the security team with system scans and collection of logs, and implementation of security controls to address Plan of Action and Milestone (POA&M) items.
Support IT Security Plan A&A activities
Provide for updates to GSFC and Agency databases on ESMO artifacts as needed
Support the design, installation, and configuration of Continous Data Monitoring (CDM) tools provided by agency mandated requirements to the EOS Ground System and Subsystems.

IceSat-2 Security Support

The contractor shall work with the IceSat-2 security representative to ensure GSFC security policies are followed. The contractor shall support Strategic planning activities, which include capacity management, security strategies, security procedures, and supporting A&A activities.
Duties shall include:
Support the security team with system scans and collection of logs, and implementation of security controls to address Plan of Action and Milestone (POA&M) items.
Develop CDM implementation Schedule and maintain CDM execution for ESMO
Support IceSat-II IT Security A&A Activities
Support IT Security Plan A&A activities
Provide for updates to GSFC and Agency databases on ESMO artifacts as needed
Support the design, installation, and configuration of Continous Data Monitoring (CDM) tools provided by agency mandated requirements to the IceSat-2 Ground System and subsystems.

PACE Security Support

The contractor shall provide the PACE IT security representative and work with the ESMO and PACE Project to ensure GSFC security policies are followed. The contractor shall support Strategic planning activities, which include capacity management, security strategies, security procedures, and supporting A&A activities.
Duties shall include:
Provide the Lead for PACE IT Security Representative and support PACE Systems Development and testing with the ESMO and PACE Projects.
Support the security team with system scans and collection of logs, and implementation of security controls to address Plan of Action and Milestone (POA&M) items.
Develop CDM implementation Schedule and maintain CDM execution for ESMO
Support PACE Project IT Security artifact collection and definition
Support IT Security Plan A&A activities
Provide for updates to GSFC and Agency databases on ESMO artifacts as needed
Support the design, installation, and configuration of Continous Data Monitoring (CDM) tools provided by agency mandated requirements to the PACE Ground System and subsystems.

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Support System Architecture evolution
Support early System Administration for evolving system design and requirements support

## Deliverables/Schedules/Milestones

The contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly |
| 2 | Performance Reports | Monthly |
| 3 | System Maintenance Schedule Updates | Weekly |
| 4 | System Documentation Updates | As required |
| 3 | End-of-task Report | End of task |

Software deliverables shall include source code, executable and all related documents, when applicable.

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. Task activities require expertise in spacecraft on-console operations, CCSDS telemetry and command formats, spacecraft command databases (PMDB), database administration, UNIX, Linux and Microsoft Windows system administration, network administration, Configuration Management, and system/ acceptance testing, and programming of operations scripts and reports. The contractor shall provide, as appropriate, personnel with experience in Delphi Library Usage, C++/Object Oriented Design, Microsoft Access and Sybase products, Java 1.4+, Clearcase Configuration Management, and the Cecil language. The contractor may propose training to ensure applied staff stay current with advancing technologies.
For the effective CCS requirements support, the assigned personnel shall have intimate knowledge of the Morning and Afternoon Constellation requirements, routine Constellation operations, formation flying, and typical analysis requirements. The personnel should have experience in working with the A-Train mission teams. The personnel shall have a working knowledge of CCS and a strong analytical background in orbit dynamics and Morning/Afternoon Constellation operations to fully test/assess the CCS capabilities.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan with further details in Local Operating Procedures for configured items used for mission support.
Configuration Management shall include configuration management of EMOS software (COTS and custom, including scripts), system configurations and documentation. Configuration Management shall also include supporting Discrepancy Review Board and relevant Configuration Control Board meetings. Configuration Management shall also support interface working group meeting and preparing CCR presentation materials as necessary. Configuration Management shall be consistent with existing Mission Systems

Configuration Management procedures and guidelines. Configuration Management shall coordinate with the existing Mission Systems Configuration Management Office (CMO) and shall use the Mission Information and Issue Tracking System for recording and tracking CCRs and DRs. They shall use Synergy as the project repository for EMOS configured items.

Facilities

Support for all subtask requirements in this SOW will be performed on-site at GSFC on the systems provided as GFE unless otherwise approved by the TM. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment to support business management functions.

Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW. This Task Order specific performance metrics include:

Maintaining the EMOS systems to meet the EMOS requirements, as specified in the (ECS) EMOS Segment Requirements Baseline, project specific Ground System Requirements Documents (GSRDs), and related Interface Control Documents (ICDs).

Delivering regular reports on schedule.

Delivering software per published schedules.

Applying operating system and security patches on schedule.

Delivering one-time reports and studies on an agreed upon schedule.

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5D NASA Space Flight Program and Project Management Requirements

NPR 7123.1A NASA Systems Engineering Processes and Requirements

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GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

The Contractor shall maintain and follow Local Operating Procedures for the maintenance and upgrade of the EOS systems. These procedures will include quality control steps prior to the delivery of products, system configurations, and system updates.

## ODC (Travel, Training and Procurement)

Travel and training may be proposed for special needs and other engineering support task activities as directed by the Project.

Training for Subtask 1 Only:

| Training | Number of classes | Type |
|---|---|---|
| VMWare vSphere | 2 | Classroom |
| VMWare vSphere | 1 | Online |
| Red Hat | 6 | Online |
| Microsoft OS System Admin | 3 | Online |
| Microsoft OS System Admin Certification | 3 | Exam |
| Configuration Management | 2 | Classroom |

Travel for Subtask 1 Only:

| Location | Duration | Dates |
|---|---|---|
| Dullas, VA for 2 team member for VSphere classroom training | 1 week | October 2019 |

Training for Subtask 3 Only:

| Training | Number of classes | Type |
|---|---|---|
| Juniper | 1 | Online |
| Juniper Certification | 1 | Exam |
| Network Certification (CISSP) | 1 | Online |
| Network Certification (CISSP) | 1 | Exam |
| Windows Server Networking | 1 | Online |

Travel for Subtask 3 Only:

| Location | Duration | Dates |
|---|---|---|
| White Sands, NM for 1 team member for New Network Hardware installation | 1 week | October 2019 |
| Pasadena, CA for 1 team member for Initial AWS EBNet Network installation | 1 week | November, 2019 |
| Pasadena, CA for 1 team member for Final AWS EBNet Network installation | 1 week | May, 2020 |
| Fairbanks, AK for 1 team member for Firewall update and installation | 1 week | October 2019 |

| | | |
|---|---|---|
| Tokyo, Japan for 1 team member for Voice system upgrade | 1 week | March 2020 |
| Wallops, VA for 1 team member for Network Upgrade | 1 week | June 2020 |
| San Fransisco, CA for 1 team members for Juniper Conference | 1 week | October 2019 |
| Orlando, FL for 2 team member for Cisco Live Conference | 1 week | June 2020 |
| Las Vegas, NV for 1 team member for Amazon Web Services Re: Invent Conference | 1 week | November, 2019 |

Travel for Subtask 2 Only

| Location | Duration | Dates |
|---|---|---|
| San Francisco, CA for AGU Conference | 1 week | December 2019 |
| Gilbert, AZ for Constellation Mission Operations Working Group (MOWG) | 1 week | December 2019 |
| Cape Town, S. Africa | 1 week | May 2020 |

## Work Location

This work shall be performed primarily on-site at the Goddard Space Flight Center, but the contractor may be required to perform some work at the contractor's facility.

## Reporting Requirements

### Weekly status report

The contractor shall generate Performance Reports every week. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall report status in person or via teleconference to the TM, Project Management or designated alternates on a monthly basis. Reporting shall include a presentation of interim results, status of development activities, action item status, and status of actual versus planned costs. The contractor shall provide all reports at least one day in advance of the monthly meeting via email, and maintain an email distribution list with the concurrence of the TM.

### Additional reports

The contractor shall also support the TM in the preparation of status reviews for internal and external funding agencies. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

Staff on this task will be required to handle controlled unclassified information (previously called SBU data.) Staff on this task will also be required to interface with Instrument Operation Teams (IOTs), which include international locations that are staffed with foreign nationals. This interface will require the contractor to maintain Technical Assistant Agreements (TAAs) through the State Department. Some staff members may be required to obtain Secret Clearances or above to support this Task Order.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2A NASA Software Engineering Requirements
GPR 7150 Goddard Software Engineering Requirements

## References

# SES II Task Order SOWs

## 5009 IT Support for Detector Characterization Lab

Date: 7-24-2019
Task Monitor (TM): LanTrang Nguyen
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services (TASK TYPE = 5)

Scope
Background –
The contractor shall provide Information Technology (IT) technical support to the Detector Characterization Lab (DCL) as described below. The contractor shall provide computer backup/restore services, computer patching services, system maintenance and system administration, IT architecture engineering, configuration management, and computer security support. On-site support is required between the hours of 8:00am-5:30pm on weekdays excluding holidays, with occasional after-hours support for system maintenance. The contractor shall support DCL end-users at GSFC, primarily located in buildings 5, 11, 20. The contractor shall manage the systems in accordance with the ETD Laboratory Systems Multi-Program IT & Project Unique IT (CD-9999-M-GSF-3275) security plan.

The Detector Characterization lab's (DCL) current computer network consists of approximately 36 computers running Linux and five computers running Oracle Solaris. There are two main file servers, with attached storage totalling approximately 400TB, and an additional backup server with approximately 600TB of disk storage. These systems include desktops that are used as workstations and for data acquisition and lab system control and monitoring. There are also six analysis servers, and two special purpose HPE/SGI UV300 High Performance Computing systems. These HPE/SGI systems are based on an advanced architecture, with 96 CPU cores and 6TB of RAM each. All DCL systems are connected via 1Gbit Ethernet, with 10Gbit Ethernet implemented on selected systems.

Summary of work –
Details of work to be performed are provided in the descriptions given below. Each description identifies specific activities to be conducted. Work priorities will be defined by this task's Government Task Monitor (TM) and reviewed no less frequently than monthly.
1. Systems Operations Support for DCL

The contractor shall:
Secure equipment in the event of utility outages
Relocate equipment within the building and potentially other buildings at GSFC, as needed.
Interface with Lab Managers to resolve facility and IT specific problems
Interface with hardware and software maintenance personnel to resolve any issues
Consult with DCL Lab Manager and Engineers to identify and evaluate new hardware and software.
Receive and inspect new property and plan for its deployment
Coordinate the disposal (excess) of unneeded property, including the sanitization of media.

2. Backup and Restore support for DCL

The contractor shall install, configure, update and resolve any issues with the backup software and operating environment.
The contractor shall develop, maintain and test appropriate backup procedures for lab computers and servers.
The contractor shall assist lab managers with data backup, recovery and archive processes.
The contractor shall review the backup logs to identify failures and last successful backups.
The contractor shall ensure that all lab computers have successful weekly full backups.
The contractor shall ensure that monthly full backups to a location in a different building than the primary backup are successfully completed
The contractor shall contact the TM whenever a device has not had a successful backup within the past 30 days.

3. System Administration Support for DCL

The contractor shall provide system administration support. This support includes setting up new user hardware, installation and configuration of software, maintenance of disk space, user help, system backups and restores, system monitoring and maintenance, security updating and monitoring and troubleshooting and problem resolution. This support shall include, but not be limited to, the following operating systems: RedHat, CentOS, Scientific Linux, Solaris and Ubuntu. Specific requirements are:

Provide lab computer system administration support
Setup new user accounts and remove accounts of departed personnel no longer requiring access to DCL systems; user data must also be disposed of or archived in accordance with DCL policies
Provide support to meeting NASA mandates for lab operating systems
Ensure that all lab computers implement Agency, Center and Directorate security requirements
Ensure that all systems are running approved operating systems
Provide installation, set-up, and configuration of lab hardware and software
Provide support to managing DCL commercial off-the-shelf (COTS) software licenses including, but not limited to…
Provide general system backups and restores, system monitoring and maintenance of division IT resources in the DCL
Provide lab computer and server backups and restores
The Contractor must maintain SA certification required by NASA for non-ACES computers and submit all required forms to obtain and maintain SA privileges
Submit trouble tickets, via Directorate identified tool, on behalf of the user to address lab hardware and software needs. Follow-up on all tickets until the issue is resolved to the user's satisfaction.
Develop scripts and programs to facilitate the work of the Lab in an effort to automate systems administration functions.

4. Configuration Management Plan and Management

The contractor shall establish and maintain a configuration managmenet plan for the DCL.

This plan will inclube, but not limited to, disk space management; workstation Configuration and management, server configuration and management, back-up Procedutres, software licensing configuration and operations plan

All changes to CM of the lab machines must be recorded in the lab notebooks resident in each lab or combined in a centrally managed server.

5. Teleworking
There are no issues with episodic telework as long as there is no impact to operations of DCL. The Contractor must notify TM of telework intentions prior to taking. Ensure TM, Lab Manager and Division IT Manager have all Contractor contact information.

6. Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the concurrence of the TM.

7. DCL IT Infrastructure
The contractor shall provide recommendations and specifications for DCL IT infrastructure hardware purchases (e.g. lab machines, disk/ SAN storage, cabling, etc…). The contractor shall submit the requestes to TM and Lab Manager for concurrence.

Installation of new hardware should follow Directorate/Division procedures before it can be included in Directorate Security Plan and connected to the network. Equipment no longer needed or required must be disposed of in accordance with Agency media sanitization policies.

Mod 1: This task mod is to extend the period of performance out to Sept. 30, 2020 to continue the support as stated in the scope above.

Period of Performance
The period during which the work for this task order shall be performed is from Sept. 30, 2019 through Sept. 30, 2020.

Deliverables/Schedules/Milestones

| Task Deliverable Items | Due Date |
|---|---|
| Schedule, Test and Perform updates to backup software. | By date agreed upon with TM, usually within 2 weeks of release* |
| Update System specific documentation (i.e. network diagrams, user's guide, etc.) upon any change/modification to the functionality of the system. | Within 1 week of modification/change to the system* |

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|---|---|
| Weekly written status reports shall include a detailed list of weekly activities, issues and risks | Weekly - prior to 9am every Tuesday* |
| Perform full backup of end-user data to backup media (tape or disk) | Monthly - due by the 15th, unless otherwise noted* |
| Backup status report of all DCL workstation backups, including the date of last successful backup and results of restore test of each computer and file share. | Monthly - due by the 15th, unless otherwise noted* |
| Vulnerability Mitigation and Waivers. Ensure that all devices are patched or waivered prior to the monthly block date. | Monthly - due by the 15th, unless otherwise noted* |
| Ticket status spreadsheet of all tickets closed during the month and all tickets that are still open. | Monthly - due by the 15th, unless otherwise noted* |
| Metric report showing the metrics achieved for work stoppage tickets, software installation/upgrade tickets, scheduled support tickets and all other tickets. | Monthly - due by the 15th, unless otherwise noted* |
| Report showing planned upgrade and maintenance for the upcoming month and perceived IT risks. The report shall list all proposed maintenance outages for the upcoming month. | Monthly - due by the 15th, unless otherwise noted* |
| Parts list report for all untagged IT items, by DCL | Quarterly - due by April 15th, July 15th, Oct 15th and Jan 15th, unless otherwise noted* |
| Network diagram of servers, storage, firewalls, and any private networks supported under this task | Quarterly - due by April 15th, July 15th, Oct 15th and Jan 15th, unless otherwise noted* |
| Provide a report detailing the hardware and software refreshes and/or maintenance that are due during the upcoming 9-months. This should include refresh and/or maintenance due date, vendor refresh and/or maintenance quote, license renewal, storage augmentations, UPS battery replacements and any other relevant terms and/or conditions as appropriate. | Semi-Annual - Due Oct 15th and April 15th, unless otherwise noted* |
| Meeting minutes detailing a biannual meeting between the SA team lead (or designee) and each lab manager. The meeting will be used to discuss the prior 6-month performance, lessons learned, review of backup procedures, and overall lab performance. | Semi-Annual - Due Oct 15th and April 15th, unless otherwise noted* |

| | |
|---|---|
| Provide assessment/review of resources to determine if additional applications or consolidation are needed. | Semi-Annual - Due Oct 15th and April 15th, unless otherwise noted* |
| Exercise the contingency plan and deliver a report with lessons learned and any updates needed to the contingency plan. | Annual – due on June 1st* |
| Increase storage capability for Euclid and WFIRST as needed | |
| Continue migration of lab workstations from Solaris to Linux | |
| End-of-task Report | No more than 10 days after task ends |

*Or as noted by Division/Directorate IT Manager

Management Approach

[redacted]

Facilities
All resources required to perform the work shall be provided by the government.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Safety, Certifications and Training

# SES II Task Order SOWs

All operations shall be conducted in accordance with: OSHA General Industry Standard 29 CFR 1910, NASA Safety Manual NPR 8715.3, any other applicable NASA Procedural Requirements (NPRs), Goddard Procedural Requirements (GPRs), and the SES II Safety and Health Plan.

| Training required for this task: Training Description and Type (mandatory, safety, certification, other, hazardous) | Course Number | Requirement (annual, etc.) |
|---|---|---|
| Environmental Awareness Training – GSFC | GSFC-SH-EAT14 | Every 3 years |
| Information Security Training | ITS-016-001 | Annual |
| Building Emergency Plan Training (on-site) | GSFC-SH-BEP12 | Annual |
| FLASHPOINT: Recognizing and preventing Workplace Violence | GSFC-WPV-FP | Annual |
| Hazcom 2012 | GSFC-SH-HCGH | One-time |
| Training for Elevated Privileges | NASA IT Security Handbook for Access Control: Managed Elevated Privileges (EP) and NAMS workflow for requesting elevated privileges | Initial for all System Admins with renewal as required |
| Cleanroom training and certification | GSFC-004-06 | Every 2 years |
| Electrostatic Discharge (ESD) training | GSFC-300-PG-8730.6.1 | Every 2 years |
| Global Export Compliance (ITAR/EAR) training | SS-LCHR_01_A87_LC_ENUS | As required |

ODC (Travel and Procurement)

No travel and no procurement needed.

Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site).

ITAR and Export Control

Technical data generated under this task may be considered export sensitive information and is, therefore, subject to protection in accordance with the International Traffic Arms Regulations (ITAR) 22 CFR 1201-30. Technical data includes, but is not limited to, presentations, drawings, technical reports, specifications, interface control documents, and procedures. All ITAR documents are to be marked appropriately.

Security Requirements

Information Technology Security procedures and requirements as defined by NPG 2810.1A will be adhered to in the performance of this task. In addition, all applicable federal rules and regulations and agency directives will be complied with.

There will be handling SBU and ITAR data, all necessary Non-Disclosure Agreements will be signed by any task personnel handling this data.

Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

Applicable Documents

N/A

References

N/A

# 5010 550 Division Property Management and Cryogenics Laboratory System Administration

Date: 08/19/19
Task Monitor (TM): Charles DeLee
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

## Scope

Background –
The contractor shall provide Information Technology (IT) technical support and property management to the Cryogenics and Fluids Branch (Code 552) as described below. The contractor shall support Code 552 lab facilities and lab users at GSFC, primarily located in buildings 7, B7 CRIF Annex and Building 400. The contractor shall manage the systems in accordance with GSFC and NASA requirements.

The Code 552 current computer network consists of approximately 35 NON-ACES computers, 29 MAC computers, and 6 running Windows. In addition, there are approximately 25 employees with ACES machines that the contractor will support. There are also two plotters, and software licenses to be maintained such as, Mathematica, Refprop, EES, Kaleigraph, IGOR, FeatureCam, PowerCADD, and TKSolver. The contractor shall provide computer backup/restore services, computer patching services, system maintenance and system administration, IT architecture engineering, and computer security support. On-site support is required during core hours of 9 am – 3 pm and 40 hrs. per week.

In addition, the contractor shall serve as a property custodian provide management of physical property including IT equipment, and other property for Code 550, Code 551, and Code 552. The contractor shall support property audits as required. There are currently 431 items in the property system with some year-to-year variance, as government needs change.

Summary of work –
Details of work to be performed are provided in the descriptions given below. Work priorities will be defined by this task's Government Task Monitor (TM) and reviewed no less frequently than monthly.

Systems Operations Support for Code 552

The contractor shall:
Interface with Lab Managers to resolve facility and IT specific problems
Interface with hardware and software maintenance vendors to resolve any issues
Consult with Code 552 Management and Engineers to identify and evaluate new hardware and software.
Provide support for developing and managing the Code 552 IT budget and spend plan. This should include a bi-annual report out of refresh and/or maintenance due date, vendor refresh and/or maintenance quote, license renewal, storage augmentations, UPS battery replacements and any other periodic terms required for IT equipment/software.

# SES II Task Order SOWs

System Administration Support for Code 552

The contractor shall provide system administration support. This support includes setting up new lab hardware, installation and configuration of software, maintenance of disk space, user help, system backups and restores, system monitoring and maintenance, security updating and monitoring and troubleshooting and problem resolution. This support shall include, but not be limited to, the following operating systems: MacOS and Windows. Specific requirements are:

Provide lab IT system administration support.
Setup new user accounts and remove accounts of departed personnel no longer requiring access to 552 systems; user data must also be disposed of or archived in accordance with NASA policies.
Provide support to meeting NASA mandates for lab operating systems.
Ensure that all lab computers implement Agency, Center and Directorate security requirements.
Ensure that all systems are running approved operating systems.
Provide installation, set-up, and configuration of lab hardware and software.
Provide support to managing 552 commercial off-the-shelf (COTS) software licenses including, but not limited to EES, Mathematica, and other analysis software.
Provide general system backups and restores, system monitoring and maintenance of division IT resources in Code 552.
Provide lab computer and server backups and restores.
The Contractor must maintain SA certification required by NASA for non-ACES computers and submit all required forms to obtain and maintain SA privileges.
Submit trouble tickets, via Directorate identified tool, on behalf of the user to address lab hardware and software needs. Follow-up on all tickets until the issue is resolved to the user's satisfaction.
Develop scripts and programs to facilitate the work of the Lab in an effort to automate systems administration functions.
Provide support to division assessment and authorization activities, including meetings and contingencies. Address risks identified by assessment teams and provide evidence of closure.
Attend bi-weekly System Administrator meeting with Division IT Manager and attend directorate meetings for special topics

Property Management
The contractor shall:
Inventory all items assigned to Code 550, 551, and 552 accounts.
Prepare/sign 20-4 (shipping documents)
Perform property transfer (between users, between accounts) via equipment.nasa.gov
Initiate property EXCESS for controlled and non-controlled items
Prepare Loan Agreement / Cannibalization Forms / Survey forms, etc.
Perform tagging and documenting of new equipment as required.
Assist in decontrolling items

Attend Property Custodian meetings
Assist of Branches with locating and scanning their items.
Serve as Division Property Liaison
Serve as back up to other 550 branch property managers.

Required skills/knowledge – System Administration, NASA IT requirements, Windows, MAC, LabVIEW, EES, Property Management, Office Suite

## Period of Performance

The period during which the work for this task order shall be performed is from task award through September 30, 2020.

## Subtask Description

No Subtasks.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | End of the Month |
| 2 | End-of-task Report | End of Task |
| 3 | IT Budget Plan Submittal | Once/year |
| 4 | Report on Periodic Maintenance/Upgrades Required | Bi-Annual October/April |
| 65 | Participate in Assessment and Authorization Activities. Provide evidence of closure of risks if identified. | Annual |
| 6 | Provide Report of Division Property Status | Post Audits |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Property will tracked with the NASA Equipment system.

### Facilities

An office is provided for one employee, with a computer and phone.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses. The government will provide a desk, a computer, and phone.

Safety, Certifications and Training
All operations shall be conducted in accordance with: OSHA General Industry Standard 29 CFR 1910, NASA Safety Manual NPR 8715.3, any other applicable NASA Procedural Requirements (NPRs), Goddard Procedural Requirements (GPRs), and the SES II Safety and Health Plan.

| Minimum Training required for this task: Training Description and Type (mandatory, safety, certification, other, hazardous) | Course Number | Requirement (annual, etc.) |
|---|---|---|
| Information Security Training | ITS-016-001 | Annual |
| Building Emergency Plan Training (on-site) | GSFC-SH-BEP12 | Annual |
| Hazcom 2012 | GSFC-SH-HCGH | One-time |
| Training for Elevated Privileges | NASA IT Security Handbook for Access Control: Managed Elevated Privileges (EP) and NAMS workflow for requesting elevated privileges | Initial for all System Admins with renewal as required |
| Cryogenic Safety | SMA-HQ-WBT-207 | Every Three years |
| Global Export Compliance (ITAR/EAR) training | SS-LCHR_01_A87_LC_ENUS | As required |

Quality Assurance Requirements
N/A

# SES II Task Order SOWs

## ODC (Travel and Procurement)
N/A

## Work Location
This work shall be performed primarily at the Goddard Space Flight Center (On-site).

## Reporting Requirements
### Monthly performance report
The contractor shall provide monthly technical and schedule progress reporting to describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements
The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. There will be NOT be any handling of classified data.

