

GSMO TASK ORDER

Task No: 1
 Modification: 8
 Task Name: Space Science Mission Operations
 Project Engineering Support
 Task Period of Performance: 3/1/2012 to 6/30/2016
 Modification Period of Performance: 8/17/2015 to 6/30/2016
 GSMO SOW Reference: 2.1, 3.7.2.3

I. Task Order History

Description of current modification (Modification 8): Perform a required upgrade to the Fermi ITPS system. This is consistent with the A.3 requirements, specifically:

Full Software Release that includes:

- * No Daily Plots "Dyp can't calculate, return value = -487.3"
- *Fermi SOAR 331, Bad timestamp data bogs ingest down
- * Ingest can't ingest files, renames them *.baddata
- * Upgrade to My SQL 5.6x, including porting all historical data to new table formats
- * Request Queue to address occasional crashes
- *Bug fixes and new features since Fermi delivery in 2010
- *Training of FOT of new version and ITPS in general

Develop and test release.

Support install and check-out in MOC.

Support problems found in check-out and initial use by FOT.

Perform a required upgrade to the Swift ITPS system. This is consistent with the A.4 requirements, specifically:

- * Support upgrade from Windows 2003 for Swift ITPS3.

Mod #	Start	End	Brief Description
0	03/01/2012	02/28/2013	Initial task order statement of work.
1	11/26/2012	10/31/2013	Provide for the implementation of an SSMO security logging solution, ITPS support for Fermi and Swift, and extend the overall period of performance for the SSMO project support.
2	5/16/2013	10/31/2013	Remove general SSMO system engineering support from this task because it will be covered under another GSMO task.

3	7/1/2013	6/30/2014	Provide for additional scope to bring SSMO system security plans as subordinate to Flight Project Directorate and extend period of performance for 8 months.
4	10/1/2013	6/30/2014	Add subtasks to specifically cover work associated with Fermi and Swift missions.
5	7/1/2014	6/30/2015	Extend the period of performance for 12 months.
6	10/20/2014	6/30/2015	Add the DSCOVR software lab (SDVF) into the SSMO SSP.
7	7/1/2015	6/30/2016	Extend the period of performance for 12 months adding IT support to MMS, MAVEN, DAT, and removing support to DSCOVR and SWIFT (ITPS).
8	8/17/2015	6/30/2016	Perform a required upgrade to the Fermi ITPS system.

II. Background

The Space Science Mission Operations (SSMO) Project has the responsibility for operations and maintenance of operational space science missions. The SSMO Project will be responsible for future space science missions usually after orbital verification is complete and routine operations are underway. However, the SSMO Project is involved in the mission development phases of new missions to assure safe and effective missions operability.

Subtask 1: Covers all work associated with the core SSMO IT Security Support. This relates directly to requirements A.1, A.2, and A.3.

Subtask 2: Covers all work associated with Fermi ITPS work as defined in requirement A.4 (for Fermi).

Subtask 3: Covers all work associated with Swift ITPS work as defined in requirement A.4 (for Swift).

III. Scope of Work

The contractor shall provide support to the Space Science Mission Operations Project for: IT Security support, ITPS support for Fermi and Swift, and System Administration.

A. Requirements

A.1. The contractor shall provide IT Security support

- a. The contractor shall serve as the SSMO Information System Security Officer (ISSO) with primary duty to assist and coordinate with SSMO Mission Teams, both at GSFC and remote, to establish and maintain appropriate and safe IT Security postures. Including the DSCOVER software lab (SDVF). Note: DSCOVER support ends Sept 2015.
- b. The contractor shall maintain the SSMO security documents as a subordinate plan.
- c. The contractor shall expand the SSMO System Security Plan to include coverage of:
 - i. SSMO VM network environment
 - ii. MMS mission
 - iii. MAVEN (external)
 - iv. FERMI-VM systems
 - v. MMOC – VM systems
 - vi. O-REX backup MSA
- d. The contractor shall provide coordination for the development of SSMO standards for NIST control compliancy.
- e. The contractor shall provide needed support and representation as an subordinate plan ISSO.
- f. The contractor shall also maintain awareness of upcoming IT Security policy changes and emerging threats that affect mission operations.
- g. The contractor shall coordinate responses to all IT Security incidents affecting SSMO Mission Operations Centers.
- h. The contractor shall report regularly and as needed with SSMO management and Mission Directors to inform the Project with regard to ongoing activities, upcoming changes, and recommendations with respect to implementation of IT Security policies within the Mission Operations Centers.
- i. The contractor shall support SSMO to ensure Project Compliance with Agency guidance by developing and maintaining Project required documentation per OMB Circular A-130, NPR 2810.1a and applicable NIST requirements. The contractor is responsible for reviewing and commenting on proposed guidance and policy changes, and assessing impact and response plans to policy and guidance as necessary.
- j. The contractor shall assess compliance with NISN (IONet) policies and recommend specific implementation strategies.
- k. The contractor shall conduct annual self-assessments; prepare and track plan of action milestones (POAMs), risk assessments, provide impact assessment, policies and procedures, awareness training and notification procedures in the events of a security breach of the Project office as well as the individual missions, to analyze their results, and recommend follow up actions.
- l. The contractor shall provide continuous monitoring support of the SSMO internal missions and support elements.

- m. The contractor shall provide Certification Assessment and Accreditation support for both internal and remote missions systems.
 - n. The contractor shall conduct credential scans of the SSMO mission operations systems (via laptop). The contractor shall maintain a historical database of scan results and work with the various System Administrators concerning finding and addressing identified vulnerabilities.
 - o. The contractor shall archive all raw scan data for possible review and/or distribution for future analysis.
 - p. The contractor shall provide equipment and licenses for performing SSMO credential scans. (stand alone laptop and secure center)
 - q. The contractor shall perform credentialed scans for the SSMO VM network (network and mission systems) via secure center
 - r. The contractor shall provide monitoring support to SSMO external missions (APL, UCB, MAVEN (JPL)). (Bi-weekly meetings).
- A.2. The contractor shall provide System Administration support
- a. The contractor shall provide System administrator work to support firewall implementation, scanning, and IT security work items as authorized for the maintenance of two workstations for the ARTEMIS mission. These machines are needed to provide a data relay from the DSN to the UCB MOC for ARTEMIS operations.
 - b. The contractor shall provide System administrator work to support the OSIRIS-REx mission.
- A.3. For the Fermi mission, the contractor shall provide development and sustaining engineering support, along with technical support pertaining to the ITPS systems (hardware and software)
- a) Update ITPS system documentation.
 - b) Conduct ITPS feature training.
 - c) Define mission-specific requirements associated with enhancements or discrepancy resolution.
 - d) Define hardware specifications for any required hardware.
 - e) Provide support for ground system testing and verification.
 - f) Formally deliver ITPS general and mission specific software releases (hardware, software, including MATLAB, and associated documentation).
 - g) Report and track ITPS software issues and enhancement lists.
 - h) Provide ITPS user support for technical questions and system problems consultation.
- A.4. For the Swift mission, the contractor shall provide necessary software upgrade support pertaining to the ITPS systems.

B. Management Reporting

The Contractor shall provide monthly status reports and reviews on the technical, cost, schedule and operational performance in accordance with the WBS to adequately describe the activities of the task to the Task Monitor.

C. Contractor Controlled Property

The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list (NPROP) of government owned property used by the Contractor on this Task Order. This support includes preparation and cooperation during property audits.

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

There are no Government furnished facilities, equipment, or software associated with this Task Order.