## Data Rights
This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents
N/A

## References

## 5011 Code 200 System Administration

Date: 07/31/19
Task Monitor (TM): Christian Yancey
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

Scope
Background – Provide ISSO service, System Administration and vulnerabilities management capabilities to Code 200.
Summary of work – Provide ISSO service, System Administration and vulnerabilities management capabilities to Code 200.
Required skills/knowledge - Microsoft Certified Professional, CISSP, ISSO experience and knowledge and access to Center vulnerability management system

Period of Performance
The period during which the work for this task order shall be performed is from task award through September 30, 2020.

Subtask Description
The contractor shall assist Code 200 ISSO and system administrators to ensure the configure and maintain operating system and software on all information systems provided under the Code 200 SSP in accordance with Federal and NASA security configuration policies and guidance. The Contractor support the Code 200 ISSO and system administrators, as required, to ensure all applicable IT systems, applications, and services are securely configured based on the security configuration standards defined by Agency Security Configuration Standards (ASCS):

The contractor shall provide full system administration capabilities to the MOS911 and WebEOC systems and assist Code 200 system administrators in the system administration of Code 200 systems.

Assist Code 200 to ensuring the NASA-provided Continuous Diagnostics and Mitigation (CDM) solutions are installed and continued to function properly (based on NASA OCIO assessment) on all supported IT devices and integrated with the Agency reporting mechanisms, including Risk Information Security Compliance System (RISCS) and IT Security Enterprise Data Warehouse (ITSEC-EDW), which feeds the Department of Homeland Security's (DHS) Federal Dashboard. Ensure Compliance with the RISCS and ITSEC-EDW reporting requirements, including security configuration profiles, patch management, hardware inventory, and software inventory. The CDM tools must be installed for reporting. For systems that cannot install CDM tools, a NASA-approved waiver must be obtained and the devices must be manually inventoried and reported to the RISCS and ITSEC-EDW per NASA policy and procedures.

Provide vulnerability management process to ensure Code 200 IT systems address all vulnerabilities of all information systems under the scope of the GSFC Vulnerability Management Processes, NASA policy and guidelines as set forth in NPR 2810.1A and applicable

IT Security Handbooks. Work closely with the Code 200 ISSO to ensure timely disposition and remediation of identified vulnerabilities. Assist the Code 200 ISSO to ensure all Agency-required vulnerability scanning, patching, application blacklisting and whitelisting, and reporting shall be performed using the Agency's defined tool set necessary for these functions (currently CDM, RISCS, and ITSEC-EDW tools). For any computing devices that cannot run the reporting agent software, a NASA-approved waiver must be obtained in accordance with NASA policy and procedures.

Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly/Bi-weekly |
| 2 | Performance Reports | Monthly |
| 3 | End-of-task Report | End of task |

Management Approach

Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan. The contractor shall utilize the Center vulnerability management system to document waivers.

Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

NOTE: Each Task Order should have specific performance metrics and should be detailed in the SOW. Examples of performance metrics could be:

Actual Milestone Progress vs Planned/Scheduled

Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements
The contractor shall meet the requirements of NPR 2810 for this SOW. The contractor ensure vulnerabilities are remediated within established schedule or ensure waivers are submitted and approved.

ODC (Travel and Procurement)
There is no non-local travel or procurements for this SOW.

Work Location
This work shall be performed primarily at the Goddard Space Flight Center (On-site).

Reporting Requirements

Weekly or Bi-weekly status report
The contractor shall generate Performance Reports bi-weekly. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings. In addition, the contractor shall provide a summary of monthly vulnerabilities for Code 200 systems highlighting those system at risk or for not being remediated within established schedules.

Monthly performance report
The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

Security Requirements
The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

Data Rights
This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

Applicable Documents
In the performance of this task, the contractor shall comply with the following documents:

# SES II Task Order SOWs

NPR 2810 Security of Information Technology

References

# SES II Task Order SOWs

## 5013 NASA Secure Software Engineering Portal (SSEP)

Date: October 25, 2019
Task Monitor (TM): Malinda Hammond
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

### Scope

Background –
The Computing Environments and Collaborative Technologies Branch (Code 585) provides a diverse variety of services and tools in support of activities within the Software Engineering Division (SED) and Engineering and Technology Directorate (ETD). One function of the Branch is to develop web based collaborative and knowledge management systems, while deploying prototypes to foster the adoption of these systems in partnership with customer groups. Code 585 has a large customer base including other branches within SED, ETD, and other directorates outside of ETD. The web applications developed support both institutional and technical needs of the customers.
Summary of work –
The Software Engineering Division is seeking support in developing the NASA Secure Software Engineering Portal (SSEP), a web-based application that will provide knowledge about software engineering and security related practices, methods, techniques, tools, processes, and personnel related measures. This information includes detailed description of practices, as well as training material, references, case studies, and lessons learned. The plan is to take and expand upon the research included in the NASA Secure Coding Portal (SCP).

A component of the SSEP will be a web based application, called the Secure Software Development Assistant (SSDA) that will recommend to a software engineer or manager a set of practices tailored to their project, based on provided software and project characteristics, to assist in the selection of those practices, according to detailed benefits and limitations. The SSDA will be accessed through the SSEP.

Both applications will contribute to development and safe execution of NASA software systems and the protection of mission assets by increasing software resilience to cyber-attacks. The contractor will follow a user centric design approach, to ensure that user experience best practices are followed. Consequently, the portal and its content will possess high standard usability properties and will be beneficial to NASA software engineers, thus increasing its potential of adoption, use, and positive impact.

Required skills/knowledge –
The contractor shall have experience in software engineering and web development technologies as well as demonstrate effective communication, organizational, and teamwork qualities. Experience with writing, maintaining, and implementing plans to continually advance the GSFC's in-house software engineering capabilities and monitor the software engineering capabilities of NASA contractors.

# SES II Task Order SOWs

## Period of Performance

The period during which the work for this task shall be performed is from task award through September 30, 2020.

## Subtask Description

Not applicable.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Virtual SARP Status Review Report/Presentation | Late April |
| 2 | Face-to-Face SARP Status Review Report/Presentation at the NASA Software Assurance Working Group Meeting (on-site) | August |
| 3 | Working Prototype of SSEP/SSDA | End of task |
| 4 | Monthly Reports | Monthly |
| 5 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Software Engineering Division Configuration Management Plan.

### Facilities

The contractor shall reside onsite at GSFC and the contractor shall provide appropriate IT support.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

| | |
|---|---|
| NPR 7120.5E | NASA Space Flight Program and Project Management Requirements |
| NPR 7123.B | NASA Systems Engineering Processes and Requirements |
| GPR 7120.99 | Goddard Project Management |
| GPR 7120.5A | Goddard Systems Engineering |
| GPR 7150.4 | Goddard Software Safety and Software Reliability Process |
| NPR 7150.2 | NASA Software Engineering Requirements |

## ODC (Travel and Procurement)
None.

## Work Location
This work shall be performed at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements
Monthly performance report
The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements
The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

# SES II Task Order SOWs

Contractors working under this task will be required to handle SBU and ITAR data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:

| | |
|---|---|
| NPR 7150.B | NASA Software Engineering Requirements |

## References

# SES II Task Order SOWs

## 5015 GOES-R Program Office IT Support

Date: July 3, 2019
Task Monitor (TM): Chris Morris
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

I. Scope
a. Background
The Geostationary Operational Environmental Satellite-R Series (GOES-R) is the next generation of geostationary weather satellites. The program is a collaborative development and acquisition effort between the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA). The GOES-R satellites provide continuous imagery and atmospheric measurements of Earth's Western Hemisphere and space weather monitoring. They are the primary tool for the detection and tracking of hurricanes and severe weather and provide new and improved applications and products for fulfilling NOAA's goals of Water and Weather, Climate, Commerce, and Ecosystem.
The Program is managed by NOAA with an integrated NOAA-NASA Program office organization, staffed with personnel from NOAA and NASA and co-located at NASA's Goddard Space Flight Center. Additional mission support staff may be located at the NOAA Satellite Operations Facility in Suitland, Maryland and the Lockheed Martin Space Systems factory in Littleton, Colorado.
GOES-R is comprised of a Program Office and two integrated NOAA-NASA project offices: the Flight Project and the Ground Segment Project. The Flight Project oversees the development of the Space Segment, which consists of the spacecraft, the instruments, launch vehicle, and the auxiliary communication payloads. The Ground Segment Project consists of the entire ground system, including the facilities, antenna sites, software and hardware for satellite command and control and to process, create, and distribute end user products, and the Remote Backup facility (RBU).
b. Summary of work
Details of work to be performed are provided in the descriptions given below. Each description identifies specific activities to be conducted. Work priorities will be defined by this task's Government TM and reviewed no less frequently than monthly.
Subtask 01 – IT Lead, Information Systems Security Officer, and Enterprise Management System Analysis (EMSA)
Scope / Objectives / Requirements – IT Lead support
- _Provide senior IT leadership and management oversight of the Program's IT systems, processes, procedures and support staff to ensure business continuity of operations and compliance with NASA Procedural Requirement (NPR) 2810.1 Security of Information Technology policies.
- _Maintain informational awareness of NASA/NOAA Agency and GSFC announced IT initiatives and policies affecting Program IT systems and develop effective Program responses, implementation strategies, budgets and schedules along with communications regarding these to IT staff, Program management and user community as needed.
- _Provide IT budget and technical responses for Agency SBIC and data call requests for information.

- Develop outreach communications as needed regarding IT best practices and strategies to meet evolving IT challenges affecting the Program.
- Ensure IT staffing levels and technical support training are appropriately maintained to meet Program IT and Agency support requirements.
- Serve as the GOES IT Configuration Control Board providing senior review and approval authority, responsible for ensuring that changes to IT system configurations and any associated risks are identified, documented and safely implemented via strategies and schedules that meet deadlines while minimizing disruption to Program operations.
- Provide senior IT oversight to ensure mission Integration, Testing and Launch campaign IT requirements are appropriately supported in terms of technology and staffing in alignment with mission schedules.
- Provide hardware and software evaluations and recommendations including network equipment, file and print servers, and personal computers, software required for networking, databases, communications, user interface, etc.
- Oversee the activities of the Enterprise Management Systems Analyst responsible for coordinating the implementation of configuration changes on GOES-R client systems.
- Provide senior IT management liaison and security consulting support for the NASA Goddard Flight Projects Directorate Board of Directors as requested.
- Provide senior IT management guidance as needed for GOES-R Ground Segment operations, system upgrades and new product development and cloud computing initiatives.

Scope / Objectives / Requirements – Information System Security Officer (ISSO)

- Lead the cybersecurity program for the GOES-R Flight Project and ensure the GOES Program System (GPS) passes annual, independently conducted, third party Authorization and Accreditation assessments in order to maintain a NASA approved Authorization-To-Operate (ATO) status.
- Serve as the principal advisor to the Information Systems Owner (ISO) on issues regarding information security.
- Develop and maintain Agency mandated IT security documentation including System Security Plans, Contingency Plans, Configuration Management Plans, Risk Assessment Reports and Standard Operating Procedures (SOPs) and related Authorization and Accreditation (A&A) artifacts required to fully document IT systems architecture, networks, and Continuous Diagnostics and Mitigation (CDM) processes in order to pass annual 3rd party accreditation assessments.
- Coordinate the annual review of Program level implementations of NIST SP800-53 “Security Controls Procedures for Federal Information Systems and Organizations” and document technical implementation details within the System Security Plan and Agency RISCS database accordingly.
- Develop Plan of Actions and Milestones (POAMs) strategies to mitigate self-discovered or assessment identified security risks and develop technical solutions to allow closure of POAMs within one year.
- For POAMS that cannot be closed, develop a Risk Based Decision (RBD) document and obtain approval of RBDs by the Center Authorizing Official for Flight Projects.
- On a monthly basis review and update the status of POAMS and RBDs in the Agency’s RISCs database.
- Conduct annual training and testing of the GOES Program System Contingency Plan (CP), document the results and lessons learned in the CP documentation and update the RISCs database accordingly.

- _Serve as a liaison to external organizations on matters of IT security affecting the GOES-R Program.
- _In the event of security breaches, process incident reports for the Flight Projects Directorate, Security Operations Center (SOC) and implement mitigation actions as required by the SOC.
- _Ensure that an appropriate operational security posture is maintained for the Program's information systems through process reviews and via performance of quality control checks and inspections of A&A artifact deliverables by IT staff and document deliverables completed in Gemini.
- _Keep organization management informed about IT security issues and communicate all appropriate IT Security information and Agency advisories to the system administrators and users on a need to know basis.
- _Obtain Secret: level security clearance required by NOAA for ISSO/IT Leads supporting GOES-R Ground Systems and for escort-free access to all areas at NOAA Wallops and NSOF facilities, as well as access to any information assurance / IT Security related data (i.e. access to classified information including the equipment and data at these facilities) and to attend classified NASA Agency security meetings.

Scope / Objectives / Requirements – Enterprise Management Systems Analyst (EMSA)

- _Provide technical support for the Configuration Management (CM) of GOES-R Program's client systems and the implementation of the Agency's Continuous Diagnostics and Mitigation (CDM) program upon those systems and inform IT management of discovered CM anomalies.
- _Ensure Program data is protected, that only CCB approved changes to software, ports and protocols are implemented, and that user account privileges are properly controlled.
- _Perform vulnerability patching, software upgrades and respond to Agency Block list & Mitigation Action Required (MAR) notifications within required timeframes.
- _Monitor data backup status across client systems, troubleshooting and performing "Monthly CrashPlan Data Review."
- _Inspect encryption status reporting and monitoring across all client systems.
- _Perform monthly checks of NOMAD email forwarding and forward removal for user email archive.
- _Update and maintain software license management and monitoring data.
- _On a quarterly basis review Elevated Privilege Account holders and monitor EP user training compliance.
- _Complete employee off boarding functions (Note: the EMSA role does not perform ON boarding actions for new employees)
- _Via electronic tools detect unauthorized software and remediate when detected.
- _Provide Incident Response Reporting to Code 710 Cyber-operations as needed.
- _Support organizationally defined A&A security actions as defined in the Gemini ConMon module
- _Investigate Splunk alerts and ensure systems are reporting to the Splunk log aggregation database.
- _Ensure AV software is installed and correctly operating at current McAfee agent version.
- _IOEP auditing to track user on/off boarding actions affecting client systems (email forwarding, data backups, system deployment/excess status)
- _Perform Customer Out-Reach and Communications as needed for client changes.

 _Keep organization management informed about IT security issues and communicate all appropriate IT Security information and Agency advisories to the system administrators and users on a need to know basis.
 _Maintain technical knowledge and use of the following GOES tools to perform the specific CM functions described for each tool:

- CrashPlan:
  - Review device/user backups and correct issues
  - Work directly with users to mitigate any necessary anomalies
  - Insure all systems have valid backups
  - Consult with Network Engineering team on complex issues
- Splunk:
  - Review alerts and mitigate issues
  - Work directly with the users to mitigate issues (e.g. not reporting to Splunk)
- Block List/Incidence:
  - Will maintain the block list and mitigate vulnerabilities on GOES workstations
  - Respond to IT incidents (Notifiers) and complete required Agency reports on mitigation action status.
- Software Inventory:
  - Create a new software inventory list and delete the others
  - Maintain software inventory (own it)
- SCCM:
  - Maintain deployment packages, baseline configurations and update as needed
  - Update deployment packages with updated drivers
  - Create new deployment packages (working with Network Engineering Team) for new laptop models
- BigFix:
  - Run weekly reports to verify required software is installed on all systems
  - On a weekly basis verify the NASA benchmark compliance scores for all GOES client systems.
  - Work directly with users to mitigate issues
  - Identify and mitigate issues with systems not reporting
  - Work with Directorate IT members to create and deploy scripts
  - Maintain whitelist
- Gemini IOEP – Auditing:
  - Assist in getting the tickets closed and maintain
  - Remove email forwarding
  - Verify data is backed up
  - Spot-check computer build tickets
- Microsoft Deployment ToolKit:
  - Import driver packages for newly purchased Dell computers
  - Update software packages for new computer builds
- Jamf:
  - Import driver packages for newly purchased Dell computers
  - Update and deploy software for Mac OS
  - Monitor security policies enforced using Jamf
  - Identify and mitigate issues with systems not communicating properly to receive updates

# SES II Task Order SOWs

Scope / Objectives / Requirements
There is a substantial development effort currently underway to build and launch this satellite and generate products within the NASA and NOAA acquisition community. However, there are not adequate resources within the user communities in NWS to define and plan to optimally exploit this data from the product delivery point, through the NWS IT Infrastructure, to the users at Centers and Weather Forecast Offices (_W_F_O_’s_)_._ _In order to address this need, NESDIS and NWS require support that assist NWS HQ staff and interface with the GOES R - U program.
This task establishes an avenue for the following area of support:
- _Maintain compliance of NPR2810.x and NIST 800-53 Standards
- _Integrated IT collaboration between NOAA and NASA to ensure Service Level Agreements (_S_L_A_’s_)_ _and Memorandums of Understanding (_M_O_U_’s_)_ _relating to IT services are being adhered to
- _Design, build and maintain Virtual Networks
- _Integration and maintenance of custom applications (e.g. IRMA, Alfresco)
- _Responsible for the technical implementation of the GOES-R Summary Investment Business Case (SIBC) technology budget
- _Implement and enforce security posture relating to Assessment and Authorization of the IT infrastructure
- _Provide training to helpdesk support on newly released engineering applications
- _Maintain MS Exchange archive environment
- _Perform penetration testing within server environment to identify and mitigate potential threats
- _Maintain Cisco and Juniper firewalls and boundary within
- _Assist in Development and review of IT Security, Contingency and Disaster Recovery Plan documentation
- _Provide technical specification for all IT hardware and software purchases
- _Provide Network Engineering support for SQL and Oracle databases
- _Test and pilot emerging technologies and provide technical guidance to the Program and Directorate based upon results
- _Provide Engineering and Administration support for IBM DOORS
- _Provide support for Video Teleconferencing infrastructure
- _Provide on-site support for launch campaigns
- _Provide on-site Network Engineering support services to remote NASA facilities
- _Maintain the GOES-R Integrated Scheduling System (GISS). This environment involves the development and maintenance of Oracle Primavera with an Oracle back-end database
- _Monthly Nessus vulnerability scans and mitigation. Implement processes and procedures to perform these duties monthly to align with NPR 2810.1X and NIST 800-53.
- _Initiate monthly Splunk Audit log review, analyses and mitigation of errors to comply with NPR 2810.1X and 800-53.
- _Tripwire Enterprise Security Suite integration and maintenance
- _Conduct 1 – _5 day site visits each to the Lockheed Martin - Denver, CO facilities, and 1 - 1 day site visit to the Exelis - Ft. Wayne IN facility to ensure NASA Resident Office compatibility with GSFC IT systems and collaborative technologies
- _Provide cloud computing support services
- _Provide back-end support for Alfresco content management system and NWS.

Subtask 03 – Applications Development and Website Design/Maintenance

# SES II Task Order SOWs

Scope / Objectives / Requirements

There is a substantial development effort currently underway to build and launch this satellite and generate products within the NASA and NOAA acquisition community. However, there are not adequate resources within the user communities in NWS to define and plan to optimally exploit this data from the product delivery point, through the NWS IT Infrastructure, to the end users at Centers and Weather Forecast Offices (_W_F_O_'s_)_._ _In order to address this need, NESDIS and NWS require support that assist NWS HQ staff and interface with the GOES R - U program.

_M_a_i_n_t_e_n_a_n_c_e_ _o_f_ _a_n_d_ _e_n_h_a_n_c_e_m_e_n_t_s_ _t_o_ _G_O_E_S_ _a_p_p_l_i_c_a_t_i_o_n_s_ _i_n_c_l_u_d_i_n_g_ _l_R_M_A_,_ _G_e_m_i_n_i_,_ _D_O_O_R_S_,_ _SharePoint, Windchill, Alfresco and Portal modules (PropHawk, CDRL Libraries, Contingency) and their interdependencies in the GOES Portal deployment.

_U_t_i_l_i_z_e_ _G_e_m_i_n_i_ _I_s_s_u_e_ _T_r_a_c_k_i_n_g_ _s_o_f_t_w_a_r_e_ _t_o_ _p_r_o_v_i_d_e_ _b_u_s_i_n_e_s_s_ _p_r_o_c_e_s_s_ _i_m_p_r_o_v_e_m_e_n_t_s_ _s_u_c_h_ _a_s_ _employee onboarding and offboarding, A&A compliance tracking, GOES IT issue tracking and Lessons Learned capture.

_M_a_n_a_g_e_ _c_o_m_p_l_i_a_n_c_e_ _w_ith and maintenance of government-mandated 2-factor authentication based on smart card technology. Applicable applications include GOES Portal (SharePoint, Alfresco, portal modules), Gemini and Windchill applications.

_M_i_g_r_a_t_i_o_n_ _f_r_o_m_ _h_y_b_r_i_d_ _p_o_r_t_al consisting of Alfresco and SharePoint to Alfresco Share. Enhance Alfresco Share data lists to receive the existing SharePoint data lists during the upcoming migration.

_S_e_p_a_r_a_t_e_ _s_e_a_r_c_h_ _f_u_n_c_t_i_o_n_ _f_r_o_m_ _A_l_f_r_e_s_c_o_ _p_o_r_t_a_l_ _b_y_ _t_h_e_ _c_r_e_a_t_i_o_n_ _o_f_ _A_p_a_c_h_e_ _S_o_l_r_ _s_e_rver.

_I_n_v_e_s_t_i_g_a_t_e_ _a_n_d_ _p_l_a_n_ _f_o_r_ _m_i_g_r_a_t_i_o_n_ _o_f_ _W_i_n_d_c_h_i_l_l_ _1_0_ _t_o_ _W_i_n_d_c_h_i_l_l_ _1_1_ _o_r_ _r_e_c_o_m_m_e_n_d_ _n_e_w_ _tool.

_P_e_r_f_o_r_m_ _m_o_n_t_h_l_y_ _c_o_d_e_ _r_e_v_i_e_w_s_ _f_o_r_ _c_u_s_t_o_m_ _c_o_d_e_ _– _portal modules (GOES Libraries, Contingency App, Property Management App), Windchill customizations, and DOORS Explorer.

_P_e_r_f_o_r_m_ _m_o_n_t_h_l_y_ _m_a_i_n_t_e_n_a_n_c_e_ _a_n_d_ _b_a_c_k_u_p_ _p_r_o_c_e_d_u_r_e_s_ _f_o_r_ _d_e_p_l_o_y_e_d_ _O_r_a_c_l_e_ _a_n_d_ _S_Q_L_ _Server Database instance in development and production for GOES deployments.

_C_o_n_d_u_c_t_ _r_e_v_i_e_w_ _m_e_e_t_i_n_g_s_ _r_e_g_u_l_a_r_l_y_ _w_i_t_h_ _a_p_p_l_i_c_a_t_i_o_n_ _s_t_a_k_e_h_o_l_d_e_r_s_ _s_u_c_h_ _a_s_ _C_onfiguration Management Office (CMO) personnel, Program/Project Librarians and Engineers.

_C_o_l_l_e_c_t_ _a_n_d_ _r_e_p_o_r_t_ _a_p_p_l_i_c_a_t_i_o_n_ _i_s_s_u_e_s_ _a_n_d_ _e_n_h_a_n_c_e_m_e_n_t_s_ _f_r_o_m_ _G_O_E_S_ _s_t_a_k_e_h_o_l_d_e_r_s_ _a_n_d_ _GOES user community.

_C_o_n_d_u_c_t_ _p_h_o_n_e_ _a_n_d_ _d_e_s_k_-side support for application and user problem resolution.