V. Material Procurement

The Contractor shall propose material that they identify as necessary to perform the work associated with this Task Order.

VI. Travel Support

The Contractor shall propose travel that they identify as necessary to perform the work associated with this Task Order.

VII. Deliverables

The Contractor shall provide the following deliverables in support of the Task Order:

ID	Deliverable Description	Due Date
1	Weekly status reports	
2	Updated SSMO IT Security Documentation as necessary	

End of Task Order Statement of Work

GSMO TASK ORDER

Task No: 2
 Modification: 5
 Task Name: LDCM Flight Operations Support
 Task Period of Performance: April 1, 2013 to May 31, 2013
 Modification Period of Performance: N/A
 GSMO SOW Reference: 199008.02.04.02.M203.12

I. Task Order History

Description of current modification (Modification 0): This is an initial task under the GSMO contract. It is a continuation of support services that were conducted under the MOMS contract with some changes in scope and deliverables.

Mod #	Start	End	Brief Description
0	03/01/2012	02/28/2012	Initial task order statement of work.
1	03/01/2012	02/28/2012	Provide for travel arrangements to support OSC facility in Gilbert, AZ.
2	10/01/2012	02/28/2012	Add new subtask to provide Cape Modeling Support
3	11/1/2012	03/31/13	[REDACTED]
4	1/8/2013		Correct end date in TOMS (Admin change)
5	4/1/2013	6/30/2013	Task extension for Flight Operations Support

II. Background

The Landsat Continuity Mission (LDCM) is a component of the Landsat Program conducted jointly by NASA and USGS of the Department of the Interior.

The LDCM Operations consist of two elements: the space element and the ground system element. The Space Segment (SS) consists of the observatory and pre-launch ground support equipment (GSE). The observatory consists of the spacecraft and two instruments.

The spacecraft will contain typical earth observing spacecraft functionality and will supply ancillary data to the instrument suite necessary to meet mission and imaging requirements. The primary instrument, the Operational Land Imager (OLI), is required to provide nine spectral bands with a maximum ground sampling distance. The second instrument is The Thermal Infra-Red Sensor (TIRS) will have a similar cross track swath width but a ground sample distance of 120-m for two bands.

Imaging sensor and ancillary data (combined as mission data) will be collected, stored onboard and subsequently down-linked to ground stations within the LDCM Ground Network (LGN) via an X-band communications link. Additionally, an X-band downlink capability will transmit mission (imaging sensor and ancillary) data to the LGN and International Cooperators (ICs) equipped to receive these data. The observatory will also receive and execute commands and transmit real-time housekeeping telemetry via an S-band link to the LGN. The SS is capable of S-Band communications with the NASA Near Earth Network (NEN). S-Band only operations may be conducted with the Space Network (SN). Both These networks are used as needed to support launch, early orbit, and contingency operations at the lower data rates. The GSE provides the functionality to perform ground-based integration and testing of the observatory prior to launch.

The initial plan for launch and early orbit planning, system integration and operations is to conduct all preparation activities from the MOC located at GSFC, with the exception of all instruments planning activities to be conducted in Sioux Falls, South Dakota. After early orbit and activation activities, normal operations will be conducted from the MOC at GSFC for a period of at least two years. In order to mission objectives the Contractor will required interfacing and closely working with USGS personnel located in Sioux Fall, South Dakota.

Subtask 1: Flight Operations

During the Pre-launch preparation phase of the mission, the Contractor shall support all mission preparation activities that include Ground System Tests (GRT's), Mission Readiness Tests (MRT's), Mission Operation Simulations (MOS's), and launch rehearsals. Test planning and oversight for testing is done under NASA management with support from the USGS. Following Launch and Early Orbit (LEO) activation and commissioning activities, the Contractor will continue to continue providing day-to-day flight Operations Support.

Subtask 2: Mission Operations Center (MOC) and Mission Operations Equipment (MOE) System Operations, Administration and Maintenance

The contractor shall support all system administration and installations required to review and install and new software and hardware deliverables in the MOC and MOE.

Subtask 3: Cape Modelling Support

The LDCM Project requires resources to review and access the CAPE, perform CAPE modeling, participate in OIV scheduling plans, assess the IC interface for scheduling, and participate in cal/val and timeline telecons. [REDACTED]

III. Scope of Work

The Contractor shall support the following mission preparation activities.

Ground Readiness Testing (GRT): The Contractor shall support the ground system level testing to verify that the ground system meets operational functional requirements and that the interfaces between elements conform to ICD specifications.

Mission Readiness Testing (MRT): The Contractor shall plan and execute a series of Mission Readiness Tests (MRT's) to validate and certify that all support elements, including the observatory and the ground system elements, meet all the operational requirements. As part of the support required by the Contractor, Working Group Meetings with the spacecraft manufacturer, NASA engineers, USGS engineers shall be conducted weekly, or deemed necessary to meet tests objectives. The Contractor shall coordinate and generate the development of test scripts, ground and operations procedures; validation of procedures through the use of existing simulation tools (software and hardware); procedure dry-runs, and actual execution of the test plan for each schedule MRT defined in the MRT Plan.

Mission Operations Simulations (MOS's): The Contractor shall support and directly participate in the execution of MOSs that are series of simulation runs to validate all the elements of the LDCM Operations Concept. The operations simulations will be performed to ensure operational readiness of the Flight Operations Team (FOT) for L&EO, Observatory activation, on-orbit operations. The FOT shall verify the timeline, operational processes, procedures and team interaction to have a successful mission. The FOT shall exercise procedures in nominal and

contingency scenarios to be able to respond to any possible contingency during activation commissioning of the observatory.

Launch Rehearsals: The FOT shall support launch rehearsals activities, even so, there is no direct responsibility on the part of Operations to execute any of the planned activities. However in order to meet rehearsal objectives, the FOT shall serve as the communication interface to exercise the launch countdown script and exercise communications with the launch site.

Observatory Tests: The FOT shall support spacecraft or observatory comprehensive tests; even so, there is no direct responsibility on the part of Operations to execute any of the planned activities. However in order to meet test objectives, the FOT shall help prepare equipment for monitoring the test at local and remote locations. The FOT shall also help train NASA engineering support (AETD/LPO) to use the MOE/miniMOE in order to observe the tests. Lastly, the FOT will be expected to implement feedback from supporting engineers where appropriate to improve the MOE Observatory Tests.

Launch and Early Orbit (L&EO)

The Launch and Early Orbit phase begins with the final countdown to launch and runs through the early orbit checkout of the LDCM observatory. This phase of operations includes all autonomous and ground-commanded events from liftoff to completion of the separation sequence initiated as LDCM de-mates from the launch vehicle in Mission. The FOT will have minimum participation in the launch phase, however the FOT shall provide full support during early orbit activities to monitor and execute command and loads necessary to activate the spacecraft. All FOT positions shall support continuously, 24 hours per day seven days a week, all commissioning activities during this time period in the Mission Operations Center (MOC), Mission Equipment Room (MER) and Launch Support Room (LSR) facilities.

Post Launch Flight Operations

This Flight Operations phase represents the period between observatory commissioning and transitioning to USGS management of LDCM operations. The LDCM mission is expected to transition from NASA to the USGS following declaration of Initial Operating capability (IOC). In the meantime the Contractor will continue providing flight operations activities and support as specified in the section A to the requirements for the duration of this task.