_C_o_n_d_u_c_t_ _G_e_m_i_n_i_,_ _D_O_O_R_S_,_ _S_h_a_r_e_P_o_i_n_t_,_ _W_i_n_d_c_h_i_l_l_,_ _A_l_f_r_e_s_c_o_ _a_n_d_ _P_o_r_t_a_l_ _m_o_d_u_l_e_s_ _(_P_r_o_p_H_a_w_k_,_ _CDRL Libraries, Contingency) training sessions.

_A_d_m_i_n_i_s_t_e_r_ _a_n_d_ _m_a_i_n_t_a_i_n_ _a_p_p_l_i_c_a_t_i_o_n_ _u_s_e_r_ _p_o_p_u_l_a_t_i_o_n_'s_ _a_c_c_e_s_s_ _a_n_d_ _a_u_t_h_o_r_i_z_a_t_i_o_n_ _a_t_ _t_h_e application level and through GSFC NAMS processes and procedures.

_I_n_v_e_s_t_i_g_a_t_e_ _i_m_p_r_o_v_i_n_g_ _a_p_p_l_i_c_a_t_i_o_n_ _r_e_p_o_r_t_i_n_g_ _b_y_ _u_t_i_l_i_z_i_n_g_ _a_ _r_e_p_o_r_t_i_n_g_ _s_e_r_v_i_c_e_ _s_u_c_h_ _a_s_ _Microsoft SSRS (SQL Server Reporting Services).

_P_r_o_v_i_d_e_ _c_u_s_t_o_m_ _r_e_p_o_r_t_i_n_g_ _c_h_a_n_g_e_s_ _a_n_d_ _f_e_a_t_u_r_e_ _enhancements for IRMA Risk Management Application.

_E_n_h_a_n_c_e_d_ _W_i_n_d_c_h_i_l_l_ _r_e_p_o_r_t_i_n_g_ _u_t_i_l_i_z_i_n_g_ _A_s_p_o_s_e_ _a_n_d_/_o_r_ _i_n_v_e_s_t_i_g_a_t_e_ _t_h_e_ _u_s_e_ _o_f_ _O_r_a_c_l_e_ _integration with Microsoft SSRS.

_I_m_p_r_o_v_e_ _P_r_o_p_H_a_w_k_ _a_n_d_ _G_e_m_i_n_i_ _r_e_p_o_r_t_i_n_g_ _b_y_ _b_r_i_d_g_i_n_g_ _d_a_t_a_ _b_e_t_w_e_e_n_ _t_h_e_ _t_w_o_ _a_p_p_l_i_c_a_t_ions.

_A_p_p_l_i_c_a_t_i_o_n_ _s_e_c_u_r_i_t_y_ _s_c_a_n_n_i_n_g_ _a_n_d_ _a_u_d_i_t_i_n_g_ _o_f_ _p_o_r_t_a_l_ _t_e_c_h_n_o_l_o_g_i_e_s_ _– _Gemini, DOORS, Alfresco, SharePoint, IRMA and Windchill.

_P_r_e_p_a_r_a_t_i_o_n_ _f_o_r_ _a_n_d_ _p_a_r_t_i_c_i_p_a_t_i_o_n_ _i_n_ _a_n_n_u_a_l_ _G_O_E_S_ _A_s_s_e_s_s_m_e_n_t_ _a_n_d_ _A_u_t_h_o_r_i_z_a_t_i_o_n_ _a_u_d_i_t_._ _Provide administrative and technical assistance of Gemini in support of this effort.

_M_a_n_a_g_e_m_e_n_t_ _o_f_ _G_O_E_S_ _I_T_ _C_C_B_ _p_r_o_c_e_s_s_e_s_._ _W_e_e_k_l_y_ _C_C_B_ _m_e_e_t_i_n_g_ _h_o_s_t_i_n_g_ _a_n_d_ _m_a_i_n_t_e_n_a_n_c_e_ _o_f_ _CCB processes with the Gemini application.

_R_e_s_p_o_n_s_i_b_l_e_ _f_o_r_ _G_O_E_S_-R.gov public website redesign, HTML content, and code management. Responsibilities to include interfacing with the GOES-R Program office to receive updates, authoring changes and delivery/uploading of HTML code to the GOES-R public website at the NOAA WOC facility.

_M_a_i_n_t_e_n_a_n_c_e_ _a_n_d_ _e_n_h_a_n_c_e_m_e_n_t_ _of Headless/Decoupled Drupal content management system which is part of the GOES-R public web site and hosted at the NOAA WOC facility.

_A_c_t_ _a_s_ _t_e_c_h_n_i_c_a_l_ _l_i_a_i_s_o_n_ _b_e_t_w_e_e_n_ _t_h_e_ _G_O_E_S_-R Program Office and NOAA WOC staff.

## II. Period of Performance

The period during which the work for this task order shall be performed is from task award through July 31, 2020

## III. Subtask Description

The task will be broken down into the following functional subtasks:
a. TBD.0001 – IT Lead, Information Systems Security Officer, and Enterprise Management System Analysis (EMSA)
a. TBD.0002 – Networks Engineering
b. TBD.0003 – Applications Development and Website Design/Maintenance

## IV. Deliverables/Schedules/Milestones

| At a minimum, the contractor shall deliver the items specified on the table below: Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Monthly Progress Reports | Monthly, by the last day of the month |
| 2 | Monthly Financial reports | Monthly, by the 15th |
| 3 | End of Task Report | 30 days after task ends or at a mutually agreeable date |

## V. Management Approach

a. Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

b. Configuration Management

All changes to CM of the lab machines must be recorded in the lab notebooks resident in each lab or combined in a centrally managed server.

c. Facilities

The contractor shall reside onsite and the contractor shall provide appropriate IT support. No regular teleworking shall be allowed, any teleworking may not impact mission accomplishment. The Division IT Manager may withdraw teleworking privileges at any time.

d. Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of

negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
The performance metrics are:
1. Actual Milestone Progress vs Planned/Scheduled
2. Actual vs Planned Costs
3. Quality of Technical Performance
a. Ability of the contractor to meet the goal of zero devices blocked due to failure to patch or waiver systems by the monthly block date

b. Surveys received from users receiving service from this task
4. Contractor Communication
5. Personnel Management

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.
g. Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
1. NPR 7120.5E NASA Space Flight Program and Project Management Requirements
2. NPR 7123.B NASA Systems Engineering Processes and Requirements
3. GPR 7120.99 Goddard Project Management
4. GPR 7120.5A Goddard Systems Engineering
5. GPR 7150.4 Goddard Software Engineering Requirements

## VI. ODC (Travel and Procurement)

The contractor shall arrange for specialized employee training, specifically as it applies to the potential use of Amazon Web Services for hosting the GOES-R.gov website and the GOES IT System disaster recovery servers.
The contractor should plan on two one-week trips for one employee to the GOES-R NASA Resident office at Lockheed Martin in Littleton, CO and one to the GOES-R NASA Resident Office at Harris Corp. in ft. Wayne, IN.

## VII. Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## VIII. Reporting Requirements

See Section IV: Deliverables/Schedules/Milestones

## IX. Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. There will be handling SBU and ITAR data, all necessary Non-Disclosure Agreements must be signed by each contractor handling this data.

## X. Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## XI. Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
1. NPR 7150.B NASA Software Engineering Requirements
2. GPR 7150.1 Goddard Software Engineering Requirements

## References

## 5016 EOSDIS Network System Engineering

Date: 07/24/2019
Task Monitor (TM): Kevin Kranacs
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

Scope
Background
The ESDIS Project (Code 423) has the responsibility to develop and lead, monitor, leverage, interoperate the data system activities of the overarching EOSDIS (Earth Observing System Data Information System). NASA's Earth Observing System Data and Information System (EOSDIS) has been a central component of the NASA Earth observation program since the 1990's. It is one of the largest civilian science information system in the US, performing ingest, archive and distribution of over 6.7 terabytes of data per day, much of which is from NASA's flagship missions Terra, Aqua and Aura. The system supports a variety of science disciplines including land use and land cover change, radiation budget, polar, ocean and atmosphere processes, global climate change, and socio-economics applications. The EOSDIS data centers, collocated with centers of science discipline expertise, archive and distribute standard data products produced by science investigator-led processing systems. The architecture of the EOSDIS provides a platform for the publication, discovery, understanding and access to NASA's Earth Observation resources and allows for easy integration of new datasets.
NASA's Earth Science Data System Program consists of two broad classes of funded elements (or projects). The first, referred to as core elements reflect NASA's responsibility for managing Earth science satellite mission data characterized by the continuity of research, access, and usability. The core comprises all the hardware, software, physical infrastructure, and intellectual capital NASA recognizes as necessary for performing its tasks in Earth science data system management. Typically, core elements provide the basic standard data products and services for NASA's missions and use capabilities at a high Technology Readiness Level (TRL). NASA The second, known as community elements are those pieces or capabilities developed and deployed largely outside of NASA core elements and are characterized by their 'evolvability 'and innovation. Typically, the community elements develop innovative new data products or advance capabilities from mid-TRL to higher TRL. Data products from community elements are generally migrated into the core elements for longer-term archiving and distribution. Successful applicable technologies from community elements can be infused into the core, thereby creating a vibrant and flexible, continuously evolving infrastructure.
ESDIS utilizes regional, national and international computer networks such as commodity Internet, Internet2, Federal Networks, GEANT, and APAN to provide connectivity between EOSDIS components and to distribute data to customers. Successful monitoring of these complex interconnections and research into new networking technologies and protocol enhancements is necessary to support EOSDIS operations.

# SES II Task Order SOWs

This task is a follow on to work performed formerly on the PAAC Contract.

Summary of work
The contractor shall perform computer network system engineering related to missions supported by the EOS Data Information System (EOSDIS). Activities shall include network system engineering and analysis, technical review of project documentation, participation in technical exchange meetings with EOS domestic and international partner institutions, participation in international networking organizations' meetings, attending technical exchange meetings with network research organizations, participating in project technical reviews, and implementing engineering prototypes.
The contractor shall perform computer network system engineering related to missions supported by the EOS Data Information System (EOSDIS). Activities shall include network system engineering and analysis, technical review of project documentation, participation in technical exchange meetings with EOS domestic and international partner institutions, participation in international networking organizations' meetings, attending technical exchange meetings with network research organizations, participating in project technical reviews, and implementing engineering prototypes. Specifically, the contractor shall perform the following:

Perform network studies of EOSDIS Wide Area Network (WAN) design(s), including implementation and requirements trade-off, cost, and evaluation of technologies to meet requirements. Propose, engineer and implement engineering prototypes to demonstrate the feasibility of relevant network technologies.
Make recommendations to support the effective redesign of existing WANs to improve performance and reduce costs.
Review and provide recommendations regarding the NASA Communications Program technical approach to implementing EOSDIS requirements.
Attend Next Generation Internet (NGI) related meetings, such as the Joint Engineering Team, the National Science Foundation, the Internet 2 project and other organizations.
Present network information to the EOS science community and the project, as required.
Consult with other project engineers to analyze and make recommendations regarding transition of IPv4 networks to IPv6.
Refine the existing automated tests to measure the performance of EOS networks and provide network engineering services specializing in network statistics and performance. Perform analysis of these test results, in support of network troubleshooting to isolate performance problems and make recommendations regarding the network implementation. These tests and services shall include:
The EOS ENSIGHT system
A Netflow based Flowviewer/Tracker/Grapher system
perSONAR.
Investigate and evaluate new tool technologies for use in performance measurements.
Perform requirements engineering and management:
Coordinate review and maintenance of ESDIS / ESMO level 2 and level 3 requirements documents.

# SES II Task Order SOWs

Track and maintain changes to interface requirements documents and sustain formal requirements using requirements management systems.
Review, develop, expand, maintain, and trace EOS mission and science network requirements
Maintain EOS network baseline requirements database and provide database and web page development and maintenance for tools used by ESDIS and ESMO personnel such as requirements tracking and performance.
Provide engineering management services relating to technical management of the EOSDIS networks. These services shall include:
Create and maintain EOS networks architecture topology and connectivity diagrams.
Participate in project planning and coordination of network implementation activities for EOS missions and technical status reporting.
Participate in planning and provide network engineering for the ESDIS project's Amazon Cloud Services regarding connectivity and network performance.
Consult with the EBnet Network Operations engineers to provide technical guidance for the re-architecting of EBnet, focusing on ESDIS subsystems.
Other work that may be required as determined by ESDIS during meetings with contractors include the following:
NASA compliant websites
Ensuring that the supported systems are secure and supports NASA security regulations
Documentation of the supported systems.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through August 31, 2020

## Subtask Description

No Subtask

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified on the table below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Monthly Progress Reports | Monthly, by the last day of the month |
| 2 | Monthly Financial reports | Monthly, by the 15th |
| 3 | End of Task Report | 30 days after task ends or at a mutually agreeable date |
| 4 | Provide network testing updates | Weekly |
| 5 | Network performance evaluation reports for EOS production sites | Monthly, due by the 15th |
| 6 | Network performance evaluation reports for EOS QA and SCF sites | As required by TM |
| 7 | EOS Interface Control Documentation | Per project schedule |
| 8 | Provide trip reports | As required by TM |

| | | |
|---|---|---|
| 9 | Provide meeting reports | As required by TM |
| 10 | Provide technical documentation and reports regarding network test results and recommendations. | As required by TM |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the ESDIS Project Configuration Management Plans.

### Facilities

The contractor shall reside onsite and the contractor shall provide appropriate IT support. Regular teleworking is allowed so long as it does not affect mission accomplishment. The Task Manager may withdraw teleworking privileges at any time.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
The performance metrics are:

Actual Milestone Progress vs Planned/Scheduled
Actual vs Planned Costs
Quality of Technical Performance
Contractor Communication
Personnel Management

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

### Quality Assurance Requirements

# SES II Task Order SOWs

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

Travel as necessary to specified national and international conferences and meetings such as:

| Destination | Purpose | # Travelers | Dates |
|---|---|---|---|
| New Orleans, LA | Internet2 Joint Tech Exchange | 1 | December 2019 |
| Indianapolis, IN | Internet2 Global Summit | 1 | March 2020 |

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

See Section IV: Deliverables/Schedules/Milestones

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be handling SBU and ITAR data, all necessary Non-Disclosure Agreements must be signed by each contractor handling this data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

## 5017 IT Systems Support and Security Management

Date: 7/25/19
Task Monitor (TM): Jerry Esper
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

### I. Scope

a. Background –Flight Projects Directorate (FPD) manages the implementation, maintenance, and operations of end-to-end space architectures, including mission operations, tracking, and data acquisition services for missions supported by GSFC. The scope of work is the directorate level Information Technology (IT) Systems Support & IT Security Management for FPD.
b. Summary of work

### IT Security Management Overall Support

#### Description of Work/Background:

The Contractor shall provide experienced staff to: serve as the Flight Projects Directorate (FPD) Information System Security Engineer (ISSE) and Alternate ISSE; serve as Information System Security Officer (ISSO) and Alternate ISSO for Directorate Level IT Security Plans; provide management and guidance to IT Security personnel throughout the FPD as assigned by the FPD Assistant Director, Information Technology (FPD AD for IT); manage and operate security assessment and support tools; ensure that the FPD is aware of security posture; ensure that the NIST compliance standards are adhered to. Specifically the contactor shall:

 Develop, publish, maintain, and update required information technology (IT) security documentation relative to Flight Projects Directorate level systems which includes:
System Information Categorizations
Plan of Actions and Milestones (POAMs)
IT Security Plans
Risk Assessments
Contingency Plans

 Serve as ISSO and Alternate ISSO for Directorate level System Security Plans and related documentation.

 Manage and assist in the development of IT System Security Plans and associated documents assigned to other ISSO's across the FPD. Monitor and ensure compliance of the documents and associated systems to federal, agency and GSFC standards, policies, processes.

 Implement, maintain and operate the FPD Centralized logging system. Create reports and communications for the ISSO's, CSO's and SA's when warranted by anomalies or other events that indicate suspicious activities on an FPD system.

 Provide BigFix and vulnerability mitigation services for the Flight Project Directorate, including

monitoring of FPD systems software versions and status, patch management, monthly reporting and ad-hoc reporting.

- Provide IT Security Engineering Support to Flight Projects as assigned by the FPD AD FOR IT.
- Disseminate security guidance, compliance standards and best practices to FPD IT Security personnel.
- Assist FPD Management with IT Security Risk Assessment and Situational awareness determinations.
- organized, up- -date, and support the FPD IT security functions
- Operate the FPD Directorate IT Security SharePoint application. Ensure that contents are

to

- Review project level security documents for compliance and risk mitigation, including the
  - Plan of Actions and Milestones (POAMs)
  - Risk Assessments
  - Contingency Plans
- Provide information technology security design and implementation support relative to new and

modified systems. Report monthly to FPD AD FOR IT on any new or modified systems.

- Maintain a database of Directorate level IT Security documents, which provides a status of IT security documentation relative to each system and identifies the category of NASA information processed, system administrators and line management. Provide updated chart monthly to FPD AD FOR IT.
- Provide advice and assistance on an as requested basis to FPD Project Managers, ISSOs, and system administrators relative to NASA IT security requirements and interpretation, system data classification, security incident reporting, and security documentation review and comment.
- Serve as the FPD Directorate Computer Security Engineer (ISSE) and Alternate ISSE
  - Chair FPD Directorate IT Working Group and FPD IT BOD.
  - Represent the FPD on all Center Wide ISSE boards.
- Plan and lead weekly meeting for project IT personnel.
- Maintain a Project Schedule for POAM Activities at the FPD Level.
- Maintain a Project Schedule of the assessment and accreditation (A&A) activities at the FPD Level

and participate in A&A process as appropriate.

- Provide IT Security and Management services to support, manage, and report on Agency and Center IT initiatives as they arise (prominent activities listed below)
  - FPD KACE deployment, sustaining, patching, and reporting
  - FPD Federal Desktop Core Configuration (FDCC) implementation and reporting
  - FPD conformance with Center-wide Vulnerability detection and reduction process
  - Migration from GSFC Active Directory to NASA Consolidated Active Directory (NCAD) migration
  - Migration from GSFC IP Address Management System (IPAMS), soon to be renamed GSARS (Goddard Security Asset Registration System), to the centralized Agency IPAM
  - Mandatory software updates pursuant to NASA 2804
  - Develop solutions for Directorate-level POAM items (e.g. Centralized logging, etc.)

- Provide IT Security Engineering Support to Flight Projects, as assigned by the FPD AD FOR IT, and

other IT security related duties for the FPD, as required.

# SES II Task Order SOWs

 Assist new flight projects and organizations in FPD to design secure systems, applications, processes and facilities.
 Coordinate with the GSFC procurement specialists and vendors to purchase required software and hardware systems and to ensure that maintenance agreements are in place.
 Prepare yearly budget providing details of the software, hardware, services, etc., needed to perform above duties.
 Propose improved technologies and processes for meeting government/industry requirements and for reducing costs.
 Perform other IT security related duties for the FPD.
 Recommend, develop, maintain, operate and implement IT hardware and software servers, applications and systems for the GSFC Flight Project Directorate (FPD), the Directorate Office and
supporting staff offices, and upon specific request by Task Manager.
 Perform regular backups for FPD Directorate-level servers and the non-ACES customer systems;
report all IT security incidents or intrusions; follow procedures for documenting, analyzing and mitigating the any IT security events with a report to the ISSO with the prescribed period of time (currently 10 days). Follow any recommendations from ISSO until the incident is closed/resolved.
 Install software patches on FPD Directorate servers and non-ACES customer systems to mitigate
system vulnerabilities in compliance with Center and Agency standards.
 Comply with NPR 2810.1(a) and IT Security Handbooks, where practical, or latest versions for IT
Security policies, procedures and standards.
 Troubleshoot problems, compromises/incidents and other IT events and recommend/implement
solutions/mitigations. Meet monthly with ISSO to discuss hardware, software and communications vulnerabilities, POAMS, risks and recommend solutions/mitigations. Implement
agreed upon recommendations. Maintain configuration management and corresponding documentation of implementations and changes made to any government IT system.
 Implement, maintain and operate the FPD SharePoint Server. Develop SharePoint solutions to assist customers. Recommend SharePoint solution for existing software applications. Meet with customers to gather and document customer requirements for new SharePoint applications. Ensure that customers understand service levels and prepare Service Level Agreements/Memorandums of Understanding, and other 7120.7 documentation as required, including and not limited to Requirements Documents, Design Document, Schedules, Testing Plans, Implementation Documents, Memorandum of Agreement/Understanding, etc.
 Coordinate with the GSFC procurement specialists and vendors to purchase required software and hardware systems and to ensure that maintenance agreements are in place.
 Prepare yearly budget providing details of the software, hardware, services, etc., needed to perform above duties.
 Propose improved technologies and processes for meeting government/industry requirements and for reducing costs. Provide help-desk type support to non-ACES computer users.
 
Provide reporting to Task Manager on status of systems or if significant problems occur.

 Due to the evolution of IT systems and related policies/procedures and the resulting intermittent
nature of this performance standard, the specific delivery instructions will be determined on a case-by-case basis.
 Limited travel may be required on an on-call basis

Training:
The Contractor shall attend training as required to maintain skills and assess and implement new tools, systems and processes to enhance knowledge in the functional areas defined in this Statement
of Work. Travel that is required to attend such training is also approved.
c. Required skills/knowledge – Flight Projects experience in the following roles
i. Information System Security Engineer (ISSE)
ii. Information System Security Officer (ISSO)
iii. System Administrator

## II. Period of Performance

The period during which the work for this task order shall be performed is from October 1, 2019 through September 30, 2020.

## III. Subtask Description

No Subtasks

## IV. Deliverables/Schedules/Milestones

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Monthly by 15th |
| 2 | Performance Reports | Monthly |
| 3 | End-of-task Report | End of task |
| 4 | 533 Financial Reports | Monthly |
| 5 | FPD System Security Plan Documentation | Per SSPs |

## V. Management Approach

a. Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.
b. Configuration Management Systems and documents will be covered under the Flight Projects Directorate Moderate
and Flight Projects Directorate Specialized System Security Plans.
c. Facilities
Appropriate IT devices to support the analyses, specification development, and report development are required. The government will provide workstations and network connections. The contractor will be responsible to install any required tools and utilities on the equipment.
d. Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing

corrective actions with the compliance of the TM.

e. Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

1. NPR 7120.5E NASA Space Flight Program and Project Management Requirements
2. NPR 7123.B NASA Systems Engineering Processes and Requirements
3. GPR 7120.99 Goddard Project Management
4. GPR 7120.5A Goddard Systems Engineering
5. GPR 7150.4 Goddard Software Engineering Requirements
6. NPR 2810.1A Security of Information Technology and IT Security Handbooks

## VI. ODC (Travel and Procurement)

Travel may be proposed for special training needs and other engineering support task activities as directed by the Project.

## VII. Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site).

## VIII. Reporting Requirements

a. Monthly status report

The contractor shall generate Performance Reports by the 15th of every month by the. The report shall include, as a minimum, a summary of the months highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

b. Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## IX. Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPR 2810.1A in the performance of this task. In addition, the

contractor shall comply with all applicable federal rules and regulations and agency directives.
Contractor will be required to handle Sensitive But Unclassified (SBU) data.

## X. Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## XI. Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
1. NPR 2810.1A Security of Information Technology

## XII. References

## 5018 New Opportunities Office Support

Date: 8-12-19
Task Monitor (TM): Bonnie Norris
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

### Scope

Background – This Statement of Work (SOW) covers Information Technology support to the New Opportunities Office and it's new business and proposal development activities.
Summary of work
The contractor shall provide continuous coverage during working hours and on-call Information Technology support to various proposal team members that are assigned to the New Business Program. The contractor shall maintain active back-up of the NOO/PDG working files and historical files. The contractor shall design, operate, and maintain Non-ACES Management Information Systems (MIS), including hardware, software, servers, and local area networks, and conduct analyses of project data and breakdown/set-up project critical personal computer equipment for personnel that relocate. The contractor will provide service for trouble shooting, problem analysis/resolution, and training on MIS provided hardware and software. The contractor will maintain, set up, and troubleshoot all data repositories used by the New Opportunities Office. The contractor will provide audio/visual support, set up and breakdown for major reviews or meetings in the Proposal Development facility or at GSFC for New Business Projects.