A. Requirements

A.1. Spacecraft Operations- Planning and Scheduling

The overall activity planning for the mission is divided between the Collection Activity Planning Element (CAPE) and the Mission Operations Element (MOE). The CAPE schedules activities on a path-row scene basis. The MOE converts CAPE-generated path-row scenes to observatory activities, schedules these and any other detailed observatory activities, and generates commands necessary to collect the identified scenes and operate the observatory. The MOE schedules activities such as orbit maneuvers and identifies these to the CAPE as periods where science data collection cannot occur.

The Contractor shall perform the planning and scheduling function for LDCM by directly interfacing with USGS for input and providing schedule requests to the network scheduling system. The Contractor shall follow networks scheduling processes and procedures to resolve scheduling conflicts and shall provide products to USGS as required supporting mission activities.

The Contractor shall secure adequate communications services through the Ground Network (GN) and Space Network (SN), or other government provided communications networks for the

delivery of spacecraft and instrument telemetry to the ground and the commanding and tracking of the LDCM spacecraft.

The Contractor shall ensure a conflict-free schedule of activities for all spacecraft contacts, spacecraft activities.

A.2 Real-time and Support Operations

The Contractor shall support all real-time operations of LDCM observatory from both ground and space networks, as necessary to meet mission objectives. Real-time operations consist of those activities that are necessary to support direct communication with the spacecraft and include: telemetry, tracking and command activities, health and safety monitoring, orbital maintenance maneuvers, system configuration, housekeeping telemetry processing, command load uplink and verification, onboard controller table and memory load/dump operations, and management of the Solid State Recorder (SSR) to capture and downlink all science and spacecraft engineering data. Support operations are those offline activities that are necessary to support the safe and nominal operation of the spacecraft and include: planning and scheduling, stored command load generation, ephemeris generation, maneuver planning support, spacecraft clock maintenance, S-Band center frequency maintenance, and trending and statistical analysis of observatory performance.

The rules and software used to perform observatory activity scheduling are to be maintained by the contractor.

A.3 Training and Competency

The Contractor shall setup and maintain a comprehensive training program for all flight operations support personnel to maintain a high level of competency with the LDCM flight operations team (FOT). The FOT shall be trained and certified to operate the mission. FOT training shall include:

- Functionality of the observatory (spacecraft and imaging sensor)
- Functionality of MOE software and hardware
- Operations procedures including launch, early orbit, commissioning, nominal, contingency/recovery procedures
- Operations Etiquette and protocol (voice box, log book, and CM training)

Training shall take various forms, including exercises to simulate typical day-in-the-life on-orbit Observatory operations and launch rehearsals. To the extent possible/practicable, the FOT shall be trained using the system(s) and interfaces that will be used in actual operations. Where this is not possible, equipment that emulates the interfaces and simulates performance with high fidelity shall be used for all testing and verification activities.

A.4 Support of Flight Dynamics System (FDS) Functions

The Contractor provided FOT shall work closely with the Flight Dynamics System Services (FDSS) contractor team, Orbital and USGS personnel to plan coordinate and execute all LDCM spacecraft initial orbit and attitude maneuvers. The FDSS contractor shall plan all maneuvers and coordinate with the multiple support elements during L&EO the execution of all maneuvers.

The Contractor shall coordinate with EMSO to define the nominal LDCM orbit with respect to the "A-Train Afternoon Constellation and on how to communicate any deviations from the expected orbital envelope. The Contractor shall notify all member satellites of the Morning Constellation of any and all instances of the LDCM spacecraft transitioning into or out of Safe or Survival Mode. Notification shall be in accordance with the Constellation agreement documents between the member satellites of the Morning Constellation and/or A-Train Afternoon Constellation and the

ESMO Project. The contractor will work with CARA (Conjunction Assessment Risk Analysis) and provide mission ephemerides for conjunction assessment.

The Contractor shall notify all member satellites of the Morning Constellation of any and all instances of the LDCM spacecraft transitioning into or out of Safe or Survival Mode. Notification shall be in accordance with the Constellation agreement documents between the member satellites of the Morning Constellation and/or A-Train Afternoon Constellation and the ESMO Project

A.5 Configuration Management (CM)

The Contractor will follow established configuration management processes for all FOT products including documentation of new or updated products, peer review and internal sign off. The products will be presented to the Configuration Manager at the in-house Configuration Control Board meeting prior to being finalized through the use of the MIS to maintain full control of any changes to the ground system, spacecraft configuration and the approval of any activities relates to changes to any of the support elements or facilities within flight operations domain. The contractor shall maintain a set of configuration controlled flight operations procedures, which include procedures for nominal, special and contingency operations.

The Contractor shall maintain and update documentation, plans and procedures as required supporting mission operations and mission support activities.

The Contractor shall maintain and update the spacecraft manufacturer provided documentation.

The Contractor shall maintain and update flight team training plans and provide the necessary training as classroom training, training exercises, and simulations.

A.6 Mission Operations Center (MOC) and Mission Operations Equipment (MOE) System Operations, Administration and Maintenance

The contractor shall support to the LDCM MOC to maintain the availability and reliability of the MOC Systems, including the MOE, CAPE, LSIMSS, S/OS, and Softbench. This also includes User Support for the LDCM MOC IT Systems, responding to user calls, troubleshooting problems, escalating as necessary to MOC Sustaining organizations, and tracking issues through completion and resolutions of any issues that may impact operational activities. Under this subtask the Contractor shall also support all the activities required to install and test new software deliverables of the ground system elements.

A.7 CAPE Modelling Support

Specifically the contractor shall provide support of the LDCM Long Term Acquisition Plan (LTAP-8) of the Collection Activity Planning Element (CAPE) to:

- 1) Support integration of cloud avoidance into LTAP-8
- 2) Assess the use of NDVI-based seasonality as a guide to acquisition scheduling
- 3) Test acquisition planning and scheduling using simulated datasets
- 4) Compare LDCM acquisition probability to historical performance of Landsat-7 LTAP
- 5) Participate in Ground System reviews as needed.

IT Security

The contractor shall provide technical and IT Security expertise to support the LDCM project in interpreting, defining, implementing, and complying with NASA and Federal IT Security Requirements. The contractor shall serve as the Alternate Computer Security Official (alt-CSO) for the LDCM MOC, representing LDCM to Code 400 and the Center IT Security personnel. The contractor shall define and maintain the LDCM MOC IT Security implementation and

documentation, facilitate center and agency reporting requirements, and perform annual IT Security Assessments and assessments for new configurations. The contractor shall lead the coordination effort with the LCDM MOC Element Vendors to maintain network compatibility and adherence with MOC IT Security requirements.

Project Reference Database Development and Sustaining Support

The Contractor shall develop, install, and sustain the LDCM Project Reference Database (PRD), which provides a central repository of MOC Application and System Configuration Items. The contractor shall maintain configuration management of the PRD; develop and maintain Translators to convert between Spacecraft and Application databases; and provide and maintain a development environment for MOC PRD users

A.7 Staff Allocation, Expertise, and Level of Effort

LDCM flight operations activities require expertise in mission planning and scheduling, on-console operations, spacecraft subsystem engineering and data analysis, development of operations scripts and reporting. The contractor shall augment the current staff levels by additional six professional engineers to plan, organize and execute launch and early orbit activities with the necessary skill-mix to safely and effectively perform observatory activation, instrument activation and calibration, safely operate the LDCM mission under Subtask 1. The augmentation of personnel will require the reassignment of some of the existing positions to meet specific datelines and support required for launch in February, 2013. These reassignments shall be coordinated with the Mission Operations Manager (MOM) and include specific engineering skills and disciplines, in all instances experienced professional engineers are required to fill the following positions:

1. One Electrical Power Subsystem Engineer (EPS)
2. One Flight Software (FSW) Specialist
3. One Ground System Engineer Lead
4. One Ground System Engineer
5. One Mission Planning Specialist
6. One Spacecraft Subsystem Engineer

As part of this augmentation of Operations personnel, the Contractor shall provide to the MOM a phasing plan and training plan to meet mission preparation requirements.

A.8 Operations Facilities

The LDCM Mission Operations Center (MOC) is currently located in Building 14, with a backup Mission Operations Center (BMOC) facility located in building 32 at GSFC. From time to time the Contractor shall relocate the FOT, and any other required portions of the mission operations workforce, to the BMOC, as needed in the event of a facility emergency and as part of the fall back due to unforeseen circumstances or by direction of the Mission Operations Manager (MOM) or the Flight Systems Manager (FSM).

The Contractor shall perform proficiency flight operations testing in the BMOC on an as needed basis, by direction of the MOM/FSM. The Contractor shall maintain the BMOC systems to provide a ready capability for relocation of operations and resumption of nominal flight operations within 2 hours of the loss of Building 14's MOC flight support functionality. The Contractor shall maintain and exercise the BMOC on a regular basis to demonstrate support capability and readiness status.

The Contractor shall establish the LDCM flight operations workforce within the primary Mission Operations Center (MOC) currently located in Building 14 at the GSFC. The Contractor shall temporarily relocate the FOT, and any other required portions of the LDCM mission operations

workforce to the Backup EOS Operations Center (BEOC) located at the GSFC, as needed or by direction of the MOM/FSM. The Contractor shall procure all office supplies and consumables used in the daily operation of these facilities through the Project Support office.

A.9 Risk Management and Best Practices

The Contractor shall apply continuous Risk Management and Best Practices compliant with NPG 7120.5. In addition, the Contractor shall comply with all Agency, Center, and USGS directives regarding Risk Management and Best Practices.

A.10 Information Technology Security

The Contractor shall apply Information Technology (IT) security standards as defined by NPG 2810.1 for systems classified as Mission (MSN) for all LDCM IT systems. In addition, the Contractor shall comply with all Federal Rules and Regulations and Agency/GSFC directives.

A.11 Organizational Interfaces

The Contractor shall interface with all USGS support organizations, as specified in the Operations procedures, Interface Control Documents (ICDs) and Operations Agreements (OAs). The Contractor shall interface with the USGS facility at Sioux Falls, S.D. to perform planning and scheduling functions as defined in the LDCM Operations Concept and requirements documents. The Contractor shall also interface with the GSFC Security Office as required for security issues or concerns.

A.12 Reviews and Meetings

The Contractor shall support all scheduled mission and project reviews. These reviews include: internal peer reviews; Pre-environmental review (PER); Flight Operations Review (FOR); Operations Readiness Review (ORR); pre launch and early orbit reviews; technical information meetings (TIM's). The Contractor shall also support all mission related meeting to coordinate preparation activities as requested or directed by the Mission Operations Manager and Project Management. The Contractor shall participate in daily mission planning, status meetings and any other related meeting that requires mission operations personnel presence.

B. Management Reporting

The Contractor shall provide monthly status reports and reviews on the technical, cost, schedule and operational performance in accordance with the WBS to adequately describe the activities of the task to the Task Monitor

The Contractor shall provide monthly financial reports to the Task Manager and the LDCM Project by using the 533M form with the necessary level of information to allow long-term budget planning. All reports shall be made available in both soft- and hardcopy media.

The contractor shall provide weekly status reports with regard to implementation progress and issues that may be relevant to impacts to mission preparation activities. The report shall include a summary of the overall accomplishment, status of assigned actions and overall performance of activities leading to preparation for launch and early orbit, such as progress in Standard Operating Procedures (SOP's) development, STOL procedures and flight operations documentation, and preparation for mission or ground tests and simulations. The report shall provide all the necessary information to ascertain any issues and concerns that may have an impact to the readiness of the operations team. Report shall be provided to the LDCM Mission Operations Manager, no later than by close of business every Wednesday

C. Contractor Controlled Property

The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list (NPROP) of government owned property used by the Contractor on this Task Order. This support includes preparation and cooperation during property audits.

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

The government shall provide contractor access to the mission operations facilities located in building 14 and building 32 facilities at GSFC. The maintenance of the MOC software and hardware is provided through other tasks and contracts..

V. Material Procurement

The Contractor shall propose material that they identify as necessary to perform the work associated with this Task Order. The Task Monitor shall concur with the materials list prior to procurement.

VI. Travel Support

The Contractor shall propose travel that they identify as necessary to perform the work associated with this Task Order. This shall include AI support for flight dynamics , orbit determination coordination and training with Orbital at Gilbert, Arizona.

Specifically, the contractor shall support the travel requirements as described in the table below:

Travel Description	Approximate Time Frame
Spacecraft training at Orbital in Gilbert Arizona	March 2012
Mission Readiness Testing-mini MOE support	March- August 2012
Flight Operations Readiness Review	July 2012
L&EO Technical Information Meeting (TIM)	April- October 2012

VII. Deliverables

The Contractor shall provide the following deliverables in support of the Task Order:

ID	Document Title	Type	Due date
LDCMOPS_PLN_0001	Flight Operations Configuration Management plan	Final Plan	Jun-12
LDCMOPS_PLN_0002	Flight Operations Team (FOT) Training Plan	Final Plan	Mar-12

LDCMOPS_PRC_0001	Ground Readiness Test (GRT) Procedures	Procedure	TRR-5 days
LDCMOPS_PRC_0002	Mission Readiness Test (MRT) Procedures (6)	Procedure	TRR-30 days
LDCMOPS_PRC_0003	Mission Operations Simulation (MOS) Procedures (6)	Procedure	TRR-5 days
LDCMOPS_PRC_0004	Standard Operating Procedures	Procedure	FOR-120 days
LDCMOPS_PRC_0005	Flight Operations Procedures	Procedure	TRR-30 days
LDCMOPS_PRC_0006	Contingency Operating Procedures	Procedure	FOR-120 days
LDCMOPS_PRC_0007	Mission Readiness Test Procedure	Procedure	As required
LDCMOPS_DOC_0001	Mission Operations Center Operations Concept	Reference	FOR-180 days
LDCMOPS_DOC_0002	Project Reference Database System DFCD	Reference	As required
LDCMOPS_DOC_0004	Launch & Activation Handbook	Reference	FOR-30 days
LDCMOPS_DOC_0004a	Launch & Activation Timeline	Reference	FOR-30 days
LDCMOPS_DOC_0005	LDCM Operations Handbook	Reference	FOR-180 days
LDCMOPS_DOC_0006	MOC & FDF Mission Operations Agreement (MOA)	Reference	In FO CM
LDCMOPS_DOC_SOP	Standard Operating Procedures	As required	FOR -30 days

End of Task Order Statement of Work

**Statement of Work (SOW)
for DSN Scheduling
Mission Support**

Task No. 03
Modification: 8
Task Name: DSN SCHEDULING
Task Period of Performance: 03/01/15 – 2/29/16
Modification Period of Performance: 03/01/15-2/29/16
GSMO SOW Reference: 2.3.2.3

Mod #	Start	End	Brief Description
0	03/01/2012	02/28/2013	Initial task order statement of work.
1	09/01/2012	02/28/2013	Continue to assist JPL Scheduler Process Owner Office, per previous agreement, by providing Building of the Proposal (BOP) support from Oct 2012 through Feb 2013.
2	03/01/2013	02/28/2014	Extend task order period of performance through Feb 28, 2014.
3	03/01/2013	07/31/2013	Provide Cluster II Scheduling, which now includes Telemetry, Tracking and Command (TTC) routine operations in addition to Wide Band Data (WBD) and TTC eclipse recovery support through Aug 31, 2013.
4	09/14/2013	10/31/2013	Provide Cluster II Scheduling to include WBD, TTC eclipse recovery operations and the TTC routine operations.
5	10/01/2013	02/28/2014	Extend Schedule Process Owner's (SPO) schedule support through Feb 28, 2014.
6	03/01/2014	02/28/2015	Extend task order period of performance through Feb 28, 2015.
7	06/28/2014	09/26/2014	Augment TTC routine and eclipse support to cover the timeframe of 6/28/14 through 9/26/14.
8	03/01/15	02/29/16	Extend task order period of performance through Feb 29, 2016.