Required skills/knowledge -
Expertise in Apple computers
Set up and operating system
Computer Administration
SharePoint
AEM and Creative Suite
Server set-up, maintenance and back up
AV equipment set up and operation
Center Computer security and standards

### Period of Performance

October 1, 2019 – September 30, 2020

### Subtask Description

No Subtasks

### Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|

| | | |
|---|---|---|
| 1 | Maintain MIS and ensure non-ACES systems are uniform, operational and configuration controlled. | Daily |
| 2 | Help Desk Log and Status Reports | Weekly |
| 3 | Performance Reports | Monthly |
| 4 | End-of-task Report | End of task |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

The contractor shall maintain configuration management on Sharepoint and the NOO servers.

### Facilities

No facilities are required other than those provided by the government.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics:
Response time to help desk requests via ticket system
Quality of Technical Performance

### Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.
The Government will provide on-site office space and computers.

### Quality Assurance Requirements

Not Applicable

## ODC (Travel and Procurement)

There is no non-local travel for this SOW.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site).

## Reporting Requirements

### Bi-weekly status report

The contractor shall generate Performance Reports bi-weekly. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor, including subcontractors, shall be available to attend monthly status meetings. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

NONE

## References

NONE

# 5020 System Administration Support for PACE & OCI I&T

Date: 12/1/19
Task Monitor (TM): Karen Pham
Contract number: NNG15CR67C
Contract SOW Reference: 4.5 Supporting Services

## Scope

Background – information about the Project or product being supported
Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission is a strategic climate continuity mission that was defined in the 2010 document Responding to the Challenge of Climate and Environmental Change: NASA's Plan for Climate-Centric Architecture for Earth Observations and Applications from Space (referred to as the "Climate Initiative"). The Climate Initiative complements NASA's implementation of the National Research Council's Decadal Survey of Earth Science at NASA, NOAA, and USGS, entitled Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond.
The Contractor shall provide the manpower necessary to perform the different activities in the PACE and OCI integration and test System Administration effort. This includes but not limited to development of and implementation of I&T secure networks to connect test areas IAW DVESTO Security Plan.

Summary of work –
Develop and implement IT network I&T configuration IAW DVESTO Security Plan needed to conduct I&T operations
Maintain Server rack to be used at FlatSat and Spacecraft level I&T and setup data storage units
Implementation of ITOS computer network and assist in set up, set up communications systems, camera systems and logging for backup
Attend safety related training applicable to the operations under their area of responsibility

Required skills/knowledge –
Linux administration knowledge
Scripting language ability
Windows OS administration knowledge
Knowledge of GIT
FEDS software knowledge
Network tcp/ip & SSH protocol knowledge
Knowledge of VOIP
Knowledge of test conductor log system options to record testing shift notes
Knowledge of camera setup and implementation of web access

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2021.

## Subtask Description

# SES II Task Order SOWs

Subtask 1: SA support for PACE Observatory I&T
Subtask 2: SA support for PACE OCI I&T
Monthly Deliverable Report
The contractor shall provide no later than the 10th working day following the close of the contractor's monthly accounting period a 533M for each individual subtask and a summary 533M at the total task level. If it is not possible to provide the individual 533M at the subtask level, the contractor shall provide on the 10th working day following the close of the contractor's monthly accounting period a break out of hours and costs by subtasks to the Contract Resource Analyst, Contracting Officer, and the Task Monitor. The report shall include current period hours and costs, cumulative to date hours and costs, and cumulative costs with a one-month cost plan. When needed, the contractor shall make adjustments to the distribution of costs, layout of the report and change reportable elements as specified by the Task Monitor and/or the Contract Resource Analyst.

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly |
| 2 | Performance Reports | Monthly |
| 3 | End-of-task Report | End of task |

## Management Approach

Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. Experience in supporting spacecraft and instrument I&T electrical ground support equipment is a must.

Configuration Management
Systems and documents will be covered under the PACE/OCI Project Configuration Management Plan, PACE-MGMT-PROC-0002, attached to this task order.

Facilities
Facilities required in the development of the networks will be provided by the Government.

Risk Management and Best Practices
The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics
The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance

metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Specific performance metrics:
Setup and configuration of ITOS workstations in testing areas
Specify and configure equipment to be ordered for data storage during I&T
Configure communication systems to be used during I&T
Configure cameras in I&T areas for on and off-site viewing
Configure selected tool to be used by test conductors for recording daily activities that can be remotely viewed
Provide IT and network security support for all Ground support equipment (GSE being used during integration, calibration and testing that requires an IP address or connects to a system that requires and IP address

Government Furnished Facilities, Equipment, Software and Other Resources
The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management
GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

The contractor shall comply with the PACE Project's Safety and Mission Assurance Plan, PACE-SMA-PLAN-0039, attached to this task order.

## ODC (Travel and Procurement)

This period of performance anticipates no travel or procurements.

## Work Location

This work shall be performed primarily at the Goddard Space Flight Center (On-site), but the contractor may be required to perform some work at the contractor's facility (Off-site).

## Reporting Requirements

Weekly or Bi-weekly status report
The contractor shall generate Performance Reports every week. The report shall include, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.
Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

The Contractor shall adhere to project requirements regarding ITAR related information, as controlled by the ITAR, 22 CFR 120-130, by the U.S. Department of State. Any transfer of controlled information to a foreign person or entity requires an export license issued by the U.S. Department of State or an ITAR exemption to the license requirement prior to the export or transfer.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements
NASA-STD-5005a Ground Support Equipment

## References

PACE-INT-PLAN-0080 Integration and Test (I&T) Plan
PACE-INT-PLAN-0175 PACE I&T Configuration Management Plan
PACE-SMA-REQ-0002 PACE Mission Assurance Requirement (MAR)

# SES II Task Order SOWs

## 6001 ESDIS Project Software and System Engineering

Date: January 30, 2019
Task Monitor (TM): Jeanne Behnke/423
Contract number: NNG15CR67C
Contract SOW Reference: 4.6 Science System Development

## Scope

### Background

The ESDIS Project (Code 423) has the responsibility to develop and lead, monitor, leverage, interoperate the data system activities of the overarching EOSDIS (Earth Observing System Data Information System). NASA's Earth Observing System Data and Information System (EOSDIS) has been a central component of the NASA Earth observation program since the 1990's. It is one of the largest civilian science information system in the US, performing ingest, archive and distribution of over 6.7 terabytes of data per day, much of which is from NASA's flagship missions Terra, Aqua and Aura. The system supports a variety of science disciplines including land use and land cover change, radiation budget, polar, ocean and atmosphere processes, global climate change, and socio-economics applications. The EOSDIS data centers, collocated with centers of science discipline expertise, archive and distribute standard data products produced by science investigator-led processing systems. The architecture of the EOSDIS provides a platform for the publication, discovery, understanding and access to NASA's Earth Observation resources and allows for easy integration of new datasets.

NASA's Earth Science Data System Program consists of two broad classes of funded elements (or projects). The first, referred to as core elements reflect NASA's responsibility for managing Earth science satellite mission data characterized by the continuity of research, access, and usability. The core comprises all the hardware, software, physical infrastructure, and intellectual capital NASA recognizes as necessary for performing its tasks in Earth science data system management. Typically, core elements provide the basic standard data products and services for NASA's missions and use capabilities at a high Technology Readiness Level (TRL). NASA The second, known as community elements are those pieces or capabilities developed and deployed largely outside of NASA core elements and are characterized by their 'evolvability 'and innovation. Typically, the community elements develop innovative new data products or advance capabilities from mid-TRL to higher TRL. Data products from community elements are generally migrated into the core elements for longer-term archiving and distribution. Successful applicable technologies from community elements can be infused into the core, thereby creating a vibrant and flexible, continuously evolving infrastructure.
This task is a follow on to work performed on the SES Contract and formerly on the METS Contract and before that, the MEDS Contract.

### Summary of work

The contractor shall support the ESDIS Project/Code 423 by providing engineering services to develop, verify, and operate the EOSDIS science data systems, working groups and science standards development. ESDIS system engineering activities include requirements analysis, EOS

ground system development and operation, system architectures, metrics monitoring, configuration management, user registration, privacy and security, COTS upgrades analysis, test data/tools development/maintenance, analysis of EOSDIS sustaining engineering/operation and infrastructure tools. ESDIS engages in signification Science Data system development activities for EOSDIS and the broader NASA Earth Science data systems efforts; such as working groups and national and international development efforts.
This task will be arranged as one primary task and three subtasks:
Subtask 6000.0001: System Engineering for the ESDIS Project
Subtask 6000.0002: Engineering and Coordination Support for the Earth Science Data Systems Working Group
Subtask 6000.0003: Engineering and Coordination Support for the CEOS Working Group on Information Systems and Services

Required skills/knowledge -
Each subtask has a differing set of skills required. Staff will be a mix of senior and junior system engineers, programmers, testers, software engineers, data analysts, and requirements engineers.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2019.

## Subtask Description

For Subtask 1: System Engineering for the ESDIS Project - Project Level Planning and System Engineering: Provide recommendations, project documentation, and analysis results with enough time to allow adequate ESDIS management review prior to distribution to the ESDIS community. The contractor will provide support for ESDIS initiatives to advance the planning, direction and communication of project strategies; propose ideas; perform technical analyses, recommend process improvements, and ensure that NASA and GSFC systems engineering and management standards are addressed. The contractor will also provide analysis results, activity recommendations, the preparation of project documentation including change requests to controlled documentation, participation in working groups and teams (as contributor or facilitator), and proposed materials to enhance the communication of project concepts within GSFC, to NASA HQ and to external groups. Provide revisions/updates/comments to requirement documents to support the ESDIS CCB process. The delivery of these updates or comments varies on the order of days to weeks with the schedule defined by the ESDIS CCB process. Perform studies and analyses, and provide reports, position papers, and recommendations, on EOSDIS evolutionary directions, consistent with NASA priorities and policies. Review IT security guidelines and documentation for applicability to the ESDIS Project, provide implementation guidance as needed. Review IT security status at various DAACs, particularly those external to GSFC. Support operations of Building 32 computing facilities as part of the Building 32 Operations Plan, particularly where interfacing with other Building 32 tenants is required. Contribute to IT security infrastructure planning for cloud

mechanisms, like CATEES; support overall IT security aspects of the EOSDIS Cloud Evolution (ExCEL) project planning and implementation.

Science System Integration: Provide daily engineering services to support ESDIS with EOSDIS science systems interface integration and test. The contractor will prepare and review revisions/updates to EOSDIS science system requirements and specifications including project plans, F&PRS, IRDs, ICDs, and other requirements documents or agreements for new and existing systems. The contractor will work with the ESDIS CCR System including CCR preparation, submission, review, and the disposition of comments to obtain CCR approval. The contractor shall provide system engineering expertise on science data processing, data management, data visualization, and science data applications. The contractor shall provide system engineering support for standards implementation and experience on such standards as (WMS, WCS, SMTS, WPS, HDF, NetCDF, OpenDAP, OGC, IPv6, and others) The contractor will support the development of test plans, requirement verification and integrated schedules for the evolution of ESDIS science system elements. Provide monthly status reports, network performance evaluation reports for EOS production sites, technical reports and documentation regarding network test results and recommendations. Finally, provide trip reports, when requested.

Sustaining Engineering: Provide analysis results and insight as needed by the ESDIS science teams or ESDIS management. The contractor will support EOSDIS science system operations meetings with the science teams, support the transition of EOSDIS science data evolution systems as they progress from development and test through the deployment to operations, and monitor the evolution systems for operational impacts to external interfaces including science teams. Activities also include technical review of project documentation and representing the ESDIS project and participation in technical exchange meetings with domestic and international partners.

Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Monthly Technical Progress & Financial Reports | Monthly, by the 15th |
| White papers of email messages recommending improvements | As required by TM |
| Progress and Issue Reports | As required by TM |
| Project Level Planning: Provide recommendations, project documentation, and analysis results with enough time to allow adequate ESDIS management review prior to distribution to the ESDIS community | As required by TM |
| System Engineering: Provide revisions/updates/comments to controlled documents to support the ESDIS configuration process | As required by TM |
| Sustaining Engineering: Provide analysis results and insight as needed by the ESDIS science teams or ESDIS management | As required by TM |

# SES II Task Order SOWs

Management Approach

a. Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. Staff will be a mix of technical task lead with work breakdown structure (WBS) & scheduling experience, senior and junior system engineers, programmers, testers, software engineers, data analysts, and requirements engineers.

b. Configuration Management

Systems and documents will be covered under the ESDIS Project Configuration Management Plans.

c. Facilities

Most staff are planned to be housed onsite in Building 32 and will remain there and bid as onsite. Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment. In some cases, due to office and cubicle space limitations for contractor personnel in Building 32, it may be necessary for some contractor personnel to work off-site at the contractor's facility. In such cases, the contractor will bid affected personnel as off-site.

d. Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5D NASA Space Flight Program and Project Manage Req.
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

ODC (Travel, Training and Procurement)

Travel and training may be required for special events in the project. Specific travel that can be planned for include:

| Type | Location | Duration | Date | Attending |
|---|---|---|---|---|
| Lance Technical Meeting | Boulder, CO | 3 days | April 2019 | 2 people |
| ISC2 Secure Summit | Washington, DC | 65days | April 2019 | 1 |
| AWS Security Conference | Boston, MA | 5 days | July 2019 | 1 |
| ESIP Summer | Tacoma, WA | 5 days | July 2019 | 2 |
| Technical Meeting | San Jose, CA | 3 days | Summer 2019 | 1 |
| Technical Meeting | Los Angeles, CA | 5 days | Summer 2019 | 1 |
| ESRI Meeting | San Diego, CA | 7 days | Summer 2019 | 2 |
| Technical Meeting | Los Angeles, CA | 5 days | September 2019 | 1 |
| AWS Reinvent | Las Vegas, NV | 5 days | December 2019 | 1 |
| AGU | San Francisco, CA | 5 days | December 2019 | 5 |
| ESIP Winter | Washington, DC | 4 days | January 2020 | 4 |
| ESDSWG 2020 | Greenbelt, MD | 3 days | March 2020 | 2 |
| | | | | |

## For Subtask 2: Engineering and Coordination Support for the Earth Science Data Systems Working Group:

The ESDIS Project (Code 423) has the responsibility to develop and manage the Earth Science Data System Working Groups (ESDSWG) ensuring a path for community recommendations regarding the evolution of NASA's earth science data system capabilities. The chartered role of the ESDSWG focuses on the exploration and development of recommendations derived from pertinent community insights of NASA's heterogeneous and distributed Earth science data systems.

~~The ESDSWG is comprised of four distinct working groups organized around key technology and information system issues. Each Working Group functions independently establishing its own work plans on germane data system issues and topics. The ESDSWG members are drawn from a broad range of NASA-funded science and technology projects, NASA information technology experts, affiliated contractor staff and other interested community members from academia and industry. The NASA-funded Community Data System Elements are required to participate in one or more of the four working groups. For more information on the working groups, see https://earthdata.nasa.gov/esdswg.~~

# SES II Task Order SOWs

The ESDSWG facilitates infusion of information technology and system components from community development efforts into NASA's Earth Science Data Systems (ESDS). ESDSWG membership consists of representatives from EOSDIS elements (ESDIS, DAACs, etc.) and NASA ESDS-funded projects that mandate ESDSWG participation, such as Accelerating Collaborative Connections in Earth System Science (ACCESS). For more information on the working groups, see https://earthdata.nasa.gov/esdswg.

The ESDIS Project also formed the ESDIS Standards Office (ESO). The ESO will coordinate the standards related activities for the ESDIS project, including ~~reviewing~~ conducting community reviews of data systems standards and ESDSWG-generated technical notes for endorsement and use by the NASA Earth Science Data Systems ~~division~~ funded data systems projects as well as researching potential external standards for reuse in NASA ESDS. The contractor will provide staff in support of the ESO.

Deliverables/Schedules/Milestones
At a minimum, the contractor shall deliver the items specified below:

| Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Monthly Technical Progress & Financial Reports | Monthly, by the 15th |

Management Approach

a. Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. Staff will be a mix of technical task lead with work breakdown structure (WBS) & scheduling experience, senior and junior system engineers, programmers, testers, software engineers, data analysts, and requirements engineers.

b. Configuration Management

Systems and documents will be covered under the ESDIS Project Configuration Management Plans.

c. Facilities

Contractors for this subtask are located off-site or remotely as required. Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

d. Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective

combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5D NASA Space Flight Program and Project Manage Req.
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

ODC (Travel, Training and Procurement)

Travel and training may be required for special events in the project. Specific travel that can be planned for include:

| Type | Location | Duration | Date | Attending |
|---|---|---|---|---|
| ESIP Summer | Tacoma, WA | 5 days | July 2019 | 3 people |
| ESDIS SE TIM | Greenbelt, MD | 3 days | August 2019 | 2 |
| OGC Comm Meeting | Leuven, Belgium | 5 days | June 2019 | 1 |
| OGC T&P Committee Meeting | Banff, CA | 5 days | September 2019 | 1 |
| OGC Technical | Toulouse, FR | 3 days | Dec 2019 | 1 |
| AGU Fall | San Francisco, CA | 5 days | December 2019 | 2 |
| ESIP Winter | Washington, DC | 5 days | January 2020 | 3 |
| OGC T&P Committee Meeting | Pusan, S. Korea | 5 days | March 2020 | 1 |
| ESDSWG | Annapolis, MD | 5 days | March 2020 | 3 |

## For Subtask 3: Engineering and Coordination Support for the CEOS Working Group on Information Services and Systems – Point of Contact: Andrew Mitchell

The ESDIS Project (Code 423) has the responsibility to develop and lead, monitor, and leverage, where appropriate, interoperability and data system activities within WGISS under the auspices and direction of NASA's Science Mission Directorate (SMD). This task centers on the provision of data system and interoperability expertise specifically to support the NASA WGISS technical leads and pursuant to SMD goals and ESDIS strategic direction.

Working Group on Information Services and Systems:

# SES II Task Order SOWs

Directed support to NASA WGISS technical leads and participation in WGISS Interest Groups (IGs) and Projects:
Directed support to NASA WGISS technical leads in CEOS-related intergovernmental organizations including GEO, USGEO, and Standards Bodies (e.g. ISO, OGC, SIF).
Directed support to NASA WGISS technical leads in the science and data system community conferences, meetings, and other events of note.

Required skills/knowledge for WGISS support:
NASA as well as other agencies (national and international) Earth science data systems
NASA's Earth Science Data Policy
Remote Sensing
Data and metadata standards for Earth science remote sensing and other data
Software System Engineering

The contractor will also provide support for the CEOS/WGISS sponsored portals. Engineering efforts include gathering and defining requirements; conducting trade studies; representing the EOSDIS at all appropriate NASA, GSFC, and project level system engineering activities; and supporting system activities that result from relevant external recommendations, project interfaces, and innovative solutions.
The contractor shall provide systems engineering support for the Committee on Earth Observation Satellites (CEOS) Working Group on Information Systems and Services (WGISS) Interoperability Catalog (CWIC).

Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Monthly Technical Progress & Financial Reports | Monthly, by the 15th |
| Summary of all WGISS activities including telecons and other meetings of note | Monthly |
| Summary of each WGISS meeting | A month after the meeting |
| End-of-task Report | End of Task |

Management Approach
a. Staff Allocation, Expertise, and Skill Mix
The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. Staff will be a mix of technical task lead with work breakdown structure (WBS) & scheduling experience, senior and junior system engineers, programmers, testers, software engineers, data analysts, and requirements engineers.
b. Configuration Management

Systems and documents will be covered under the ESDIS Project Configuration Management Plans.

c. Facilities

Contractors for this subtask are located off-site or remotely as required. Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

d. Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5D NASA Space Flight Program and Project Manage Req.
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

ODC (Travel, Training and Procurement)

Travel and training may be required for special events in the project. Specific travel that can be planned for include:

| Type | Location | Duration | Date | Attending |
|---|---|---|---|---|
| CEOS WGISS 47 | Silver Spring, MD | 5 days | April 2019 | 1 |
| CEOS WGISS 48 | Frascati, IT | 5 days | September 2019 | 1 |
| CEOS | Thailand | 5 days | September 2019 | 1 |

# SES II Task Order SOWs

## Work Location

This work shall be performed primarily onsite at the Goddard Space Flight Center. Some staff are planned to be housed offsite at the contractors location. Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

## Reporting Requirements

### Weekly or Bi-weekly status report

Where needed and/or requested by the TM.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. All reports should be delivered electronically. The contractor shall provide monthly cost reporting on this subtask in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meeting either in person or via telecon. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. The contractor will not be required to handle classified data. However the contractor will have access to Sensitive But Unclassified (SBU) data related to community projects and is expected to maintain confidentiality of such data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents as appropriate:

NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

None

## 6002 ESDIS Configuration Management and Metrics Support

Date: April 1, 2019
Task Monitor (TM): Steven Bailey/586
Contract number: NNG15CR67C
Contract SOW Reference: 4.6 Science System Development

### Scope

Background

The ESDIS Project (Code 423) has the responsibility to develop and lead, monitor, leverage, interoperate the data system activities of the overarching EOSDIS (Earth Observing System Data Information System). NASA's Earth Observing System Data and Information System (EOSDIS) has been a central component of the NASA Earth observation program since the 1990's. It is one of the largest civilian science information system in the US, performing ingest & archive of over 22 TB of data daily and distribution exceeding 66 TB per day, much of which is from NASA's flagship missions Terra, Aqua and Aura. The system supports a variety of science disciplines including land use and land cover change, radiation budget, polar, ocean and atmosphere processes, global climate change, and socio-economics applications. The EOSDIS data centers, collocated with centers of science discipline expertise, archive and distribute standard data products produced by science investigator-led processing systems. The architecture of the EOSDIS provides a platform for the publication, discovery, understanding and access to NASA's Earth Observation resources and allows for easy integration of new datasets.

NASA's Earth Science Data System Program consists of two broad classes of funded elements (or projects). The first, referred to as core elements reflect NASA's responsibility for managing Earth science satellite mission data characterized by the continuity of research, access, and usability. The core comprises all the hardware, software, physical infrastructure, and intellectual capital NASA recognizes as necessary for performing its tasks in Earth science data system management. Typically, core elements provide the basic standard data products and services for NASA's missions and use capabilities at a high Technology Readiness Level (TRL). NASA The second, known as community elements are those pieces or capabilities developed and deployed largely outside of NASA core elements and are characterized by their 'evolvability 'and innovation. Typically, the community elements develop innovative new data products or advance capabilities from mid-TRL to higher TRL. Data products from community elements are generally migrated into the core elements for longer-term archiving and distribution. Successful applicable technologies from community elements can be infused into the core, thereby creating a vibrant and flexible, continuously evolving infrastructure.

This task is a follow on to work performed on the SES Contract and formerly on the METS Contract and before that, the MEDS Contract.

Summary of work

# SES II Task Order SOWs

The contractor shall support the ESDIS Project/Code 423 by providing engineering services to develop, verify, and operate the EOSDIS science data systems, working groups and science standards development. ESDIS system engineering activities include requirements analysis, EOS ground system development and operation, system architectures, metrics monitoring, configuration management, user registration, privacy and security, COTS upgrades analysis, test data/tools development/maintenance, analysis of EOSDIS sustaining engineering/operation and infrastructure tools. ESDIS engages in significant Science Data system development activities for EOSDIS and the broader NASA Earth Science data systems efforts; such as working groups and national and international development efforts.
Required skills/knowledge – Staff will be a mix of senior and junior system engineers, programmers, integration and test engineers, software engineers, data analysts and requirement engineers.

## Period of Performance

The period during which the work for this task order shall be performed is from task award through March 31, 2020.

## Task Description

The contractor shall provide full lifecycle support in the design, development and release of:
The ESDIS/ESMO/EDOS Configuration Management (CM) System,
The ESDIS Metrics System (EMS) and associated metrics analysis.

Configuration Management (CM) Background, Scope and Concept of Operations

COMET is the CM system that fulfills the configuration management needs of the Earth Science Data and Information System (ESDIS), Earth Science Mission Operations (ESMO), and the EOSDIS Data and Operations System (EDOS) within the auspice of the Goddard Space Flight Centers Earth Science Project Division.

The overall goal of the CM system is to follow and enforce document management directives, procedures, policies and guidelines using a system of software and hardware to automate the process where prudent. The CM system will be able to audit actions committed and report on the status and disposition of all documents under its control.