I. Background

This task authorizes the contractor to perform DSN scheduling activities in order to generate conflict free schedules for Cluster II (TTC eclipse recovery operations and the TTC routine operations through 6/2015), Kepler, LADEE, and STEREO DSN. DSN scheduling services for ACE, GEOTAIL, LRO, SOHO, MMS and Wind SSMO missions will be provided through individual mission operations task orders.

II. Work to be Performed

The Contractor shall provide a conflict-free schedule of activities for all spacecraft contacts, spacecraft activities, and instrument operations that are consistent with the overall Science Operations Plan for each mission.

The Contractor shall secure adequate communications services through the Deep Space Network (DSN) for the delivery of GSFC Code S spacecraft and instrument telemetry to the ground and the commanding and tracking to each spacecraft.

The contractor shall update the DSN Integrated Mission Scheduling Plan which describes in detail the Contractor's approach to integrating GSFC DSN scheduling activities with FDF and JPL products.

The contractor shall assist the Schedule Process Owner's (SPO) office by building at least one initial week-long proposed schedule. During this period of performance, the contractor shall assist the SPO office by building at least one initial week-long proposed schedule in a two week timeframe each month.

III. Management Approach

A. Staff Allocation, Expertise, and Level of Effort

The contractor shall ensure the availability and competence of the work force necessary to execute the management and technical activities specified in this SOW. This shall be accomplished through recruitment, training, certification, and the analysis of comparable work environment and associated compensation. The contractor shall manage staff allocation to the required tasks described in this SOW.

B. Management Reporting

Annual summary of GSFC scheduling audit and lessons learned for all SSMO missions using the DSN.

The contractor shall provide weekly status reports that include all SSMO DSN scheduling services. The content of these reports shall be defined in the contractor task implementation plan.

The task manager shall be notified as soon as possible in the event of mission conflicts that are having resolution issues.

C. Configuration Management

The contractor shall support the DSN Configuration Management approach for scheduling GSFC missions.

D. Operations Facilities

The contractor shall provide operational facilities as specified in the Task Implementation Plan. At a minimum, facilities and equipment will be provided to support the following list of missions: Cluster II, Kepler, LADEE and STEREO.

E. Risk Management and Best Practices

The contractor shall routinely identify risks associated with s/c emergencies, launches, and ground station equipment outages and shall recommend to the Task Monitor any changes to systems or procedures that could reduce or eliminate the risk. A Risk Status meeting to review the scheduling risk list will be done twice a year.

The contractor shall deliver an annual DSN scheduling audit report that describes GSFC DSN scheduling practices followed for each GSFC mission scheduling service. The contractor shall have a process in place for applying lessons learned and best practices.

F. Information Technology Security

The Contractor shall be responsible for Information Technology (IT) security for all systems operated by the Contractor for NASA or used by the Contractor to connect to any NASA network that requires compliance with GSFC and NASA security requirements. The Contractor shall make arrangements and coordinate security checks and scanning of operational systems as required by GSFC and the Agency.

The Contractor shall apply IT security standards as defined by NPR 2810.x for systems classified as a Mission (MSN) for all Space Science IT systems. In addition, the Contract shall comply with all Federal Rules and Regulations and Agency directives.

IV. Technical Approach

A. Requirements

The contractor shall support the JPL Resource Allocation Review mid range scheduling activities for each GSFC/SSMO mission in accordance with each mission PSLA. In general the long range schedule shall be six months ahead unless specified by JPL.

The contractor shall support the DSN short term scheduling activities in accordance with each mission's User Loading Profile.

The contractor shall routinely maintain the mid-range and short term schedules which includes working around s/c emergencies, launches, and ground station equipment outages

The contractor shall review & maintain the RAP User Loading Profile for each GSFC mission. This activity is typically done twice a year unless specified otherwise by JPL.

B. Support Services

The contractor shall identify any licenses and other IT support necessary for this DSN scheduling task.

C. Organizational Interfaces

On a routine basis the contractor shall work with each mission's flight ops team, Mission Director, the Flight Dynamics Facility, and Science Team. The contractor shall also need to work with the JPL DSN scheduling group, Resource Allocation Team, Mission Interface Managers (MIMs), JPL Navigation, DSN Predict Group, and JPL Network Operations Project Engineers.

V. Performance Metrics

The contractor shall identify performance metrics in the task implementation plan for government review. These performance metrics in general shall reflect the contractor's performance in meeting mission requirements and the contractor's cost estimates.

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

The Contractor shall propose and justify materials required to meet the objectives of this statement of work. The contractor shall be accountable for all property used.

VII. Deliverables

The Contractor shall deliver the following Reports:

533M – monthly

533Q – quarterly

Annual summary of GSFC scheduling audit and lessons learned for all SSMO missions using the DSN

Weekly task order status reports that include all SSMO DSN scheduling services

Updates to the Scheduling Risk List for SSMO DSN scheduling services

Updates to the SSMO Wiki for SSMO missions using the DSN

Week-long proposed schedule in SSS with email notification to the SPO office.

The contractor will provide inputs to the mission specific end of year cost summaries

END OF SOW

GSMO TASK ORDER

Task No: 5
 Modification: 8
 Task Name: SCA Integrated Network Studies Support
 Task Period of Performance: 3/1/2012 to 6/30/2014
 Modification Period of Performance: 7/1/2013 to 6/30/2014
 GSMO SOW Reference: 2.2

I. Task Order History

Description of current modification (Modification 0): Initial task order statement of work for SCA Integrated Network Studies Support.

Mod #	Start	End	Brief Description
0	03/01/2012	02/28/2013	Initial task order statement of work.
1	06/29/2012		Change project RA from Sherrie Wood to Brett Gillard.
2	07/30/2012	02/28/2013	Provide TS/SCI clearance for team members and 9 domestic travel trips.
3	08/20/2012	02/28/2013	Augment travel plan to include 5 domestic trips and 3 international trips.
4	10/1/2012	02/28/2013	Support study defining the future scope for the next generation Space Based Relay for the Exploration and Space Communications Division
5	11/5/2012		Change TM from Nate Wright to John Hudiburg. Change BH from John Hudiburg to Jeff Volosin.
6	1/1/2013	02/28/2013	Replan to adjust staffing profile changes involving the removal of T&M vendor support.
7	3/1/2013	9/30/2013	Extend period of performance and add sub-task accounting/reporting.
8	7/1/2013	6/30/2014	Extend period of performance for subtask 1 until first quarter 2014 and subtask 2 until end of PoP. Replan to adjust staffing profile and travel plan.

II. Background

Trade Study Analysis

At present, NASA's space communications infrastructure is comprised of three component networks—the Space Network (SN), Near Earth Network (NEN), and Deep Space Network (DSN). To meet NASA's "One Network" objectives, these

component networks will be re-architected into a single network. Shown in Figure 1.1, the "One Network" objective is a single integrated network encompassing all assets in NASA's space communications infrastructure emphasizing commonality among all assets wherever possible. This shift in architecture will reduce the operational costs of NASA's space communications and navigation infrastructure, and simplify the user missions' interface to securing communications and navigation services.

To that end, the Space Communication and Navigation (SCaN) program's systems engineering team is conducting a trade analysis on the integrated network architecture. This trade analysis examines two key aspects of the integrated network: (a) integrated network management, and (b) integrated service execution. There are various architecture alternatives for integrated network management and integrated service execution. For each architecture alternative identified, key characteristics are addressed, taking into account the functions allocated to the various entities of the architecture and the interfaces among them. While no attempt is made to assess or compare these alternatives, the intent is to provide sufficient information for distinguishing one architecture alternative from another, and can serve as a basis for cost estimates and risk and benefit analyses leading to the selection of the "best-value" alternative.

It is expected that some distinctions will remain between different elements in the network due to the mission domains (i.e., near Earth, Mars vicinity, outer planets) they were originally designed to serve. For example, although the current Space Network would no longer exist as an independent network, the integrated network will contain an Earth-Relay element as depicted in Figure 1.1. The Earth Relay element includes the Tracking Data Relay Satellite (TDRS) constellation and its dedicated ground stations and that will continue to serve Earth-orbiting missions. Similarly, while the Deep Space Network will no longer be an independent network, the integrated network will continue to contain large aperture ground stations with the highly sensitive receivers, powerful transmitters, and accurate frequency and timing needed to accomplish deep space communications and navigation.

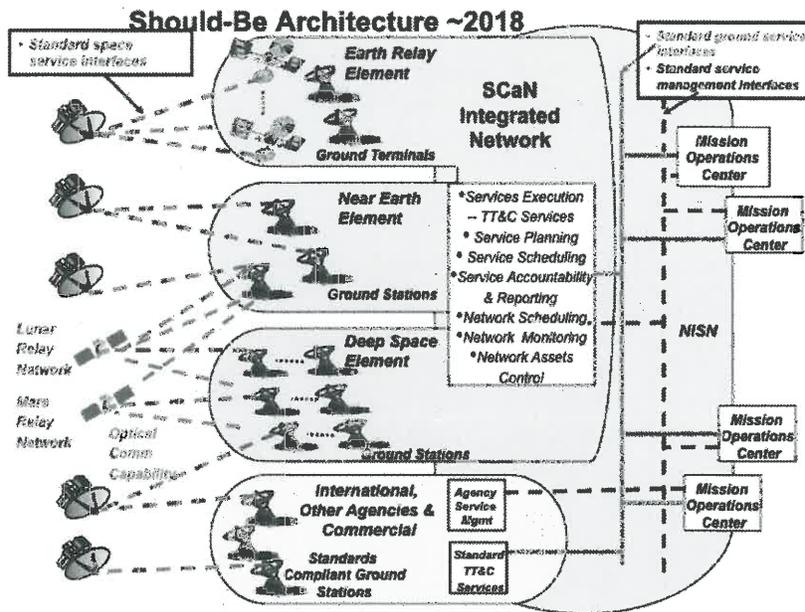


Figure 1.II1: "Should-Be" Architecture~ 2018

III. Scope of Work

The contractor shall provide subject matter expertise in SCA_N operational networks and development projects.

A. Requirements

The Contractor shall provide study services for the conceptual design and development of subsystems and systems, thereby participating in the identification of scientific objectives, mission requirements and technical concepts. In addition the contractor shall as requested, support risk identification, [REDACTED]

[REDACTED]. The contractor shall participate in Technical Trade Studies and other engineering analyses.

Final Task Order Report: The Contractor shall submit a final task order report, which documents and summarizes the results of the entire task accomplishments and work performed, including recommendations and conclusions based on the experience and results obtained. The final task order report shall include a narrative, including tables, graphs, diagrams, photographs, and drawings in sufficient detail to comprehensively explain the results achieved under the task order. The final task order report shall

also include the final incurred cost for the task order. The Contractor shall include a completed report documentation page (NASA Form SF-298) as the final page of each submitted report. The final task report for each task order shall be submitted within 30 calendar days after the completion of the effort under the task order.

The contractor shall submit electronically a Weekly Status Report documenting work completed during the current week and a review of planned work for the following week.

The contractor shall report costs in the monthly 533 at the WBS 4 level.

The contractor shall provide personnel to plan, conduct and/or participate in study analysis.

TS/SCI clearance is required for team members on this task for an important study defining the future scope for the next generation Space Based Relay Study for the Code 450 Exploration and Space Communications Division. Team members need to understand the full functionality and partner relationships within the network operational environment in order to effectively represent these requirements within the next generation TDRS study.

The contractor shall provide support of an important study defining the future scope for the next generation Space Based Relay Study for the Code 450 Exploration and Space Communications Division will also be included. Top Secret/Sensitive Compartmented Information (TS/SCI) level clearance is also required for team members supporting this task. Team members need to understand the full functionality and partner relationships within the network operational environment in order to effectively represent these requirements within the next generation TDRS study.

B. Management Reporting

Monthly Progress Reports: The Contractor shall submit a separate monthly progress report of all work accomplished during each month of contract performance.

Monthly Progress Reports shall address as a minimum the following: The Contractor shall address the accomplishments and progress of all work performed under each task order for the month being reported. Each task order shall be a separate report. The report shall be in narrative form and brief in content. The report shall include a description of overall task order progress to include technical accomplishments and status of deliverables.

Also the report shall provide a quantitative description of overall progress and identify any risks or problems, which may impede performance and proposed corrective actions. Also the report shall have a discussion of the projected work activities to be performed during the next monthly reporting period. The Contractor shall include a completed report documentation page (NASA Form SF-298) as the final page of each submitted report. Monthly reports shall be submitted by the 15th day following the month being reported. If the task order is awarded beyond the middle of a month, the first monthly report shall cover the period from task award until the end of the following month. 30 Days

C. Contractor Controlled Property

The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list (NPROP) of government owned property used by the Contractor on this Task Order. This support includes preparation and cooperation during property audits.

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

There are no Government furnished facilities, equipment, or software associated with this Task Order.

V. Material Procurement

The Contractor shall propose material that they identify as necessary to perform the work associated with this Task Order. The Task Monitor shall concur with the materials list prior to procurement.

VI. Travel Support

The contractor shall develop and coordinate a comprehensive travel plan and provide a monthly travel status report.

Travel shall be provided as necessary to support this effort.

Travel will include both domestic as well as foreign travel. The following are estimates: Domestic 5 trips International 3 trips.

VII. Deliverables

As described in Scope of Work above.

End of Task Order Statement of Work

GSMO TASK ORDER

Task No: #6
 Modification: 5
 Task Name: POES On-Orbit Vendor Support
 Task Period of Performance: 03/01/2012 to 02/29/2016
 Modification Period of Performance: 03/01/2015 to 02/29/2016
 GSMO SOW Reference: 3.1, 3.7

I. Task Order History

Description of current modification (Modification 5):
 [Redacted text block]

Mod #	Start	End	Brief Description
0	03/01/2012	02/28/2013	Initial task order statement of work.
1	12/18/2012		Administrative mod.
2		02/28/2014	No cost extension.
3		02/28/2015	No cost extension.
4	06/10/2014		Administrative mod.
5	03/01/2015	02/29/2016	Modification to extend the period of performance through February 2016.