Documentation pertaining to configurations, interfaces, operating procedures and other aspects of operating missions, ground systems and science data systems are required to be controlled. The control of these documents provides opportunity for changes to be evaluated by those impacted before implementation. A configuration management system helps automate and track the CM process by using software, database, networking and other technologies.

Users with differing levels of privilege access the CM system using a standard, yet secure, web browser and operating system combination. Depending on their assigned role, users may

create, edit, delete, and comment on Configuration Change Requests (CCRs) and or upload (Word/PDF Formats), download (Word/PDF Formats) or review existing comments. Users must log in with unique and individual usernames and passwords. Upon login, users will be presented with an individual report showing outstanding, pending and other actions.

Users of the CM system will access different screens or web pages for administration, creation, editing, searching and other functionality. The CM system will provide status, reports and notifications of outstanding CCRs and other aspects of the system, dependent on user role. Users will allow users opt in/out of receiving notifications of status, though some communications will be required regardless user options (i.e. overdue assessment emails).

ESDIS Metrics System Background, Scope and Concept of Operations
The Earth Science Data and Information System (ESDIS) Metrics System (EMS) is designed to support the ESDIS project management by collecting and organizing various metrics from the Earth Observing System (EOS) Distributed Active Archive Centers (DAACs) and other Data Providers. The EMS metrics are reported to Data Centers, User Working Groups, Office of Management and Budget, ESDIS and NASA Headquarters to evaluate performance and effectiveness of the EOSDIS. The metrics data and the analysis reports generated from EMS provide NASA managers the information needed to determine how to best apply resources to support the science community and improve services.

The EMS shall support the needs of the ESDIS project by collecting and reporting on ingest, archive and distribution of products and services from EOSDIS data centers and other providers. Sufficient information shall be captured to allow for characterization of users and usage trends, product generation and storage of EOSDIS related data products and services.

The overall goal of the EMS is to collect and analyze data on the usage of products and services delivered via the Internet or stored in databases at EOSDIS supported data centers and other facilities. Specifically, the EMS allows the project and other users access to metrics from the Data Providers including such information as number of users, type and amount of data archived, type and amount of data distributed, and other related information. The EMS is located at the Goddard Space Flight Center (GSFC) and is operated by the ESDIS Science Operations Office (SOO).

The EMS is a collection of servers, databases, Custom Off The Shelf (COTS) software applications (including enterprise-level Google Web Analytics tools) and locally developed Oracle and custom code designed to support the ESDIS project management by collecting and organizing various metrics from the Earth Observing System (EOS) Data Centers and other Data Providers. The system also provides a variety of reporting capabilities (routine, ad hoc, system performance and process tracking) via an Oracle APEX/HTMLDB interface.

Users with differing levels of privilege access the EMS system using a standard, yet secure, web browser and operating system combination. Depending on their assigned role, users may access and download or review existing metrics. Users must log in with agency unique identities

and passwords. Upon login, users will be presented with summary metric reports, although users may request individual, specialized reports to be created and delivered.

Users of the EMS will access different screens or web pages for administration, creation, editing, searching and other functionality. The EMS will provide status, reports and notifications of issues and other aspects of the system, dependent on user role. Administrative users will assign roles and configure notifications, though some communications will be required regardless user options (i.e. overdue assessment emails).

Specific applications development, systems administration, systems management and engineering services support tasks will include, but not be limited to the following:
Gathering and documenting requirements for the system (this includes technical, operational, functional, data/database and business process requirements).
System design activities.
Application design and development.
Database design and development.
Implementation of the system in accordance with functional, operation, data/database and business process requirements.
Implementation, maintenance and tuning of database structures including any changes to the metadata as determined by ESDIS.
Migration, verification and reconciliation of all necessary legacy data and documents.
Development of test plans and procedures (as appropriate to the Development Integrated Test - DIT, Systems Integrated Test - SIT, User Acceptance Test - UAT and production/operations environments utilized) to validate that the system functions in accordance with technical, operational, functional, data/database and business process requirements.
Perform and document results of testing (as appropriate to the DIT, SIT, UAT and production/operations environments utilized) to validate that the system functions in accordance with technical, operational, functional, data/database and business process requirements.
Development of test scripts to support acceptance testing by Business Process Owners.
Support installation and configuration of application server, database server and development framework components as needed with support of system and network administrators.
Ensure the system is compliant with all relevant NASA Technical Standard (NASA STD) related to configuration management for configuration-controlled documents. In the case of the Configuration Management System, this also includes ensuring the system is compliant with all relevant Procedures and Guidelines (PG), and Goddard Procedural Requirements (GPR).
Provide user training and support as required.
Maintain the application in an operational status.
Track artifacts related to testing results, defects, enhancement requests, and new requirements.
Provide recommendations for future technical or functional improvements to the system.
Perform testing of the system following installation of patches or updates (O/S, database, application server, development framework) to validate operations.

# SES II Task Order SOWs

Work with the EOSDIS User Registration System (Earthdata Login) to identify users in the metrics system.
Support future release activities as required.
Demonstrations of functionality at critical milestones

Metrics Collection Tool Background, Scope and Concept of Operations

Community Data Systems award recipients are required to provide monthly metrics on the data and services provided by their projects. These metrics are reported using the Metrics Collection Tool (MCT), developed originally by the Global Land Cover Facility at the University of Maryland. This tool is being maintained and operated at the Goddard Space Flight Center as it has been since 2008. For projects whose products or services are distributed in whole or in part by a Distributed Active Archive Center (DAAC) that is already reporting metrics to the ESDIS Metrics System (EMS), a mechanism called the EMS-MCT Bridge is available to transfer certain values between the systems.

The MCT shall support the needs of the ESDIS project by collecting and reporting on NASA's Making Earth System Data Records for Use in Research Environments (MEaSUREs), Advanced Collaborative Connections for Earth System Science (ACCESS), and Research, Education and Applications Solutions Network (REASoN) projects and products and services. Sufficient information shall be captured to allow for characterization of users and usage trends, product generation and storage of EOSDIS related data products and services.

Specific applications development, systems administration, systems management and engineering services support tasks will include, but not be limited to the following:
Gathering and documenting requirements for the system (this includes technical, operational, functional, data/database and business process requirements).
System design activities.
Application design and development.
Database design and development.
Implementation of the system in accordance with functional, operation, data/database and business process requirements.
Implementation, maintenance and tuning of database structures including any changes to the metadata as determined by ESDIS.
Development of test plans and procedures to validate that the system functions in accordance with technical, operational, functional, data/database and business process requirements.
Perform and document results of to validate that the system functions in accordance with technical, operational, functional, data/database and business process requirements.
Development of test scripts to support acceptance testing by Business Process Owners.
Support installation and configuration of application server, database server and development framework components as needed with support of system and network administrators.
Ensure the system is compliant with all relevant NASA Technical Standard (NASA STD) related to configuration management for configuration-controlled documents. In the case of the

Configuration Management System, this also includes ensuring the system is compliant with all relevant Procedures and Guidelines (PG), and Goddard Procedural Requirements (GPR).
Provide user training and support as required.
Maintain the application in an operational status.
Track artifacts related to testing results, defects, enhancement requests, and new requirements.
Provide recommendations for future technical or functional improvements to the system.
Perform testing of the system following installation of patches or updates (O/S, database, application server, development framework) to validate operations.
Support future release activities as required.

Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Monthly Technical Progress & Financial Reports | Monthly, by the 15th |
| In addition to Monthly Technical Progress & Financial Reports the contractor shall provide, maintain, and update on an ongoing basis the following deliverables and upload these artifacts to the ESDIS wiki:<br>Project plans, schedules, risks/issues/mitigations register and milestone lists.<br>Requirements Definition Documents traceability matrix.<br>Interface Control Documents, Operations Agreements, Design and Operations Description Document (which includes the build description and operational procedures).<br>System design diagrams and documentation.<br>Fully documented source code and configuration files.<br>Fully documented build scripts and executable files.<br>Test plans and procedures.<br>Acceptance testing Test Scripts.<br>Test results summary report.<br>User training materials, user guides and documentation.<br>Lists of outstanding defect/enhancement/requirement artifacts.<br>Database design and schema documentation.<br>Inputs to Procedures and Guidelines documents, Operations Concepts, Transition Plan and other documents as needed.<br>Review and presentation materials, posters, etc. | As needed throughout the performance period. |
| Weekly status reports | Every week |

Management Approach

a. Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. Staff will be a mix of technical task lead with work breakdown structure (WBS) & scheduling experience, senior and junior system engineers, programmers, testers, software engineers, data analysts, and requirements engineers.

b. Configuration Management

Systems and documents will be covered under the ESDIS Project Configuration Management Plans.

c. Facilities

For this task, contractors need to work offsite due to office and cubicle space limitations for contractor personnel in Building 32, appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

d. Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics

Performance on this task will be measured by the following:

Timeliness and quality in performance of specific tasks required by the Statement of Work.

Timeliness and quality (accuracy and completeness) of required deliverables.

Performance and availability of the delivered system.

Timeliness and quality in performance of maintenance activities.

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5D NASA Space Flight Program and Project Manage Req.
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

ODC (Travel, Training and Procurement)

Travel and training may be required for special events in the project. Specific travel and training that can be planned for includes:

| Location | People | Dates |
|---|---|---|

# SES II Task Order SOWs

| | | |
|---|---|---|
| ESDSWG - Annapolis | 3 | April 2019 |
| Oracle 18c Training – Washington DC | 1 | April 2019 or as available |
| Oracle 18c Training – Washington DC | 1 | May 2019 or as available |
| ESIP – Tacoma, WA | 1 | July 2019 |
| AGU – San Francisco, CA | 2 | December 2019 |
| ESIP – Washington DC | 2 | January 2020 |
| ESDSWG - Annapolis | 3 | March 2020 |

## Work Location

This work shall be performed primarily onsite at the Goddard Space Flight Center. Some staff are planned to be housed offsite at the contractors location. Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

## Reporting Requirements

### Weekly or Bi-weekly status report

Where needed and/or requested by the TM.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. All reports should be delivered electronically. The contractor shall provide monthly cost reporting on this task in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meeting either in person or via telecon. The contractor shall comply with any and all additional requests for status meetings and reports.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. The contractor will not be required to handle classified data. However the contractor will have access to Sensitive But Unclassified (SBU) data related to community projects and is expected to maintain confidentiality of such data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

# SES II Task Order SOWs

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents as appropriate:

NPR 7150.B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

None

## 6003 Science Data Applications Dev't & Operations for ESDIS

Date: January 2019
Task Monitor (TM): Kathleen Baynes / 586
Contract number: NNG15CR67C
Contract SOW Reference: 4.6 Science System Development

Scope
Background -
This task will support the ESDIS Project (Code 423). EOSDIS provides science data to a wide community of users for NASA's Science Mission Directorate. The ESDIS Project is responsible for:
Processing, archiving, and distributing Earth science satellite data (e.g., land, ocean and atmosphere data products)
Providing tools to facilitate the processing, archiving, and distribution of Earth science data
Collecting metrics and user satisfaction data to learn how to continue improving services provided to users
Ensuring scientists and the public have access to data to enable the study of Earth from space to advance Earth system science to meet the challenges of climate and environmental change.
Promoting the interdisciplinary use of EOSDIS data, including data products, data services, and data handling tools to a broad range of existing and potential user communities.

This task is focused on developing and operating tools that promote the interdisciplinary use of EOSDIS data and services for a broad range of users.

Summary of work – The contractor shall provide science data system engineering, software system engineering and software engineering services to design, develop and deploy science systems and applications for science operations, data processing, data management, and data analysis and visualization. Data system engineering may include problem definition, solution analysis, process planning and control, system documentation development and maintenance, system integration, and product evaluation. Software system engineering may include requirements definition and analysis, software design, process planning and control, software documentation development and maintenance, verification, validation and test, and software integration. The science system software may include COTS, GOTS, new development, legacy code, or some combination of the aforementioned. Science systems development may include hardware definition, integration, test and deployment. The contractor will provide operations support, including implementation and maintenance of the associated hardware and software. The contractor will provide support for cloud prototyping, development, migration, and operation activities aimed at beginning a GIBS transition to Amazon Web Services cloud–based infrastructure.

# SES II Task Order SOWs

The contractor shall utilize existing capabilities for requirement collection and approval, issue tracking, agile software development/planning, software repositories, user support and other collaboration technologies that compose the Earthdata Web Infrastructure. All work activities will be tracked within this suite of tools. A description of this tool suite and capabilities can be found on the following web page https://earthdata.nasa.gov/about-eosdis/science-system-description/web-infrastructure-wi. Specifically, code and content developed through this task order will be submitted and managed through https://ecc.earthdata.nasa.gov/ unless otherwise noted. (Note: The ESDIS Project supports the Earthdata Web infrastructure as a separate task.) In addition, cloud transitions activities will require utilization of NASA-compliant General Application Platform (NGAP) as directed by task monitor.

This task will be arranged as a single subtask:

Subtask 6003.0001: Science Data Applications Development and Operations

Required skills/knowledge -
Staff will be a mix of senior, mid level and junior staff composed of a project/task management, system engineers, software developers, software testers, database administrators, requirements engineers, technical writers, system/network administrators, user interface designers and operators. Science software developers will need to be able to retrieve, extract and produce imagery from NASA Earth science data. Staff will need to be able to work in contemporary Linux and VMware environments (CentOS/Redhat) and have knowledge of developing, deploying and operating systems that are highly available with limited human intervention. Knowledge of advanced iSCSI SAN technology, specifically Equallogic SANs and developing and testing resilient backups for over 500TB of disk is required. Additionally, this task requires knowledge and operation of automated configuration management and control technologies (e.g. Puppet, Spacewalk, Capistrano, Chef, OpenNMS, LDAP, CloudFormation, Terraform) and continuous integration technologies such as JIRA/Bamboo/Confluence. Software development within environments is polyglot utilizing diverse capabilities including automated testing, Java, JavaScript, C, shell scripts, Groovy/Grails, Python, Mapserver, ElasticSearch/SOLR, jUnit, JQuery, SQL, Apache, OpenLayers, HTML, Drupal, GDAL, OGC, HDF and NetCDF programming techniques, libraries and standards.

Finally, staff will need significant familiarity with the fundamentals of Amazon Web Services (AWS) product offerings, including knowledge of AWS terminology, foundational services, available security measures and management tools.

Period of Performance
The period during which the work for this task order shall be performed is from task award through March 31, 2020.

Subtask Description

# SES II Task Order SOWs

For Subtask 6003.0001: Science Data Applications Development and Operations – Point of Contact Kathleen Baynes, 301-614-6005, 240-357-6576, kathleen.baynes@nasa.gov

The contractor shall provide full lifecycle support in the design, development, testing, release and operations of:
Global Imagery Browse Services
Web Applications and Content Development
Data as a Service Prototypes

Global Imagery Browse Services (GIBS)
The goal of GIBS is to present NASA Earth science data in formats and with services that are easily usable by a wide variety of users. These services must be highly responsive, available and complement other EOSDIS systems (e.g. Common Metadata Repository, User Registration System and Earthdata Web Infrastructure, etc. – see https://earthdata.nasa.gov/about-eosdis/science-system-description). GIBS interfaces are based on Open Geospatial Consortium (OGC) and other standards. GIBS is populated with imagery from data providers, including Science Investigator-led Processing Systems (SIPS), Science Data Segments (SDS) and DAACs. GIBS may also process science data archived at SIPS, SDS and DAACs into browse data products. Users of GIBS include other EOSDIS components, U.S. government agencies, commercial entities and the general public.

Development of GIBS software and services are done in collaboration with JPL and the EED-2 contract. The contractor will need to develop components for GIBS and work with the JPL/EED-2 development teams to test and integrate custom software. Contractor staff located at GSFC shall accept, test and modify code delivered by JPL to work within the GIBS systems located in Building 32 (primary) and Building 13 (backup). Additionally, significant portions of this developed code shall be accepted, tested, and deployed to Amazon Web Services cloud infrastructure. GIBS related software is stored on GitHub and within the Earthdata Code Collaborative - https://ecc.earthdata.nasa.gov/.

The contractor shall:
Develop, test, and deploy GIBS systems
Provide separate development and testing environments to enable the implementation and testing of features and concepts before promotion to production environment
Provide the production environment for on-premises GSFC-based GIBS system
Collaborate with EED-2 contractor in specifying system functionality, developing, testing, deploying, and operating cloud-based GIBS as directed by the TM.
Sustaining Engineering
Manage and operate all systems and software including system administration, application administration, and software administration
Address system issues and bugs
Deliver and maintain code within https://ecc.earthdata.nasa.gov/ and Github (https://github.com/nasa-gibs) as directed by the TM
Generate GIBS imagery and data layers

# SES II Task Order SOWs

Develop software to generate images from NASA Earth science data
Convert imagery into GIBS compatible formats (For Mod 6, this effort for backlogged imagery is considered complete and is now an as-needed activity only.)
Communications and documentation
Participate in, conduct, and document meetings
Participate in standards organizations as directed by the TM
Develop and update documentation and requirements
Communicate layer on-boarding progress to stakeholders as directed by the TM.
Develop and implement plans, processes and schedules using an Agile methodology
Participate in larger EOSDIS-wide Program Increment (PI) planning activities and Scrum of Scrums as prescribed by the Scaled Agile Framework® (SAFe)
Provide information to SAFe leadership teams as required by the TM
Conduct system engineering studies and generate reports as required by the TM

## Web Applications and Content Development

Data and information from EOSDIS are principally provided to users via web technologies. These technologies must provide intuitive and usable interfaces and content and be attractive for wide audiences. This portion of the task includes development of web applications, creation of web content and organization of materials to present users within highly functioning websites and tools. The primary areas of work for this component of the task include Worldview, the Sea Level Change Portal and interactive website content for Earthdata.nasa.gov as directed by the task monitor.

Worldview (https://worldview.earthdata.nasa.gov/ ) is an interactive data visualization web client. Worldview utilizes GIBS web services to present browse imagery to users in an easy to use interface that is web client agnostic. Using best practices for user interface design, Worldview exposes and demonstrates the highly responsive services GIBS offers. Worldview also integrates additional EOSDIS services to demonstrate interoperability. These services include Kayako, Earthdata Code Collaborative, Earthdata.nasa.gov website, CMR, and DAAC services. The Worldview application is developed within local developer environments (laptops) and hosted within the Earthdata.nasa.gov web infrastructure. The Earthdata Web Infrastructure provides integration, testing and production environments into which Worldview will be deployed.

Within this statement of work, the contractor shall also work collaboratively on integrating content from the Sea Level Change portal team located at JPL and other information into Earthdata.nasa.gov.

Approaches for development of Worldview and collaboration in developing content for Earthdata.nasa.gov from the JPL Sea Level Change portal team may also be applied to additional interactive features for Earthdata.nasa.gov, including content generation and maintenance, as well as internal sites to be used by the GIBS operations staff.

Finally, the contractor will work with the EED2 contractors to support for cloud activities aimed at beginning a Worldview transition from GSFC-based physical systems to Amazon Web Services cloud–based infrastructure.

The contractor shall:

Develop and deploy web applications
Provide development and deployment support
Deploy web applications into the Earthdata.nasa.gov Web Infrastructure
Work with EED-2 contractors to support deployment of Worldview to NGAP in support of cloud transition activities.
Provide temporary augmented support to address challenges associated with deliverables as required by TM
Generate and maintain web site content for Earthdata.nasa.gov
Deliver and maintain web application code within Earthdata Code Collaborative
Communications and documentation
Conduct and document meetings
Participate in standards organizations and apps challenges
Develop and update documentation
Develop plans, processes and schedules
Devise and conduct meetings to support Agile development processes.
Report on development progress and milestones during development planning meetings

Deliverables/Schedules/Milestones

| GIBS Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Develop and prototype visualization metadata object model | NLT September 30, 2019 |
| Finalize vector product support (development) and integrate new products (operations) | NLT March 31, 2020 |
| Finalize geostationary product support (development) and integrate new products (operations) | NLT March 31, 2020 |
| Develop report on storage plan beyond CY2020 | NLT June 30, 2019 |
| Support EED2 Cloud Transition Activities | As required by Task Monitor |
| Re-Baseline GIBS requirements in Jama | Continuous |
| Submit source code to the Earthdata Code Collaborative and GitHub Open Source Project | Continuous |
| Perform biweekly sprint planning meetings for both Worldview and GIBS development | Continuous |
| Conduct and Document Technical Working Group Telecons | Not less than monthly |
| Conduct and report on backup integrity tests | Twice per calendar year |

# SES II Task Order SOWs

| GIBS Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Provide updated cloud transition roadmaps for GIBS and OnEarth including data migration plans | NLT September 30, 2019 |

| Worldview Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Support access to granule-based imagery based on GIBS use cases | As required by Task Monitor |
| Implement new intro “tour” of Worldview capabilities and GIBS imagery | NLT May 31, 2019 |
| Prototype integration of commercial imagery (e.g., Planet Labs) into Worldview to provide “detailed imagery on demand” | As required by Task Monitor |
| Deploy Worldview to NGAP 2.0 environment | As required by Task Monitor |
| Baseline requirements in Jama | Continuous |
| Submit source code to the Earthdata Code Collaborative and GitHub Open Source Project | Continuous |
| Perform biweekly sprint planning meetings | Continuous |
| Conduct and Document Technical Working Group Telecons | Monthly |

600x Common Deliverables/Schedules/Milestones

| Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Monthly Technical Progress & Financial Reports | Monthly, by the 15th |
| Report on external availability (uptime), operational metrics (ingest, archive, distribution, new and existing data sets) and user support tickets from Kayako User Support tool for all systems and services (e.g. GIBS, Worldview, etc…) | Monthly, by the 15th |
| In addition to Monthly Technical Progress & Financial Reports the contractor shall provide, maintain, and update the following deliverables as requested and upload these artifacts to the Earthdata wiki or other designated repository:<br>Requirements Definition Documents traceability matrix.<br>Interface Control Documents, Operations Agreements, Design and Operations Description Document (which includes the build description and operational procedures).<br>System design diagrams and documentation.<br>Fully documented source code and configuration files. | As required by Task Monitor ™ |

| Deliverable Item/Milestone | Deliverable Due |
|---|---|
| Fully documented build scripts and executable files.<br>Test plans and procedures.<br>Acceptance testing Test Scripts.<br>Test results summary report.<br>User training materials, user guides and documentation.<br>Lists of outstanding defect/enhancement/requirement artifacts.<br>Database design and schema documentation.<br>Inputs to Procedures and Guidelines documents, Operations Concepts, Transition Plan and other documents as needed.<br>Review and presentation materials, posters, etc. | |
| White papers recommending improvements | As required by TM |
| Progress and Issue Reports | As required by TM |
| Project Level Planning: Provide recommendations, project documentation, and analysis results with enough time to allow adequate ESDIS management review prior to distribution to the EOSDIS community | As required by TM |
| System Engineering: Provide revisions/updates/comments to controlled documents to support the ESDIS configuration process | As required by TM |

Management Approach

a. Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. Staff will be a mix of technical task lead with work breakdown structure (WBS) & scheduling experience, senior and junior system engineers, programmers, testers, software engineers, data analysts, and requirements engineers.

b. Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

c. Facilities

Nominally, staff are planned to be housed onsite in Building 32 and will remain there and bid as onsite. Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

In some cases, due to office and cubicle space limitations for contractor personnel in Building 32, it may be necessary for some contractor staff to work off-site at the contractor's facility. In such cases, the contractor will bid affected personnel as off-site.

d. Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

e. Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.

f. Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

g. Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5D NASA Space Flight Program and Project Manage Req.
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

# SES II Task Order SOWs

ODC (Travel and Training)

SUMMARY - SES II Travel for April 1 2019 – March 31, 2020 for 6003

| # Travelers | Destination | Dates | Purpose |
|---|---|---|---|
| 2 | Greenbelt, MD | April 2019 (2 days) | PI 19.2 Planning |
| 2 | Greenbelt, MD | April 2019 (2 days) | GIBS/WV Spring Summit 2019 |
| 4 | San Diego, CA | April 2019 (3 days) | FOSS4G North America |
| 2 | Denver, CO | April 2019 (2 days) | LANCE UWG Face-to-Face |
| 3 | Washington, DC | 10 May 2019 | NationJS Frontrunners |
| 1 | Greenbelt, MD | Jun 2019 (2 days) | Task 6003 GIBS/WV Support & Planning |
| 2 | Greenbelt, MD | Jul 2019 (3 days) | PI 19.3 Planning |
| 2 | Tacoma, WA | Jul 2019 (4 days) | ESIP Summer 2019 |
| 3 | Washington, DC | Jul 2019 (3 days) | An Event Apart 2019 Washington, DC |
| 2 | Greenbelt, MD | 19-22 Aug 2019 | SE TIM |
| 1 | Greenbelt, MD | Sep 2019 (2 days) | Science Team meeting |
| 3 | Las Vegas, NV | Fall 2019 (2 days) | React Conf |
| 2 | Greenbelt, MD | 25-26 Sep 2019 | PI 19.4 Planning |
| 2 | Greenbelt, MD | Sept 2019 (2 days) | GIBS/WV Fall Summit 2019 |
| 2 | San Fransisco, CA | 10-12 Oct 2019 | Github Universe |
| 1 | Greenbelt, MD | Oct 2019 (2 days) | MODIS/VIIRS Science Team Meeting |
| 1 | Greenbelt, MD | Nov 2019 (2 days) | Task 6003 GIBS/WV Support & Planning |
| 2 | Washington, DC | Dec 2019 (2 days) | NationJS (React) |
| 5 | San Fransisco, CA | 9-13 Dec 2019 | AGU Fall Meeting |
| 2 | Greenbelt, MD | January 2020 (2 days) | PI 20.1 Planning |
| 1 | Annapolis, MD | March 2020 (3 days) | ESDSWG |

SUMMARY - SES II Training for April 1 2019 – March 31, 2020 for 6003

| # Trainees | Destination | Dates | Purpose |
|---|---|---|---|
| 2 | Online | Spring 2019 | AWS Technical Essentials |
| 1 | Columbia, MD | Spring 2019 | Systems Operations on AWS |
| 1 | Online | Summer 2019 | The Python Language |

Work Location

This work shall be performed onsite at the Goddard Space Flight Center. Some staff (approximately 1/3) are planned to be housed offsite. Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at

the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

Reporting Requirements
a. Weekly or Bi-weekly status report
Where needed and/or requested by TM.

b. Monthly performance report
The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. All reports should be delivered electronically. The contractor shall provide monthly cost reporting on this subtask in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meeting either in person or via telecon. The contractor shall comply with any and all additional requests for status meetings and reports.