II. Background

The Polar Orbiting Environmental Satellite (POES) Project utilized Lockheed Martin under contract NAS5-30350 to build and launch environmental satellites. This task is designed to obtain on-orbit support as detailed below.

[Redacted] has also established an agreement to receive services from [Redacted] in [Redacted] to provide the required support for [Redacted] Miniature Inertial Measurement Units (MIMUs) currently on-orbit aboard NOAA satellites.

- [Redacted]
- [Redacted]
- Independent Verification & Validation (IV&V) will be provided by NASA.
- The SOCC will not require vendor on-site support for uploading of changes.
- No more than two flight software patches per spacecraft will be required during the period of performance.
- The repair of up to two Standard Controls Processors (SCPs) will be required during the period of performance.

• [REDACTED]
[REDACTED] will perform monthly temperature corrections on LIM data, and will support telecons and respond to action items as needed.

III. Scope of Work

The Contractor shall provide support to on-orbit activities for NOAA-15 through NOAA-19 satellites that include on orbit anomaly investigations; Flight Software maintenance; Flight Software Simulators; troubleshooting the MIMUs on NOAA satellites; on-orbit RGYRO/GYE operations by performing FSW enhancements to improve pointing performance, both in RGYRO and in GYE.

- 1) On orbit anomaly investigations for NOAA-15 through NOAA-19 satellites.
 - a. Support shall include participation in monthly Polar Spacecraft Anomaly Review Board meetings, co-chaired by NOAA and NASA.
 - b. Provide/retrieve related documentation as requested.
 - c. Support Tiger teams as requested.
- 2) Maintain the proficiency of personnel and hardware in order to perform Flight Software Maintenance of the NOAA-15 through NOAA-19 satellites
 - a. Support shall include design, coding and testing of the changes, development of an uplink procedure and testing of the uplink procedure. All testing shall be done on the TIROS Emulator Processor (TEP).
 - b. Review and test flight software code changes and uplink procedures developed by NASA or NOAA as requested.
- 3) Maintain Flight Software Simulators hardware and software: Test and Training System (TTS) at SOCC and TEP at the spacecraft vendor facility.
 - a. Provide support in troubleshooting anomalies of the Command Encryption Modules.
 - b. Support the TTS working group.
- 4) The contractor shall provide to NOAA and NASA and their representatives written and/or oral information relating to the MIMUs on NOAA satellites especially relating to failure modes, observed anomalies, MIMU telemetry, and MIMU structure as requested. The contractor shall participate in teleconferences as requested.
 - a. The contractor shall evaluate MIMU telemetry data monthly.
 - b. The contractor shall perform temperature corrections on LIM data monthly.
 - c. The contractor shall evaluate approaches/concepts for using MIMU data for non-failed channels in a MIMU where a channel has failed.
 - d. The contractor shall suggest possible workarounds for a partial MIMU failure.
- 5) Support on-orbit RGYRO/GYE operations by performing FSW enhancements to improve pointing performance, both in RGYRO and in GYE. This includes tool development, ADACS analysis, FSW coding and test. End product will be new FSW code with associated database parameter updates.
- 6) Support on-orbit MIMU operations during GYE operations to collect and analyze 2 RLG MIMU data. Determine if 2 RLG MIMU data is usable for RGYRO operations. Develop required analysis tools to develop RGYRO algorithms suitable for 2 RLG MIMU use, perform required ADACS analysis, FSW coding and test. End product will be new FSW code with associated database parameter updates.

A. Management Reporting

The contractor shall provide monthly technical progress reports to the TM by phone or in writing. This report shall summarize the major accomplishments for the past month, the major plans for the upcoming month, open issues and/or baseline changes, and identify significant issues/concerns.

B. Contractor Controlled Property

The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list (NPROP) of government owned property used by the Contractor on this Task Order. This support includes preparation and cooperation during property audits.

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

The contractor assumes that all tagged and installation-provided GFE currently located at GSFC will be made available for performance of this task order (TO). All property required to perform this task is currently identified in the MOMS Property Database. Custodianship for this property will be the responsibility of this Task Order's organization with this function being performed under WBS element 1.2

V. Material Procurement

The Contractor shall propose material that they identify as necessary to perform the work associated with this Task Order.

VI. Travel Support

No travel required for this task.

VII. Deliverables

The Contractor shall provide the following deliverables in support of the Task Order:

Deliverable	Content	Schedule
Monthly Reports	<ul style="list-style-type: none"> • Technical Accomplishments • Status of deliverables and quantitative description of overall progress • Risks/problems and possible corrective actions • Projected work activities for following month 	No later than the 15 th day following the calendar month being reported
Final Task Order Report	<ul style="list-style-type: none"> • Comprehensive explanation of results <ul style="list-style-type: none"> ○ Narrative form ○ Includes tables, graphs, diagrams, photographs, and drawings ○ Recommendations and conclusions 	By Completion of the Task Order

End of Task Order Statement of Work

GSMO TASK ORDER

Task No: #7
 Modification: 11
 Task Name: LRO Mission Operations and Maintenance Support
 Task Period of Performance: 1 Mar 12 to 30 Sep 15
 Modification Period of Performance: 15 Oct 14 to 30 Sep 15
 GSMO SOW Reference: Section 3; 3.3, 3.4, 3.6, 3.7

I. Task Order History

Description of current modification (Modification 11): This is a modification to extend the LRO Operations task for another year and include subtasks for MPS and ITPS support (replacing GSMO TO 34 and SES TO 3002).

Mod #	Start	End	Brief Description
0	03/01/2012	09/30/2012	Initial task order statement of work.
1	03/01/2012	09/30/2012	Administrative Modification
2	10/01/2012	09/30/2013	Task order extension statement of work
3	11/13/2012	09/30/2013	Additional subtask for MIMU IRU support
4	4/22/2013	9/30/2013	Additional Scope to subtask 1
5	4/22/2013	9/30/2013	Administrative Modification
6	10/1/2013	9/30/2014	Task order extension statement of work
7	1/2/2014	9/30/2014	Additional Scope to subtask 1 and added Deliverable
8	3/1/2014	9/30/2014	Administrative Modification
9	5/1/2014	9/30/2014	Additional Scope and Deliverable to Subtask 1
10	10/1/2014	9/30/2015	Task order extension statement of work with two new subtasks
11	10/15/2014	9/30/2015	Additional Scope and Deliverable to Subtask 3

II. Background

Launched in June, 2009, the Lunar Reconnaissance Orbiter (LRO) mission completed its initial one-year exploration mission in September, 2010, at which time a two-year science mission began. At the end of September, 2012, the originally proposed science mission was completed. In August, 2012, the Director of the NASA Planetary Science Division authorized an extension of the science mission to the end of September, 2014. At the end of September, 2014, the extended science mission phase will be completed. In August, 2014, the Director of the NASA Planetary Science Division authorized a second extension of the science mission to the end of September, 2016.