Security Requirements
The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives. The contractor will not be required to handle classified data. However the contractor will have access to Sensitive But Unclassified (SBU) data related to community projects and is expected to maintain confidentiality of such data.

Data Rights
This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

Applicable Documents
None

References
None

# 6004 GLOBE Program's Data and Information System (DIS)

Date: August 12, 2019
Task Monitor (TM): Lisa Dallas
Contract number: NNG15CR67C
Contract SOW Reference: 4.6 Science System Development

## Scope

### Background

The Global Learning and Observations to Benefit the Environment (GLOBE) program (www.globe.gov) is a worldwide hands-on, primary and secondary school-based science and education program. GLOBE's vision promotes and supports students, teachers, scientists, and members of the general public to collaborate on inquiry-based investigations of the environment and the Earth system working in close partnership with the primary sponsor NASA as well as the two other sponsoring agencies NOAA and NSF. GLOBE provides grade level-appropriate, interdisciplinary activities and investigations about the atmosphere, biosphere, hydrosphere, and soil/pedosphere, which have been developed by the scientific community and validated by teachers. GLOBE connects students, teachers, scientists, and citizens from different parts of the world to conduct real, hands-on science about their local environment and to provide a global perspective on these observations.

Created in 1994, GLOBE began operations on Earth Day 1995. Since then the GLOBE user community has grown substantially. GLOBE supports more than 34,000 GLOBE-trained teachers, over 1.5 million students, representing over 33,000 schools around the world that have contributed over 160 million measurements in the GLOBE database. The international GLOBE network includes representatives from 121 participating countries coordinating GLOBE activities that are integrated into their local and regional communities.

The objective of this Statement of Work is to detail the specific GLOBE Data and Information System (DIS) requirements for its operations, sustaining engineering, and community support. In order to do so, we first present an overview of GLOBE Program's organization, its data and information system, science areas, and community.

### GLOBE's Organization

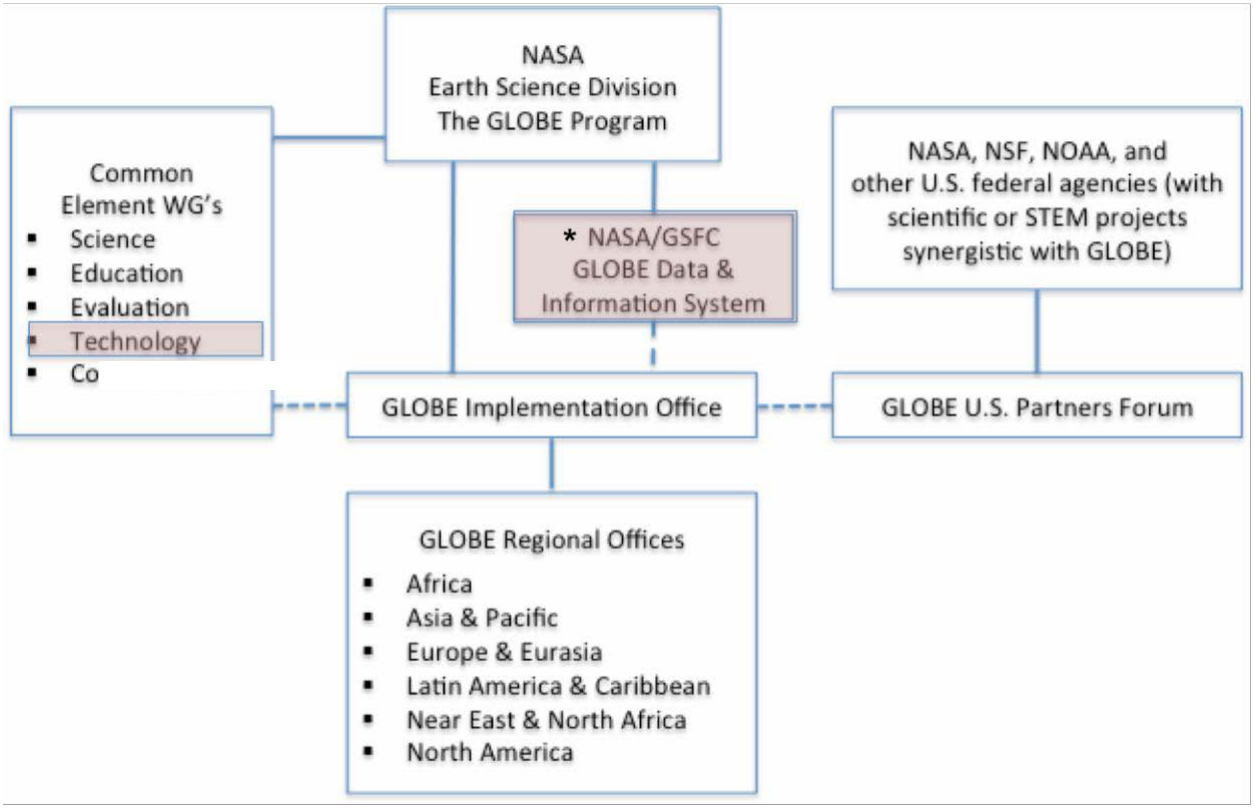
The organization of the GLOBE Program and its related elements span several organizations and contractor teams, as shown in Figure 1. GLOBE is sponsored by the U.S. National Aeronautics and Space Administration (NASA), with support from the National Oceanic and Atmospheric Administration (NOAA), the National Science Foundation (NSF),and the Department of State. Internationally, GLOBE is implemented through Government-to-Government agreements with each Country Partner responsible for in-country activities. As the lead agency for GLOBE in the U.S., the Earth Science Division of NASA Headquarters at Washington D.C. has the primary responsibility for administering the Government-to-Government agreements, and the management of the GLOBE Implementation Office and the Data and Information System

(DIS) that support the worldwide implementation. Here, GLOBE's Program Manager provides resources for GLOBE activities and sets the priorities and direction for the overall program.

The central component of the GLOBE Program is the GLOBE Implementation Office (GIO). The GIO supports the GLOBE common elements of science, education, evaluation, and communication. Also, the GIO is the implementing organization for other US agency and international agreements that are sponsored by the NASA HQ Program Office. GIO is selected through a competitive NASA solicitation process. The current awardee is University Corporation for Atmospheric Research (UCAR) located at Boulder, CO.
The primary interfaces between the GIO and the GLOBE DIS management in Code 586 are shown in Figure 1 as the colored boxes noting the contractor staff involved in the operations, sustained engineering and development activities for GLOBE.

The active participation and contribution from various members of the GLOBE community is essential to the continued success of GLOBE. This participation is achieved through the Common Element Working Groups (WGs) and the U.S. Partners Forum.

GLOBE's Data and Information System (DIS), which this statement of work is for, is managed by NASA GSFC Science Data Systems Branch (Code 586) at Greenbelt, MD. GLOBE DIS supports the GLOBE common element of Technology.



# SES II Task Order SOWs

FIGURE 1: The current organizational structure of the GLOBE Program (c. 2016). The entities are shown here as the boxes with major (solid) and secondary (dashed) information flows connecting.

GLOBE's Data and Information System: When the system was first introduced, it had a cutting edge data and information system, which was well-received and innovative for its time. Internet-based technologies have changed dramatically since the 1990s so the need to modernize and evolve the GLOBE DIS began in 2012. This redesign has culminated in the existing data and information systems of the GLOBE site today. The current GLOBE DIS is now built upon the latest information technologies and has proved a means for engaging and supporting the user community with advanced tools and services to further the goals of the GLOBE Program.

The system requirements to support GLOBE's organizational structure, workshops, eTraining, Visualizations, and workflows for joining GLOBE have all been implemented in detail with constant interactions, communication, and feedback from the GLOBE Program Manager, GLOBE Science Adviser, GIO, GSFC TM, GLOBE's Working Groups, and community. The GLOBE's DIS currently consists of the following major components. Figure 2 identifies all GLOBE Version 2.0 subsystems.

Science and Training Data: 20+ years of observation data, over 162 million measurements, records of over 58K trained teachers, scientists, and students, and related content on education, science, news items, events, etc.

Software systems

Data Entry: this tool is used for entering GLOBE data by members into the GLOBE database from the GLOBE site.

Data Entry Apps: this tool enables entering GLOBE data from the field via mobile iOS and Android devices.

Email Data Entry: a tool for ingesting data from automated weather stations, other data centers, or user data entry forms via email.

Visualization: this capability is used to map, graph, filter and export data that has been measured across the GLOBE protocols since 1995.

Workshop: this tool is used for administrating and managing GLOBE workshops (registrations, credits, etc.)

Liferay system: Customizable Off-the-Shelf Content Management System that serves as the foundation for the GLOBE and GLOBE Observer Websites.

eTraining: provides online supplemental modules for teachers and scientists to review, train, or introduce GLOBE material.

Honor Roll: a way to recognize the data contributions of GLOBE students and schools.

Metrics and Reporting: Tools to provide users with metrics on data entry and system usage.

Photo System: a tool for uploading users' images and processing them.

System Databases – contains user and web content information, as well as GLOBE scientific data measurements and materialized views.

Ruby on Rails Database: storing science and training data as well as users' records.

Collaboration Tool: support for GLOBE community collaboration including forums, commenting, shared document and image repositories, "friending", communities, blogs and member searching.

Advanced Data Access Tool: this tool is used to find and retrieve GLOBE data via different search parameters.
Content Management System: support for publishing content including web pages, news, events, features and other structured content
GLOBE Observer Mobile Apps – support for citizen scientists to take scientific measurements for a subset of the GLOBE science protocols (currently clouds, land cover, and mosquitos) via mobile iOS and android devices

Development, Staging and production Environments: Hosted on Amazon Cloud servers, managed by NASA/GSFC
Back up system: Hosted on Amazon Cloud servers, managed by NASA/GSFC.

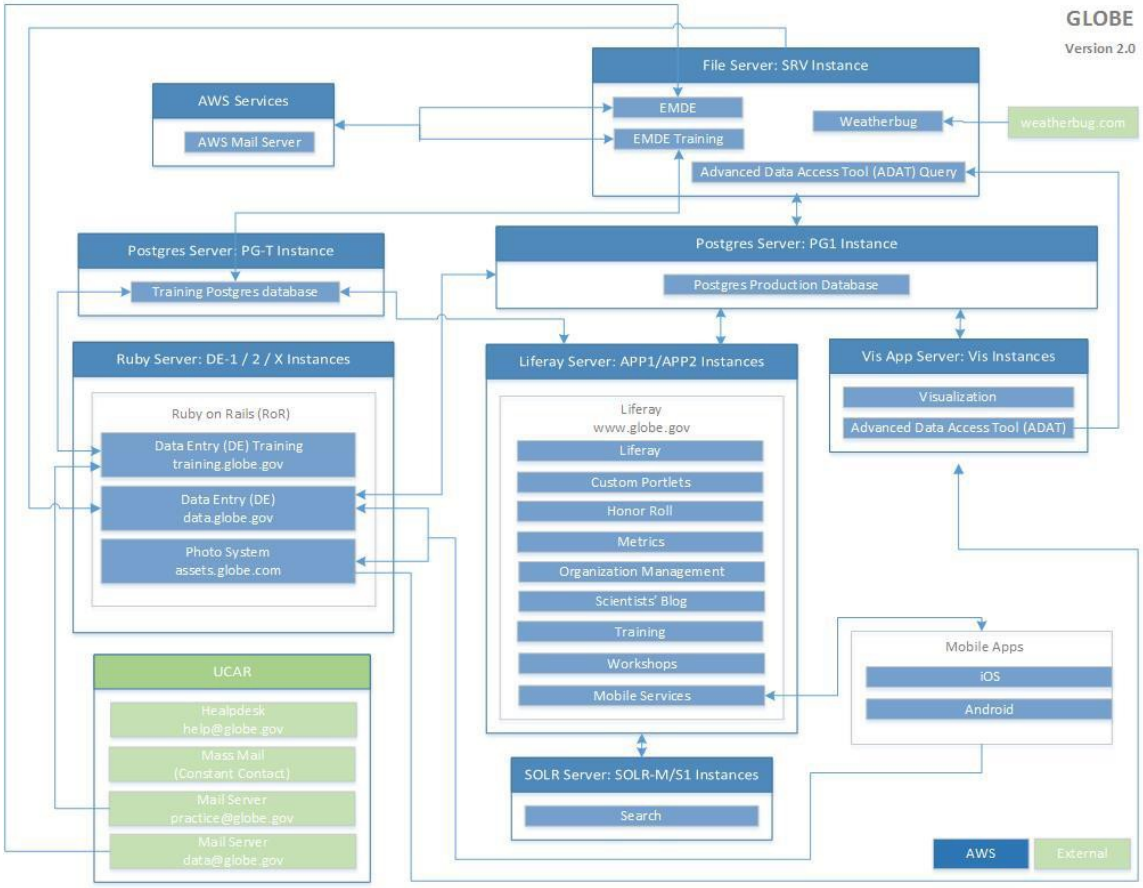



FIGURE 2: GLOBE DIS Subsystems (c. 2016).

GLOBE's Science Areas: GLOBE's Science data protocols and educational materials span atmosphere, biosphere, hydrosphere, soil (pedosphere), and Earth as a System scientific areas. For more information regarding GLOBE's data protocols please see GLOBE's Teachers Guide available here: http://www.globe.gov/do-globe/globe-teachers-guide.
GLOBE Community: The GLOBE Program has a rich community of students, teachers, scientists, trainers, country coordinators, citizen scientists, and alumni across the world. In terms of technology, the community spans both high- and low-end users. There are 121 participating countries as of January 2019 from six regions: Africa, Asia and Pacific, Europe and Eurasia, Latin America and Caribbean, Near East and North Africa, and North America. Each country

has a Country Coordinator and a support team; the Country Coordinator works with the GIO and the respective GLOBE Regional Office to coordinate and implement GLOBE in their countries. To learn more about the GLOBE community please visit: http://www.globe.gov/globe-community.

Summary of work –
The contractor shall support the Science Data Systems Branch by providing software and system engineering services to smoothly transition, operate, maintain, enhance, verify, test, and backup GLOBE's Data and Information System (DIS), as outlined in previous sections, for the GLOBE program. This Task is compromised of the following subtasks, which will be described in the next sections.
subtask 6004.1: GLOBE DIS Operations, Sustaining Engineering, and Community Support.
subtask 6004.2: GLOBE Science Advisor Support.
subtask 6004.3: GLOBE Citizen Science Support.
subtask 6004.4: GLOBE Citizen Science Supplemental Support
subtask 6004.5: Data Management Standards for Citizen Science inputs to the GLOBE DIS (completed 3/31/2018)

Required skills/knowledge - System Engineering, System Administration (Amazon Web Services/Cloud Computing), Database development and administration (Ruby on Rails, Postgres, Elasticsearch), Software Engineering (Ruby on Rails, Perl, Java/Javascript), Project management, Web Design, User Interface design, Content Management (i.e. Liferay) , Data System Engineering, data ingest, data visualization, mobile application development (iOS and Android), software testers, GLOBE-trained DIS expert, and GLOBE scientist (knowledge and experience with GLOBE science data, protocols and tools), and proficiency in team work, international collaboration, and customer service.

## Period of Performance

The period during which the work for this task shall be performed is from April 1, 2016 to March 31, 2020.

## Subtask Description

Subtask 1: GLOBE DIS Operations, Sustaining Engineering, and Community Support.
The contractor shall support NASA/GSFC with operations and sustaining engineering of the GLOBE DIS as well as supporting GLOBE's international community regarding GLOBE DIS matters. The SES II contractors shall operate the GLOBE DIS system from no later than April 1, 2016. Due to GLOBE's international nature, its high number of users, high volume of public data and the need for the website's availability to users 24/7, the DIS is hosted by a commercial data center and service provider.
Maximum allowable downtime for the GLOBE site services is one day per year.
Maximum allowable data loss for the GLOBE site is the amount of data that is entered in one day, during a one year period.
The GLOBE DIS shall adhere to NASA mandates and policies for software, websites, and data systems.

# SES II Task Order SOWs

The system engineering activities include gathering GLOBE requirements, requirements analysis, data system architecture, database architecture, database management and operations, content management, system design and development, user interface design and development, mobile app development, data analysis and visualization, configuration management, user registration, software and system level testing, privacy and security. The key functions of the system include:
Content and User Management
Database Architecture and Data Ingest
Visualization
Data Entry System
Email Data Entry System
Workshop
Collaboration Tool
Collaboration Social Networking Capabilities
Reporting and Metrics
Awards and Recognition (Honor Roll)
eLearning system
Data Entry Apps (iOS and Android)
GLOBE Observer (GO) Citizen Science App (iOS and Android)
Advanced Data Access Tool (ADAT)
Photo System
Sustaining Engineering for all GLOBE Components

The contractor shall support sustaining engineering activities for the smooth transition, operation, and backup of the GLOBE DIS throughout the performance period of this task. Sustaining engineering shall include gathering, documenting, and developing new DIS requirements from GLOBE users' feedback, Technology Working Group, GLOBE sponsors and supporters (NASA, NSF, NOAA, and State Department), and in collaboration with NASA/GSFC, as well as improving the configuration and settings of the DIS development, hosting and backup environments for a better international user experience of the GLOBE Site.
Database administration and development expertise are required for maintenance and sustaining engineering of the GLOBE DIS database (Postgres) and data entry forms and their functionalities (Ruby on Rails).

The contractor shall operate and maintain a backup system for GLOBE's DIS. The backup should be maintained and be recoverable in case of GLOBE DIS Site outages that could not be remedied by service providers for the GLOBE DIS in a timely manner.
Maximum allowable downtime for the GLOBE backup system is one day per year.
Maximum allowable data loss for the GLOBE backup system is the amount of data that is entered in one day, during a one year period.
The backup system shall adhere to NASA mandates and policies for software, websites, and data systems.

The contractor shall provide and maintain up-to-date documentation for all GLOBE DIS

subsystems describing its hosting and backup environments and architecture, design, (sub)systems, interfaces, data flow, operations, maintenance, security plan, configuration management plan, and associated limitations and risks.
The contractor shall test functionality and performance of the GLOBE website, database, tools, and applications prior to release for operations. The contractor shall also assess compatibility of the GLOBE DIS Web services on different platforms (e.g. Windows, Mac) and browsers (e.g. Firefox, IE, Chrome, Safari) as well as tablets (e.g. iPads) and mobile devices when applicable (e.g. iOS and Android devices).
The contractor shall gather requirements, define, plan, and implement necessary DIS bug fixes and enhancements based on established DIS priorities agreed upon among the following parties: (DIS priorities are usually decided as a result of periodic DIS reviews, Technology Working Group meetings, and weekly DIS status meetings.)
GLOBE Program manager
Recommendations of GLOBE's Chief Science Adviser (please see description in the next subtask)
User community feedback: gathered from GLOBE working group meetings, annual meeting sessions, workshops, community feedback sessions, and GIO help desk reports.
GLOBE DIS Testers' findings and assessments
GLOBE DIS project manager's guidance
GLOBE DIS priorities and available resources.

It is essential that the team performing this task either gain or have GLOBE training for entering data and performing analysis using GLOBE data, in order to test, maintain, and improve the GLOBE website for GLOBE users (e.g. teachers, trainers, students, and scientists, and individual citizens).

At least two individuals of the DIS team need to be GLOBE trained and able to support and lead DIS training sessions for the GLOBE community. This includes attending various GLOBE regional meetings, GLOBE annual meetings, supporting GIO's DIS requests based on community communications through Working Groups, GIO's helpdesk, and site forums, and being familiar with specific GLOBE DIS limitations and requirements of different GLOBE regions and user groups.

Subtask 2: GLOBE Science Advisor Support:
GLOBE's Chief Science Adviser shall be an experienced internationally recognized Earth Scientist, who has knowledge of and experience with GLOBE's applications, services, community, and scientific objectives. GLOBE's Chief Science Adviser will gather, review, and help define and test various requirements for GLOBE's DIS. These requirements include criteria and approaches for entering, validating, archiving, accessing, and visualizing GLOBE community measurements of in-situ surface weather, hydrology, climate, phenology, land cover, and soil characteristics among others. The Chief Science Adviser shall attend GLOBE Science Working Group meetings, GLOBE DIS meetings, and GLOBE annual meetings in order to perform the above-mentioned duties and help develop GLOBE DIS requirements.
Subtask 3: GLOBE Citizen Science Support
April 22, Earth Day, 2015, marked the GLOBE Program's 20th anniversary. The GLOBE program manager at NASA HQ as well as the GIO provided their GLOBE@20 initiatives to GSFC. From the

overall GLOBE@20 plan, the citizen science element had the most direct relation/impact to the DIS. Since the inception of this task in April, 2016, a Citizen Science App for GLOBE entitled "GLOBE Observer" or abbreviated "GO" was developed for both iOS and Android devices. The App currently contains the capability to collect data for three science protocols: Clouds, Land Cover, and Mosquito Habitats.

The contractor shall support NASA CAN Grant awardees to further operate and develop this capability. Relevant awardees include the NASA Earth Science Education Collaborative (NESEC; Ms. Holli Riebeek Kohl, POC), which leads the citizen science portion of GLOBE and directs the associated GLOBE Observer website, and the GLOBE Mission Earth (GME, Dr. Kevin Czajkowski, PI) project, designed to improve STEM education by fusing GLOBE with NASA assets and increasing the participation of students and citizens in the GLOBE program

The GLOBE Observer App and its data collection components (i.e., Clouds, Land Cover, and Mosquito Habitat Mapper) will continue to be updated under this task. The vision for GLOBE Observer is to contain different Citizen Science Apps for various GLOBE protocols. The SES II DIS team under this task shall operate, maintain and provide bug fixes and updates for these Apps as necessary (at the time of this SOW update, GLOBE Observer contains the Cloud App, Land Cover App, and the Mosquito Habitat Mapper). Planned updates include a more interactive and usable cloud training module, an improved user communication and alerts module, and mechanisms to support user IDs and user recognition. The contractors shall also support integration of at least one additional citizen science apps for GLOBE Observer during this task's period of performance (e.g. Biometry/Tree Height and Fire Fuels).

Furthermore, the contractor shall support partnerships with organizations that develop GLOBE citizen science apps for other GLOBE protocols (e.g. soil moisture, hydrology, atmosphere, etc) as these partnerships are identified by the GLOBE Program Manager, GLOBE Science Adviser, NESEC GLOBE Observer lead and approved by the GLOBE DIS Task Monitor. In particular, a few of these possible future partnerships are, Albedo and Water Quality Apps, as well as Apps supporting modified protocol and precipitation protocols. The GLOBE DIS team shall help define DIS requirements for development of those Apps and support their integration and release as part of the GLOBE Observer App for both Android and iOS devices. The contractor shall also develop and maintain an interface for these Apps to communicate with the GLOBE (citizen science) database.

Subtask 6004.4: GLOBE Citizen Science Supplemental Support

The required work supplements subtask 3, the core production of the GLOBE Data and Information System's technology infrastructure needed to expand the GLOBE Program to non-member audiences (i.e. Citizen Scientists). This subtask includes GLOBE DIS work in support of GLOBE Citizen Science projects under NESEC. In particular, work includes optimization of the data visualization tools to fully engage GLOBE's citizen scientists, integration with social media tools to make GLOBE available where non-member GLOBE citizen scientists already are, more robust mobile app development to make it easy for citizen scientists to make observations and submit data to GLOBE, and communication leadership and graphics support to improve communication with new audiences. These additions are intended to make the user experience engaging by meeting the needs of the GLOBE program's much broader new citizen science audience.

# SES II Task Order SOWs

Mobile app developments under this subtask consist of improvements and additions to the GLOBE Observer App developed under subtask 3. In particular, at least one citizen science App will be developed and integrated with GLOBE Observer app and the existing Apps' capabilities will be enhanced.

Additional work in this subtask will improve the technical approach for citizen science by preparing the existing GLOBE database for significant growth, developing a framework for future app development, and improving the data visualization tool to handle more data. This additional work is necessary to accommodate the growth anticipated from the audience expansion in an efficient and cost-effective manner. (NOTE: This work is scheduled for completion by the end date for MOD 3.)

Work under this subtask for CY 3 onward consists primarily of maintenance and sustainment of the citizen science Apps and GLOBE Observer website. In addition, database performance tuning, and mechanisms (e.g., APIs) to support the increase of data supplied by citizen science users, as well as the ability to extract data from the GLOBE database for further processing outside of the GLOBE system will be developed. The metadata standards recommended as a result of MOD 3, Subtask 5 of this SOW (completed 3/31/2018) shall be implemented where applicable.

Subtask 6004.5: Data Management Standards for Citizen Science inputs to the GLOBE DIS (NOTE: This subtask completed 3/31/18 and is not being extended under MOD 6)

In April 2016, the Earth Science Division in the Science Mission Directorate of NASA HQ published a call for proposals under Research Opportunities in Space and Earth Sciences (ROSES) 2016. Shown as Appendix A.47, this call is titled "Citizen Science for Earth Systems Program". The purpose of this program is to develop and implement capabilities to harness voluntary contributions from members of the general public to advance understanding of the Earth as a system. The program complements NASA's capability of observing the Earth globally from space, air, land, and water by engaging the public in NASA's mission to "drive advances in science, technology, aeronautics, space exploration, economic vitality, and stewardship of the Earth". The program aims to advance the use of citizen science in scientific research about the Earth by directly supporting citizen science activities, as well as by deploying technology to further citizen science research. This solicitation seeks two types of proposals - citizen science research and low cost sensor deployment for the collection of well-calibrated citizen science data. The awards are expected to be made through cooperative agreements in two phases – first, a prototyping phase lasting 8 months and second, an implementation phase of 3 years.

The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process, and contribute meaningfully to our understanding of the Earth system and global environment. Announced by the U.S. Government on Earth Day in 1994, GLOBE launched its worldwide implementation in 1995. The GLOBE Program has now been active for over 20 years. The data gathered by the participants in this program are archived and distributed by the GLOBE Data and Information System (GLOBE DIS). Recently, the GLOBE DIS has started to support citizen science/

crowdsourcing data as well. It is anticipated that the data resulting from the selected for full implementation of the Citizen Science for Earth Systems Program will be archived in GLOBE DIS, following a successful peer review of data quality. These data will need to be openly available to users according to NASA's Earth Science Data and Information Policy.

The purpose of this subtask is to develop a white paper documenting earth science data management standards and best practices for citizen scientists and make recommendations for GLOBE DIS citizen science data archive and access accordingly. The recommendations will be presented to and reviewed by GLOBE Program manager, science adviser, [redacted] GLOBE DIS project manager at GSFC. The standards and recommendations will then be finalized in the white paper. Moving forward, the white paper will serve as guidelines for exemplary Earth science data and information system for citizen science, particularly for projects selected for full implementation of the above-mentioned ROSES solicitation. It is expected that by following the standards and best practices outlined in the white paper, the projects will be able to provide the data to GLOBE DIS in a consistent manner, which will facilitate use of the data by a broad user community.

## Deliverables/Schedules/Milestones

NOTE: In some cases, references numbers in the following tables may be skipped (e.g., going from 5 to 7. This indicates that a deliverable was satisfied under a previous contract mod. To maintain consistency between mods, original reference numbers for ongoing deliverables have been retained.)

Subtask 6004.1

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | DIS Operations Status Reports | Weekly |
| 2 | DIS enhancements and sustaining engineering Status Report | Weekly |
| 3 | Performance and Financial Reports | Monthly |
| 4 | Updated system/subsystem documentation to include, but not limited to GLOBE System Architecture document, GLOBE Disaster Recovery Plan, , software architecture, software and configuration management, security plan, and mobile data entry API. | Twice a year |
| 5 | Push bug fixes on all subsystems to production based on help desk reports from GIO and established DIS priorities | Monthly |
| 6 | | |
| 7 | Release at least one enhancement to the visualization system based on established DIS priorities (adding data layers, more analysis capabilities, etc) | Quarterly |
| 8 | Release at least one enhancement to the data entry system based on established DIS priorities (adding new data protocols, enhancing existing protocols, migrating data entry capability to GLOBE Observer App, etc) | Quarterly |

| | | |
|---|---|---|
| 9 | Release enhancements to the workshop system | Twice a year |
| 10 | Release at least one enhancement to the Advanced Data Access Tool (ADAT) (e.g. performance improvement, extraction of additional measurement attributes such as site ID and user ID ) | Quarterly |
| 11 | Release updates to the Photo System (e.g., image gallery) | Twice a year |
| 12 | Release updates to the Collaboration tool | Twice a year |
| 13 | Release at least two updates/enhancements to Liferay system (portlets, frontend, etc.) | Quarterly |
| | | |
| 16 | Have at least one representative attend GLOBE DIS Reviews (Virtual meeting and possibly once a year in-person) | Triennially |
| 17 | Have one representative attend Technology Working Group Meetings (Virtual meetings) | monthly |
| 18 | Provide DIS Support for GLOBE partnerships with NASA satellite missions such as SMAP, ICESat-2, and CloudSat | As directed by TM and GLOBE program manager |
| 19 | Release updates to the database system to improve performance and/or improve logging and analysis capabilities and/or support system revisions (e.g., renaming of old photos using new naming convention, DV view modifications, etc.) (e.g., present a trade of candidate technologies to revise the GLOBE database architecture and thus improve performance (e.g., database messaging system); test and implement improved logging and analysis capability) | Quarterly |
| 20 | provide communications direction for GLOBE (e.g., average of 15 posts to Facebook and Twitter monthly) | Monthly |
| 21 | End-of-task Report | End of task |

Subtask 6004.2

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Performance and Financial Reports | Monthly |
| 2 | Help define requirements, review and test enhancements to the visualization system | Monthly |
| 3 | Help define requirements, review and test enhancements to the data entry system | Monthly |
| 5 | Help define requirements, review and test enhancements to the GLOBE Observer Citizen Science Mobile App for iOS and Android devices | Monthly |

| | | |
|---|---|---|
| 6 | Help define requirements, review and test enhancements to the Advanced Data Access Tool (ADAT) | Quarterly |
| 7 | Help define requirements, review and test enhancements to the Photo System | Quarterly |
| 8 | Attend Science Working Group Meetings and Communicate their DIS requirements to the team(Virtual Meetings) | Bi-monthly |
| 9 | End-of-task Report | End of task |

Subtask 6004.3

# SES II Task Order SOWs

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | GLOBE Observer's Operations Status Reports | Weekly |
| 2 | Citizen Science enhancements and sustaining engineering Status Report | Weekly |
| 3 | Performance and Financial Reports | Monthly |
| 4 | Updated documentation on GLOBE Observer App and API | Twice a year |
| 5 | Release updates to GLOBE Observer's App for iOS and Android (bug fixes and enhancements, e.g. manage password expirations, ability to send notifications through the app, updates/improvements to user "help") | Twice a year |
| 6 | Develop (database, app, interface, and data visualization capability), integrate with GLOBE Observer, and release two citizen science apps for two distinct GLOBE data protocols to result in new GLOBE Observer releases for iOS and Android.<br>Note: Fire Fuels and Eclipse re-release are planned) | March 31, 2020 |
| 7 | Update GLOBE's Citizen Science subsite | Quarterly |
| 9 | Release one enhancement to GLOBE's citizen science data visualization | Quarterly |
| 10 | Release one enhancement to GLOBE's citizen science database | Quarterly |
| 12 | maintain and update Mission Earth Subsite as part of the Mission Earth project of Dr. Kevin Czajkowski | March 31, 2020 |
| 15 | Support Mission Earth PI, Dr. Kevin Czajkowski by implementing GLOBE DIS requirements of his Mission Earth project (e.g., development of new protocol with associated data entry, storage, and visualization components) . | March 31, 2020 |
| 19 | Investigate options and develop a discussion board capability on the GLOBE Observer website for citizen scientists | March 31, 2020 |
| 20 | Provide updates/enhancements to core GLOBE Observer app capabilities to increase personalization, recognition, and collaboration among citizen scientists (e.g., integrated recognition system, integrated avatar system) | March 31, 2020 |
| 21 | Provide communications direction for GLOBE Observer and support the preparation for and broadcast of four Facebook Live Events | March 31, 2020 |
| 22 | Update "clouds" training in GLOBE Observer App to be interactive and to improve usability based on evaluation results from years 1-2 | September 30, 2019 |
| 23 | Build mechanisms to support user IDs within GLOBE Observer | March 31, 2020 |
| 24 | Integrate recognition system for "clouds" within GLOBE Observer | March 31, 2020 |

| | | |
|---|---|---|
| 25 | Create/Enhance a mechanism for regular communication and alerts issued via the GLOBE Observer App (e.g., requests for data observations from a specified area, i.e., "geofence" concept) | March 31, 2020 |
| 26 | Develop and implement a system that automates the photo approval process and "buckets" photos based on categories (e.g., flagged (contains inappropriate content, faces, text, etc.), questionable, acceptable) and facilitates science review of photos. | March 31, 2020 |
| 27 | Implement the ability to query the GLOBE database and return all/subset of the observations submitted by a specified user/users for both API-out and ADAT. | March 31, 2020 |
| 28 | Design, test, and utilize automated test scripts for standard GLOBE Observer inputs for all GLOBE Observer protocol modules (e.g., Clouds, Land Cover, etc.) and supporting infrastructure (settings, notifications, etc.) using an open source commercial framework such as Appium. | March 31, 2020 |
| 28 | End-of-task Report | End of task |

Subtask 6004.4

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Performance and Financial Reports | Monthly |
| 14 | Provide enhancements, maintenance and bug fixes for existing "data in" API and documented instructions | Ongoing |
| 15 | Provide enhancements maintenance and bug fixes for existing GLOBE "data out" API and documented instructions | Ongoing |
| 16 | Provide maintenance and bug fixes for existing GLOBE Observer website and GO App framework based on help desk reports and established priorities (includes graphical enhancements) | Ongoing |
| 17 | Provide enhancements to GO app framework (e.g., integration of GLOBE data entry forms with GO app) based on established priorities | At least twice per year |
| 18 | End of Task Report | End of subtask 4 |

Subtask 6004.5 (NOTE: This subtask completed 3/31/2018)

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Performance and Financial Reports | Monthly |
| 2 | White paper titled Data Management Standards and Best Practices for Citizen Science for Earth Systems Program | March 31, 2018 |

# SES II Task Order SOWs

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. Staff will be a mix of technical task lead with work breakdown structure (WBS) & scheduling experience, senior and junior system engineers, programmers (Java, Javascript, Ruby on Rails), database engineers (Postgress), testers, software engineers, data analysts, data visualization engineers, mobile app developers, and requirements engineers.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

Appropriate IT devices to support the analyses, specification development, and report development are required. It shall be the contractor's responsibility to provide and set up local workstations and network connections at the contractor's off-site facilities as required, and to install any required tools and utilities on the contractor's equipment.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

### Performance Metrics

The work performed for this task will be evaluated by the TM based on the technical merit. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW. Performance metrics include:

- Actual Milestone Progress vs Planned/Scheduled
- Actual vs Planned Costs
- Quality of Technical Performance
- Contractor Communication
- Personnel Management

### Government Furnished Facilities, Equipment, Software and Other Resources

DIS DNS services are provided by NASA Goddard. Some software may be provided by the NASA Grantees to GLOBE DIS for integration (e.g. new citizen science apps).

### Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:

NPR 7120.5E NASA Space Flight Program and Project Management Requirements
NPR 7123.B NASA Systems Engineering Processes and Requirements
GPR 7120.99 Goddard Project Management

# SES II Task Order SOWs

GPR 7120.5A Goddard Systems Engineering
GPR 7150.4 Goddard Software Engineering Requirements

## ODC (Travel and Procurement)

| Location | Duration | Dates |
|---|---|---|
| Hardware and software for subtask 1: data center service fees for development, staging, production, and backup environments, DNS charges, as well as renewal of the vmWare and eLearning licenses | 12 months | April 1, 2019 to March 31, 2020 |
| Software for subtask 1: Liferay License renewal | 12 months | March, 2020 |
| Travel for subtask 1: GLOBE Asia/Pacific Regional Meeting in Seoul, Korea, 1 person | 6 days | May, 2019 |
| Travel for subtask 1: GLOBE Africa Regional Meeting in Antananarivo, Madagascar, 1 person | 7 days | April, 2019 |
| Travel for subtask 1: GLOBE Regional Meeting, Detroit, MI, 3 people | 8 days | July, 2019 |
| Travel for subtask 1: GLOBE Latin America Regional Meeting in Natal, Brazil, 1 person | 6 days | September, 2019 |
| Travel for subtask 1: DIS Review at GSFC, 2 people | 4 days | May, 2019 |
| Travel for subtask 1: GLOBE Near East and North Africa Regional Meeting in Kuwait City, Kuwait, 1 person | 7 days | December, 2019 |
| Travel for subtask 1: GLOBE Europe Regional Meeting in Trieste, Italy, 1 person | 7 days | October, 2019 |
| Travel for subtask 1: Amazon re:Invent 2018 Conference in Las Vegas, NV, 2 people | 7 days | December, 2019 |
| Travel for subtask 1: Citizen Science Association Conference in Location TBD, 1 person | 6 days | March, 2020 |
| Travel for subtask 1: GLOBE North American Regional Meeting in Berkeley,CA, 1 person | 6 days | September, 2019 |
| Travel for subtask 1: American Geophysical Union Conference, San Francisco, CA, 1 person | 5 days | December, 2019 |
| Travel for subtask 2: GLOBE Annual Meeting, Detroit, MI, 1 person | 8 days | July, 2019 |
| Travel for subtask 2: North American Association for Environmental Education (NAAEE) Conference in Lexington, KY, 1 person | 5 days | October, 2019 |
| Travel for subtask 2: Citizen Science Association Conference in Location TBD 1 person | 7 days | March, 2020 |
| Travel for subtask 2: American Geophysical Union Conference, San Francisco, CA, 1 person | 5 days | December, 2019 |
| Travel for subtask 3: Facebook Live Event in Wallops, VA, 1 person | 3 days | April, 2019 |

| | | |
|---|---|---|
| Travel for subtask 3: Facebook Live Event in Omaha, NB, 1 person | 4 days | June, 2019 |
| Travel for subtask 3: Facebook Live Event in Boulder, CO, 1 person | 3 days | September, 2019 |
| Travel for subtask 3: Facebook Live Event in Langley, VA, 1 person | 3 days | October, 2019 |

## Work Location

This work shall be performed primarily at the contractor's facility (Off-site), but the contractor may be required to perform some work at the Goddard Space Flight Center (On-site).

## Reporting Requirements

### Weekly or Bi-weekly status report

The contractor shall generate Performance Reports every week. The report shall include, as a minimum, a summary of the week's GLOBE DIS Operations status, DIS highlights/accomplishments, milestones/schedule/deliverables, risks and customer meetings.

### Monthly performance report

The contractor shall provide monthly technical and schedule progress reporting to adequately describe the activities of the contractor team to the TM. The contractor shall provide monthly cost reporting in accordance with the WBS. The contractor, including subcontractors, shall be available to attend monthly status meetings.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will not be handling of classified data.

## Data Rights

This SOW shall adhere to all Data Rights Clauses as stated in the SES II contract.

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2B NASA Software Engineering Requirements
GPR 7150.1 Goddard Software Engineering Requirements

## References

http://www.globe.gov
"GLOBE Impact Around the World" site: http://www.globe.gov/about-globe/metrics/impact

# SES II Task Order SOWs

"GLOBE Site Analysis and Recommendations", January 2011, 514-EED-001 prepared under contract NNG10HP02C.
Code 580 SES I Contract NNG10HP02C , Task Orders 6002 and 6005.
Code 580 SES II Contract NNG15CR67C SOW.
"GLOBE Website Site Modification Requirements, documenting Discussions and Policy Decisions", prepared by RWS under contract NNG10CR25C, Task # 6002, version 1.5, 11/30/2012
NASA's "Research Opportunities in Space and Earth Science (ROSES) 2013" (NNH13ZDA001N) Proposal call titled "GLOBE Implementation Office".
NPR 7150.2A NASA Software Engineering Requirements, available via http://nodis3.gsfc.nasa.gov
GPR 7150 Goddard Software Engineering Requirements, available via http://software.gsfc.nasa.gov

## 6005 WFIRST WFSC Software Systems Engineering Support

Date: 03/04/2019
Task Monitor (TM): Alden Jurling/Code 551
Contract number: NNG15CR67C
Contract SOW Reference: 4.6 Science Systems

### Scope

Background – The WFIRST mission will study essential questions in the areas of dark energy, exoplanets and perform a high latitude survey. Launch is planned for 2025.
Science Objectives
The Wide Field Infrared Survey Telescope (WFIRST) is a NASA observatory designed to perform Wide Field imaging and surveys of the near infrared (NIR) sky. The current design of the mission makes use of an existing 2.4m telescope, which is the same size as the Hubble Space Telescope.
WFIRST is the top-ranked large space mission in the New Worlds, New Horizon Decadal Survey of Astronomy and Astrophysics. The Wide Field Instrument will provide a field of view of the sky that is 100 times larger than images provided by HST. The coronagraph (JPL) will enable astronomers to detect and measure properties of planets in other solar systems.

Summary of work
Develop graphical interfaces to existing WFSC tools and develop interactive analysis workflows for analysis and control tasks
First portion of this will be development of graphical “solution viewer” tool
Perform maintenance and continued development of existing display and analysis libraries, particularly software centric support areas
Develop and implement continuous integration (CI) testing strategy for WFSC software suite
Recommend approach for automated GUI testing in WFSC software and evaluate available commercial and open source options
Orchestrate packaging and deployment of WFSC software tool suites into laboratory and I&T environments as needed
Advise WFSC team as needed on software architecture and system design as needed
Prepare software design and user documentation on new and existing systems as needed
Prepare software development documentation, schedules and status as directed

Required skills/knowledge – Mission Development Experience required.

Specialized Skills: At least 5 years Software Development and Engineering Experience, prefer at least 10 years of software development experience. Knowledge of satellite integration and test flow, ground support and science data processing systems development or test experience is required. Working knowledge of modern software development process and practices is required. Knowledge of satellite telemetry and command creation, configuration management and use is required. Knowledge of Mission development phases is required. Knowledge of Python programming, GUI development, Object Oriented Design, automated software testing and continuous integration if preferred.

## Period of Performance

The period during which the work for this task shall be performed is from task award thru 03/31/2020.

## Subtask Description

Not Applicable

## Deliverables/Schedules/Milestones

At a minimum, the contractor shall deliver the items specified below:

| Ref# | Deliverables | Due Date |
|---|---|---|
| 1 | Status Reports | Weekly/Bi-weekly |
| 2 | Performance Reports | Monthly |
| 3 | End-of-task Report | End of task |
| 4 | Report on recommended CI strategy for WFSC | 2019-08 |
| 5 | Prototype version of solution viewer tool | 2019-10 |

## Management Approach

### Staff Allocation, Expertise, and Skill Mix

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work.

### Configuration Management

Systems and documents will be covered under the Project Configuration Management Plan.

### Facilities

The contractor shall reside offsite however the contractor will be required to perform duties onsite at regular intervals. For any onsite work the project will provide appropriate IT support.

### Risk Management and Best Practices

The contractor shall manage schedule, cost, and technical risk through monitoring and reporting of progress and performance metrics, identifying issues well in advance of negative consequences, recommending corrective action to the TM, and implementing corrective actions with the compliance of the TM.

Performance Metrics

The TM, based on the technical merit, will evaluate the work performed for this task. The TM shall develop detailed performance metrics that shall reflect the contractor's performance in meeting research analysis, specific mission requirements, deliverables and delivery schedule, and the contractor's cost. Technical evaluation of the task performance is a subjective combination of performance metrics, technical quality of deliverables, cost control, significant events, innovations and meeting requirements set forth in the SOW.
Performance metrics will be:
Number of peer reviews attended versus not attended
Action Item metrics (pertains to only those actions assigned to the contractor)
Number of actions open, closed, and planned versus actual duration to close

Government Furnished Facilities, Equipment, Software and Other Resources

The Government will provide account and passwords to government-furnished workstations where existing versions of various relevant software packages shall be maintained. It shall be the contractor's responsibility to complete any GSFC required security-related training courses.

Quality Assurance Requirements

The contractor providing technical services shall comply with all CMMI Level 2 processes established for the Project and deliverable products. Applicable requirements include, but not limited to:
NPR 7120.5D NASA Space Flight Program and Project Management Requirements
NPR 7123.1A NASA Systems Engineering Processes and Requirements
GPR 7120.1C Project Management
GPR 7120.5A Systems Engineering

## ODC (Travel and Procurement)

Travel will be required for engineering support task activities as directed by the Project. Assume 6 trips per 12 months to GSFC Greenbelt, MD with each trip having one week duration.

## Work Location

The majority of the work can be performed off site. Some of this work shall be performed on-site at the Goddard Space Flight Center, It is expected that the contractor shall travel to GSFC anywhere from 4 to 6 times a year for technical meetings, attend reviews and face to face meetings with the other team-members.

## Reporting Requirements

Weekly status report

The contractor shall participate in the Wavefront Sensing and Control Team's weekly meeting as required. The contractor shall report, as a minimum, a summary of the weeks highlights/accomplishments, milestones/schedule/deliverables, risks, action item status.

## Security Requirements

The contractor shall comply with Information Technology Security procedures and requirements as defined by NPG 2810.1A in the performance of this task. In addition, the contractor shall comply with all applicable federal rules and regulations and agency directives.

There will be no handling of classified data.

## Data Rights

This SOW shall adhere to the following Data Rights clause, as stated in this contract: "the default Data Rights clause under this contract is FAR 52.227-14 RIGHTS IN DATA-GENERAL as modified by NASA FAR Supplement 1852.227-14-Alternate II and Alternate III and GSFC 52.227-90. Any exceptions to this clause will be covered by FAR 52.227-17 RIGHTS IN DATA-SPECIAL WORKS as modified by NASA FAR Supplement 1852.227-17, and, if applicable, GSFC 52-227.93."

## Applicable Documents

In the performance of this task, the contractor shall comply with the following documents:
NPR 7150.2A NASA Software Engineering Requirements
GPR 7150 Goddard Software Engineering Requirements

## References

# 9998 Computer Security and System Administration (SA)

(Extracted from Section 2 of the SES II Contract)
The computer security and SA support under this element refers to support across multiple Divisions within the Engineering and Technology Directorate (ETD), Division specific support under this Core contract is stated. Division specific system administrative support supporting specific Projects and/or Division specific functions are located in the IDIQ section of the SOW.
The current ETD Information Technology (IT) environment contains the following services:

- _Splunk server, for consolidating log files
- _Windows Service Update Services (WSUS)
- _System Center Configuration Manager (SCCM)
- _Spacewalk Free & Open Source Systems Management Server
- _Red Hat Satellite server
- _Wiki services (i.e. confluence)
- _MacOS Patching Server
- _Kali Penetration Testing Server
- _Foundstone scanner
- _Symantec Endpoint Protection Server

## 2.1 Computer Security

The Contractor shall provide IT technical support to the ETD facilities and associated desktops as described below. The Contractor team shall work in concert with Division level IT managers and Division System Administration (SA) teams (not necessarily under this contract vehicle) supporting a wide array of efforts to ensure NASA, Center and Directorate level polices and best practices are adhered to, given the constraints of their requirements. ETD IT facilities support a variety of activities associated with NASA projects, from Mission conception to spacecraft/instrument operations. These activities include the development of high performance and cost effective solutions to the most challenging problems on flight missions ranging from suborbital projects—including balloons, sounding rockets, and airplanes—to interplanetary probes and flagship observatories. In addition, we acquire and distribute science data worldwide. Systems located in these facilities frequently contain sensitive International Traffic in Arms Regulation (ITAR) and Sensitive But Unclassified (SBU) data that shall be handled according to NASA regulations.

### 2.1.1 ETD/Code 500 Information System Security Officers (ISSO)

The Contractor shall employ individuals that shall serve as ETD/Code 500 Information System Security Officers (ISSO). Tasks for the ISSOs encompass all IT security-related initiatives such as leading the development, maintenance, and operations of system security plans for systems located within the Divisions, supporting the development of Directorate level policies and best practices checklists related to current and persistent IT security issues for Directorate System Administrator's (SA) use, and keeping abreast of current IT security related issues and mitigation processes.
The Contractor personnel in the ISSO roles shall hold a Top-Secret clearance to participate in Center level cyber security meetings. The Contractor personnel in the ISSO roles shall also hold (or have a

plan to hold within 6 months of being assigned to the position) a Certified Information Systems Security Professionals (CISSP) certification.
The ISSOs shall support the ETD IT as follows:

- _Interact and consult with Division level system administration teams to convey the understanding of how IT is used across the Directorate in support of institutional and Mission requirements.
- _Support the development of ETD procedures and lead trade studies to identify problems and recommend Directorate-wide solutions to the Computer Security Officials/IT managers in the technical areas of IT security as it relates to the IT environment within the Directorates.
- _Prepare and maintain security documentation for ETD IT Security Plan including: Risk Assessment, Security Plan, Contingency Plan, Data Flow Analysis, Network Diagram, Security Assessment and Authorization testing and Continuous Monitoring.
- _Maintain membership in IT working groups such as, Data Center Consolidation, System Administrators Working Group, Active Directory Working Group, the
Agency Security Configuration Standards (ASCS) Group, at the direction of the Directorate IT Manager.
- _Develop and maintain automated processes and procedures to streamline the continuous monitoring of ETD IT resources to ensure compliance with ETD, GSFC, Agency, and Federal mandates, policies and guidelines.
- _Prepare IT security policies and procedures to ensure consistency with NASA and GSFC guidelines. Security related IT best practices are shared with working level System Administrators.
- _Monitor and report statistics on lower organizational levels (Division/Branch) System Administrators adherence to Directorate level policies and procedures in a consistent manner. Report shall be presented to the Directorate and Division level IT managers via electronic delivery (e-mail), on a monthly basis.
- _Provide vulnerability scanning reports for all ETD devices to the Division level SA teams on a monthly basis, one week following the Center scan and in accordance with an approved Code 700 format. Provide SAs with proper procedures to correct all vulnerabilities. Support Division level SA teams by researching solutions working within Center resources, if the vulnerability is discovered across multiple Divisions.
- _Resolve of all IT Security Incidents in ETD and work with the Government Directorate and Division Computer Security Official (CSO) to bring issues to conclusion.
- _Complete all necessary incident reports and vulnerability scans within 10 calendar days of an incident with the support of the Division SA team.
- _Process all IT related waivers for ETD Divisions: Review waivers for compliance with GSFC/ NASA policies and IT security Standard Operating Procedures (SOPs). Support the Division level SA teams in researching other possible secure solutions.
- _Develops scripts and other support applications, supporting high-level reporting and system patching.

The Contractor team shall have working knowledge of system and security administration for Windows, Macintosh, Linux, and UNIX systems for desktops, workstations and servers. It is required that the Contractor be familiar with web technologies including deployment, hosting, and management. The Contractor team shall also have experience administering systems running typical Engineering software applications (i.e. ProEngineer, MathCAD, etc) and maintaining firewalls. The Contractor shall have working knowledge of the GSFC IT security environment and be up-to-date on current IT security related issues and mitigation.

2.1.2 Division Lead System Administrator (SA) and Alternate Computer Security Official (ACSO) for the Mechanical Systems Division (Code 540), Instrument Systems and Technology Division (Code 550), Electrical Engineering Division (Code 560), Software Engineering Division (Code 580), and the Mission Engineering and Systems Analysis Division (Code 590)

The Division Lead SA serves as the Team Lead for the Division team(s) of System Administrators (potentially on different contract vehicles) in support of a large enterprise environment supporting infrastructure and Project specific customers, primarily reporting the Government Division IT Manager (referred to as the Division IT manager) of the Divisionassigned to. The Division Lead SA shall have the ability to solve problems quickly and completely; the ability to identify tasks which should be automated and then write tools to automate them; possess a working knowledge across all of the Windows/Linux/Mac/Unix based operating systems: understand the concepts of paging and swapping, inter-process communication, devices and device drivers; and shall be able to perform system analysis and tuning. The Division Lead SA is also considered to be part of the Division SA team, closing the more complex support tickets.

The Division Lead SA shall also possess a solid understanding of networking/distributed computing environments, understanding the principals of routing, web application programming, and the design of consistent network-wide file systems. The Lead SA shall have experience in the installation and administration of Windows Active Directory (AD), be knowledgeable in Group Policy objects, Microsoft IIS, and Windows Server Update Service (WSUS), Storage Area Network (SAN) environments, databases and Virtual Servers.

Each ETD's Division Government Computer Security Official (CSO) shall determine the policies to ensure sound IT security procedures for their respective Division; the ACSOs have the responsibility to ensure that the system administrators carry out these policies and procedures. The ACSOs shall complete assignments of various projects and policies dictated by NASA, the GSFC and the ETD Directorate.

The ACSOs shall perform all tasks of the Division CSO when the CSO is not available. When serving as CSO in the absence of the CSO, the ACSOs shall provide critical communications between the Division they support and the ETD ISSOs, on all matters related to IT security. The ACSO shall copy the Division CSO on all communications and provide documentation to the Division CSO on all tasks performed.

A monthly vulnerability scan is performed by GSFC security officials, working under the direction of the Center’s Chief Security Officer, assessing the security of ETD assets connected to the GSFC network. The ACSOs shall provide Division specific reports on a monthly basis, posted to the security wiki, highlighting issues with Divisions assets to the Division IT manager and system administration team and shall ensure all vulnerabilities are corrected or waiver provided/approved prior to the date that the system is scheduled to be blocked on the local network.

The lead SA/ACSOs shall support the Division IT as follows:

- Develop proposal and papers for the integration of new products/techniques into the existing Division IT environment, act as a vendor liaison, and make presentations to IT managers at the Division and Directorate level before changing the current IT configuration.
- Resolution of all Division level IT Security Incidents working with the Division IT manager and system administration team, Directorate ISSOs, and Center security teams. Provide SA team with proper procedures to correct all identified vulnerabilities or research a solution to be implemented by the SA team. Complete all necessary incident reports and vulnerability scans within 10 calendar days of an incident.

- Perform monthly tests of system backups for each Division, ensuring that full system backups are completed and stored in a physically different onsite location, at least monthly. Provide a monthly report, to the Division IT Manager, via e-mail, on the status of all Division backups and test restores.
- Process all IT related waivers for their Division. Review waivers for compliance with GSFC/NASA policies and IT security SOPs, or research other possible secure solutions.
- Maintain a backup of encryption/decryption keys to recover encrypted data for users who forget their password.
- Scan all Division computers to ensure compliance with NASA/GSFC data and IT security requirements, as part of the process for establishing IP addresses, Certification, new-builds, and post-security incidents.
- Provide input and reviews of security documentation for IT Security Plan including: Risk Assessments, Security Plans, Contingency Plans, Data Flow Analyses, Network Diagrams, Security Assessments and Authorization testing.
- Maintain an understanding of Active Directory, Dell's KACE, Symantec Endpoint Protection, Symantec PGP and how these tools/capabilities are installed and implemented at NASA.
- Document and distribute Security Bulletins, when the primary CSO is not available, to alert Division users of special IT issues/vulnerabilities when they arise.

2.2 Consolidated ETD System Administration (SA)

The Contractor shall provide a consolidated portion of the IT technical support to the Divisions within the ETD for non-Agency Consolidated End-user Services (ACES) administered systems. The Contractor shall provide Virtual Machine (VM) management/expertise, ETD shared server resources, engineering software license management, helpdesk support, and documentation support to the ETD Divisions. The Contractor shall manage systems in accordance with the ETD Laboratory Systems Multi-Program IT & Project Unique IT (CD-013-M-GSF-5001) security plan. The Contractor shall provide support for 3rd party applications to ETD employees with ACES-managed systems, as needed. The Contractor shall provide IT architecture engineering, configuration management, and system administration.

2.2.1 Shared Server Support for ETD Divisions

The Contractor shall configure and maintain the ETD SA service ticket system, Storage Area Network (SAN) device, Spacewalk Free & Open Source Systems Management Server, Red Hat Satellite server, MacOS Patching Server, ETD Print Server, ETD License Servers and other ETD shared servers. The Contractor shall deploy updates to ETD computers, as approved by the ETD configuration control board.

The Contractor shall provide assistance in the definition of the hardware configuration for the ETD Divisions IT infrastructure. The Contractor shall provide for maintenance of a Configuration Management plan for the ETD shared IT resources. This plan will include: disk space management, server configuration and management, back-up procedures, software licensing configuration and operations plan.

2.2.2 VMware / Server Support for the ETD Divisions

The Contractor shall:

- Deploy the virtual machines/systems and manage the physical infrastructure needed to maintain the virtual machines and systems.
- Install, configure, update and resolve any issues with the VMware software and operating environment.
- Manage the server resources in order to maximize performance and reliability for all VMs on the server.
- Resolve all issues involving the physical infrastructure (server, storage, network, power, etc.).
- Manage the ETD vCenter environment and ensure that all ETD VMs are reporting.
- Ensure completion of daily virtual machine backups for disaster recovery purposes.

2.2.3 SA Documentation Support for the ETD Divisions

The Contractor shall:

- Develop and maintain procedures and guidelines for continuity, consistency, and awareness of system administrator services.
- Develop and maintain documentation to inform ETD users of IT access procedures, such as, Virtual Private Network (VPN) and Elevated Privileges (EP).
- Maintain the ETD Users IT Policies and Procedures Document.
- Maintain the ETD System Administration Policies and Procedures Document.

2.2.4 Helpdesk Support for the ETD Divisions

The Contractor shall:

- Provide phone support to all ETD users between the hours of 8:00am-5:00pm on weekdays excluding holidays.
- Utilize the Helpdesk Expert Automation Tool (HEAT) support/help ticket system to track and report on IT-related problems and/or service requests. When necessary the Division IT Manager will establish the priority of individual service requests.
- Resolve work stoppage tickets within 8 business hours of the trouble ticket submittal or phone message by either fixing the issue or providing an equivalent loaner computer from the Division pool of loaner machines.
- Resolve software installation/update tickets within an average of 2 business days.
- Resolve all other support tickets within an average of 5 business days.
- Tickets open for more than 5 business days, shall require a documented agreement with the ticket owner/originator to extend the completion date of the ticket.
- Provide monthly reports on customer satisfaction survey results to the Directorate IT Manager, via an excel spreadsheet, on the 15th of each month.
- Provide monthly reports showing the average time to close tickets:
- Work stoppage tickets;
- Software installation/update tickets, and
- All other types of tickets.

2.2.5 ETD Engineering Software License Management

# SES II Task Order SOWs

The Contractor shall:

- Develop and maintain procedures/guidelines for tracking the use of existing engineering software tools (i.e. ProE, MatLab, LabView, MSC, etc).
- Develop and maintain documentation/reports for ETD IT managers of tool usage, reporting monthly on tool over/under utilization.
- Add, delete, and update license files on the ETD license servers. Work with engineering tool Point of Contacts (POC), to integrate their tools into the ETD environment.
- Develop and maintain a real-time web enabled Dashboard that provides accessibility to license/tool usage by Division employee and project supporting, cost reports, and trends based on tool usage, for the Division IT managers.
- Maintain the list of ETD 'owned' tools, including; the tool POC, vendor, license renewal dates, license server, cost for use, and users of the tools.
- Organize user forum meetings for tool POCs and IT managers to discuss current licenses available, use trends and inclusion of new tools/licenses on a bi-annual basis.

# SES II Task Order SOWs

## 9999 Flight Software Sustaining Engineering (FSSE)

(Extracted from Section 3 of the SES II Contract)
The Contractor shall ensure the health, safety and success of the spacecraft and/or science operations of each on-orbit spacecraft the SED supports. This support includes pre-launch Flight Software (FSW) training and flight software maintenance preparations through post-launch/on-orbit multi-mission flight software sustaining engineering. The Contractor shall be required to analyze on-orbit anomalies, recommend and provide flight software solutions, provide consultation to the Flight Operations Team (FOT), prepare flight software patches, investigate and prototype agreed upon new technology initiatives, and provide a current archive of all flight software versions, associated tools, testbed software and databases for each supported mission. The Contractor shall also be assigned sustaining engineering responsibilities for several new missions during the contract period.
The Contractor shall be required to follow, maintain, and support the continuous improvement of the Multi-Mission Flight Software Sustaining Engineering (MMFSSE) infrastructure, including all existing MMFSSE processes, procedures, standards, guidelines, templates, tools, and policies.
The FSSE team collectively supports a wide array of on-orbit missions, including:
Pre-launch FSSE support continues for James Webb Space telescope (JWST) Integrated Science Instrument Module (ISIM); Magnetospheric Multiscale Mission (MMS); Deep Space Climate Observatory (DSCOVR); Ice, Cloud, and land Elevation Satellite (ICESat-II) Advanced Topographic Laser Altimeter System (ATLAS); and Space Environment Testbeds (SET).
 _Post-launch FSSE support continues for Global Precipitation Measurement (GPM); Tropical Rainfall Measuring Mission (TRMM); Terra; Aqua; Aura; Cassini Composite Infrared Spectrometer (CIRS); Fermi; Lunar Reconnaissance Orbiter (LRO); and Solar Dynamics Observatory (SDO) - with Swift Burst Alert Telescope (BAT) only if/as needed.

The FSSE lab facility has configuration-controlled versions of the software on-board the spacecraft, in addition to supporting equipment including original spacecraft simulators.

The Contractor shall possess knowledge and technical expertise in the areas of Flight Software (FSW) design, development, integration, and testing. The FSSE engineer shall not only be familiar with the inner workings of the FSW itself and all peripheral systems and tools that exercise the FSW, but also how spacecraft subsystems interact with the FSW. Specific specialized experience shall be required in the following areas related to Multi-Mission FSSE support:

a) Flight computers, including the 1750A, M68000, Pentium, Intel 8085, 80386, 80486, Mongoose, R 6000, PowerPC, UTMC69R000, and Coldfire processors.

b) Flight software languages, including C, C++, Ada, Jovial, JAVA, FORTRAN, Assembler (1750A, 386, 486, Motorola 68000, 80C85, UTMC 69R000), Perl, SQL, HTML, Artisan Studio code generator, Matlab/Simulink FSW modeling, RealTime Workshop code generator, Rational Rose Realtime, and Java Script.

c) Onboard operating systems, including VxWorks, VRTX (real-time), Real Time Operating System (RTEMS), MMS Executive, TLD Ada Kernel, and TRW FSW Executive.

d) Ground systems, including Advanced Spacecraft Integration & System Test Software (ASIST), Integrated Test and Operations System (ITOS), Integrated Trending and Plotting System (ITPS), New Technology Ground Support Equipment (NTGSE), GSFC Mission Services Evolution Center (GMSEC) software, AstroRT, and Eclipse.

e) All FSW functional areas, including Attitude Control, Telemetry and Command Management, Flight Operating Systems, Telemetry Monitors, Science Management, Spacecraft Health and Safety, Navigation/Orbit Control, Failure, Detection, and Correction, Instrument Management, Core Flight Executive/Core Executive System (cFE/CFS), and Robotics.

f) End-to-end FSW Sustaining Engineering processes, as included in the FSSE Plan and Operations Interface Agreement (OIA), and for FSW patches, FSW Independent Verification and Validation (IV&V), FSW tutorials, FSW lab recertification, multi-mission FSW support configuration management planning, Technical Exchange Meetings (TEMs), FSW Test Facility Move Process/Checklist, FSW Table Build Process, FSW Weekly Input Standard, FSW monthlies, and archiving of FSW products.

g) FSW simulation and testing support, including Spacecraft simulators, build test, IV&V, lab certification test, and acceptance test.

h) On-orbit FSW anomaly support, including FSW on-orbit anomaly troubleshooting, analysis, solution recommendation, and installation support and monitoring.

i) FSW algorithms, mathematics, including Quaternion mathematics, Runge-Kutta, Kalman filtering, Euler Axis/Rotations, orbital mechanics, Eigen Axis Inertial Guidance Maneuvers, telemetry commutation and de-commutation, control systems, onboard telemetry monitors, closed loop commanding, navigation, flight executives, error checking, and algorithm correction.

j) Spacecraft FSW interface devices, including Earth sensors, star trackers, magnetic torquers, magnetometers, Sun sensors, gyroscopes, reaction wheels, thrusters, solar arrays, transmitters and receivers, antennae, and science instruments.

k) Communications buses and protocols, including 1553B, 1773, 1355, Transmission Control Protocol/Internet Protocol (TCP/IP), RS-232, 422, 423, Consultive Committee for Space Data Systems (CCSDS), SpaceWire, CCSDS File Delivery Protocol (CFDP), and Astrowire.

### 3.1 Pre-launch FSSE Roles and Responsibilities

The Contractor shall support several of the pre-launch activities, including the following services:

1. Develop Mission-specific FSW Knowledge.

Develop insight into FSW requirements, design, code, operations concept, FSW Testbed and tools, FSW tests & expected results, failure scenarios, developer configuration management processes, methods, techniques, discrepancy reporting processes, etc.

2. FSW Testbed Move and Re-certification
Re-locate and certify the mission's FSW Testbed to long term FSW Branch facilities. These facilities shall be identified and provided by the Government.

3. Develop and certify a FSW Mission Operations software tools set under the guidance of the Flight Software Systems Branch management.

4. Support pre-launch mission simulations
These include launch and early orbit scenarios, Comprehensive Performance Testing, and mission readiness testing. Support includes preparing loads plus FSW maintenance scenarios, participating in mission simulations by providing FSW-related analysis and support, and developing/generating anomaly situations to be used during the simulations.

5. Develop FSW Regression Tests
These tests shall be used post-launch in the FSW Testbed for testing overall FSW integrity following implementation of approved changes to the FSW.

6. Develop a mission-specific Library of appropriate documents
These include FSW User's Guides, simulator manuals, Requirements & Design documents, ground system user's guides, logs of all FSW change requests to date, configuration management plans, Project Database documents, etc.

7. Develop a FSSE Plan, Operations Interface Agreement (OIA), and Configuration Management (CM) Plan, using the Flight Software Branch developed Templates.
These plans are used to maintain the FSW, Testbed elements, tools, test procedures & results, etc, and to govern FSW-related interface responsibilities between the FSSE team and the Flight Operations Team or other groups who may play a role related to FSSE, anomaly resolution and/or mission operations.

8. Verify pre-launch readiness of the FSW Branch for post-launch FSSE.
Includes meeting the requirements of the Code 582 FSSE Readiness Checklist.

9. Support launch & in-orbit checkout. This includes supporting flight operations with anomaly resolution as required, addressing questions related to the flight software implementation, and supporting launch and early orbit maneuvers and commanding

10. Support the FSW Development team as assigned
Support includes FSW unit and build test support, FSW testing (acceptance, system, regression, operational scenarios, etc), or other assignments that aid the FSW Development team's productivity while also providing FSW insight progress for the FSSE engineer(s).

### 3.2 Post-launch FSSE Roles and Responsibilities

The Contractor shall support several of the post-launch activities, including the following services:

1) Provide FSW Analysis to the FOT and Science Teams (where assigned)
Investigate FOT and on-orbit science issues, and answer FSW-related questions on functionality of the code, flight hardware/software interface, ground commands to the FSW, telemetry, operational scenarios, anomaly resolution, etc; examine FOT-requested FSW options; provide FSW-related training to the FOT.

2) Perform FSW Anomaly Investigations
Analyze real-time and playback telemetry, FSW-reported status, memory dumps, ground command sequences, FSW code and data listings; recreate the anomaly in the FSW Testbed to determine its cause; analyze and report on recommended FSW solutions to resolve the anomaly.

3) Support Recovery from FSW-related Anomalies
Validate proposed recovery solutions in the FSW Testbed; aid the development and execution of spacecraft reconfiguration procedures; flight software changes/enhancements, verify proper FSW functions/execution following recovery by performing functional, performance and regression tests.

4) Provide FSW Products to the FOT and Science Team (where applicable)
Provide FSW loads, updated FSW documentation, database updates, FSW ground reference image, FSW installation and on-orbit certification procedures, as per the OIA.

5) Develop & Validate All FSW CCB-Approved FSW changes
FSW table changes and software patches including software workarounds to hardware problems, health and status issues, operations-related support, payload issues and enhancements, and FSW performance improvements.
Full life cycle process applied, with reviews convened for Requirements and Design, Code Walkthrough and Test plan, and Test Results and Uplink Readiness

6) Support FOT during the Uplink of Each FSW change

Provide the FSW installation procedure; Verify the MOC-to-Testbed uplink test; Coordinate uplink activities to ensure proper ground/flight interfaces; Confirm proper post-uplink FSW functions and performance.

7) Participate in the Post-Launch FSW CCBs

Ensure that all requests for FSW patches and other FSW-related work are approved, prioritized, and tracked via the FSW Configuration Control Board (CCB). CCB membership includes a Project lead (co-chair), FOT, FSW lead, and other specialists as applicable in the resolution of on-orbit FSW anomalies or approved software changes.

8) Maintain the FSW Testbed(s)

Ensure the proper functioning of the Testbed, including working with Code 582 and the Mission Systems Administration Team, and mission-specific expertise at GSFC in the maintenance of commercial hardware and software, systems management, security requirements and issues, computer operations, and configuration management of the software development environment.

9) Maintain FSW Expertise

Ensure availability of FSSE specialists to meet mission needs and requirements.
Ensure continued Contractor FSW expertise concerning operations performance, anomaly investigating and spacecraft-safeing recovery techniques, the FSW test environment, test cases, test process, and test results for nominal and contingency flight situations.

10) Maintain all Software used for FSW Sustaining Engineering

Ensure the completeness of the FSW Development, Test, and Mission Operations Tools sets, developing enhancements as necessary to test and analyze FSW changes, support interface changes between the MOC & the Testbeds, improve visibility into FSW characteristics, etc.
Maintain the Flight Software Systems Branch Dynamic Simulator products, including mission-specific versions of the Goddard Dynamic Simulator (GDS), updating as needed to resolve coding errors or model new hardware features for testing FSW changes, including improving modeling of flight hardware and on-orbit command and data handling capabilities, and other interfaces and onboard functions.