This task order authorizes the contractor to provide mission operations and engineering support to the Space Science Mission Operations (SSMO) Project for the LRO mission, which includes all LRO space and ground segment assets under direct control of the SSMO project and the scheduling of assets controlled by JPL (DSN resources) and/or GSFC Code 450 (NENS, antennas and USN resources). Technical Direction will be provided by the Mission Director as assigned by the Mission Operations and Validation Branch. LRO Mission Operations will be performed at the LRO Mission Operations Center (MOC) in Building 32 at Goddard Space Flight Center. The assigned Contractor will interface with the SSMO Project, the LRO Project Science Team, Flight Dynamics Facility, GSFC Code 450, JPL/DSN, and each of the individual Instrument Science Operations Centers (SOCs).

III. Scope of Work

The Contractor shall provide all operations and engineering support required to perform LRO mission operations, anomaly identification and resolution, and delivery of science and engineering data products to the Instrument Science Operations Centers (SOCs) and other supporting GSFC organizations.

A. Requirements

Subtask 1:

- A.1. The contractor shall support various reviews and working groups, as necessary, by providing operations input to the review packages.
- A.2. The contractor shall support ground system releases and perform acceptance and regression testing as appropriate.
- A.3. The contractor shall maintain and adhere to Operations Agreements and ICDs between the LRO Science Operations Centers (SOCs) and the LRO Mission Operations Center (MOC).
- A.4. The contractor shall provide telephone and on-site technical support for LRO spacecraft simulator users upon request. Assume 2 hour per month telephone support per user, and three days of on-site support per user of the whole task period. The contractor shall maintain the User's Manual and configuration logs for the simulators.
- A.5. The contractor shall perform Orbiter operations.
- A.6. The contractor shall report anomalies to the SSMO Project as defined in Section VII, Deliverables. The contractor shall provide a Root Cause and Corrective Action (RCCA) report within 10 business days of any anomaly caused by a personnel error.
- A.7. The contractor shall provide AGS maintenance support.
- A.8. The contractor shall provide DSN Scheduling support.
- A.9. The contractor shall prepare materials and lead a Command Authorization Meeting (CAM) for all special and non-nominal operations activities.
- A.10. The contractor shall maintain BMOC equipment and test the BMOC systems and operations concept quarterly.
- A.11. The contractor shall maintain the DPS at WSC and other stations as required.
- A.12. The contractor shall maintain and support all MOC hardware and software (including Flatsat), including license renewals.
- A.13. The contractor shall provide System Administration support for MOC systems and adhere to all IT security requirements.
- A.14. The contractor shall compile periodic spacecraft trending reports to include key telemetry for all major subsystems and instruments, make note of all instances of limit violations and out-of-specification behavior. Reports shall be compiled on a weekly and quarterly basis and shall be reviewed by the SSMO Project and cognizant AETD personnel.
- A.15. The contractor shall investigate and resolve issues with DMS performance.
- A.16. The contractor shall develop, maintain, and provide configuration control of all LRO MOC documentation, flight procedures, STOL procs, mission database and appropriate ground segment software.
- A.17. The contractor shall provide coordination of all calibration and special operations with the LRO Project Science Team, the LRO MOT, and all Instrument SOC's, to include establishing instrument operational priorities as directed by the LRO Project Scientist or his representative. The contractor shall ensure all required subsystem analysis is completed for special operations requests, to include power and thermal analyses as

required for orbiter attitude slew requests, and that all constraints and restrictions are satisfied.

A.18.

Subtask 2:

B.1. The contractor shall provide on-orbit support of the LRO MIMU IRU. This support includes, but is not limited to, answering questions regarding on-orbit behavior, analyzing telemetry data to determine gyro life expectancies, supporting EEPROM refresh activities, anomaly resolution, etc. Requests will be made by a GSFC engineer to Honeywell for a given task. Honeywell shall provide the Task Monitor (TM) an estimate of the required hours necessary to complete the task and the TM shall provide confirmation of authorization to proceed.

Subtask 3:

- C.1. The contractor shall provide up to 16 hours per month (192 hours/year) of software engineering support for LROMPS system problems and/or fixes as needed.
- C.2. The contractor shall analyze all LROMPS system problems, if any and provide NASA with an estimate of time needed to fix the problem, and seek approval before any problems are fixed.
- C.3. The contractor shall renew the LROMPS Software Escrow Agreement.
- C.4. The contractor shall deliver an upgraded MPS system with the capability to ingest and process a new product from the LOLA Science Operations Center known as the LOLA8 Product. This upgrade will be based on the MPS release currently operating in the LRO MOC.

Subtask 4:

- D.1. The contractor shall provide software development and sustaining engineering support along with technical support pertaining to the ITPS system.
- D.2. The contractor shall analyze all ITPS system problems, if any and provide NASA with an estimate of time needed to fix the problem, and seek approval before any problems are fixed.

B. Management Reporting

The Contractor shall provide monthly status reports and reviews on the technical, cost, schedule and operational performance in accordance with the WBS to adequately describe the activities of the task to the Task Monitor. In addition, the Contractor shall provide a weekly report by the close of business each Wednesday. The weekly report will include a status of all ground and space segment anomalies, testing, troubleshooting, and/or configuration changes; status of special operations (past and planned); notes/issues/concerns. Before the end of the first week of each month, the Contractor shall report the science data capture statistics from the previous month.

C. Contractor Controlled Property

The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list (NPROP) of government owned property used by the

Contractor on this Task Order. This support includes preparation and cooperation during property audits.

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

Not Applicable

V. Material Procurement

The Contractor shall propose material that they identify as necessary to perform the work associated with this Task Order. The Task Monitor shall concur with the materials list prior to procurement.

VI. Travel Support

The Contractor shall propose travel that they identify as necessary to perform the work associated with this Task Order.

Specifically, the contractor shall support Project Science Working Group (PSWG) meetings twice per year and the travel requirements as described in the table below:

Travel Description	Approximate Time Frame
GSFC to JHU/APL for PSWG Meeting	October, 2015
GSFC to TBD for PSWG Meeting	February, 2015

VII. Deliverables

The Contractor shall provide the following deliverables in support of the Task Order:

ID	Deliverable Description	Due Date
1	Weekly Report	COB Wednesday each week
2	Escalation Plan describing pre-approved anomaly responses, S/C Subsystem Engineer Points-of-Contact, and management calling tree	Updates as necessary
3	Summary of Configuration Baseline	Updated quarterly
4	S/C Trending Report summarizing key telemetry for all major S/C subsystems and instruments, and identifying instances of limit violations and out-of-specification performance	Compiled weekly and quarterly
5	Anomaly Closeout Reports including root cause analysis of incidents, anomaly resolution, corrective actions/lessons learned, interim workarounds, and final resolution	By the 10 th business day following the

		resolution of Level I Anomaly
6	MIMU Data Analysis Reports, MIMU Anomaly Reports, and other verbal and written correspondence regarding MIMU operations. The contractor shall provide an estimate of hours to complete any requested task and shall not proceed until authorized by the TM.	As Requested and Approved by TM and GNC Representative
7	Calendar of events to include all spacecraft and instrument special operations and calibration activities. These activities will be scheduled in detail at least one week in advance and projected, to the extent possible, one month in advance	COB Thursday each week, showing the detailed schedule for the following week and projections for next three weeks following; covering a total of 4 weeks
8	Prepare ancillary data and deliver to the Navigation and Ancillary Information Facility (NAIF) in accordance with the Interface Control Document between the LRO MOC and the NAIF (451-ICD-001201)	December 15, 2014 March 15, 2015; June 15, 2015; September 15, 2015
9	Renew LROMPS Software Escrow Agreement	June 2015
10	LROMPS Release that includes LOLA8 product	October 30, 2014

End of Task Order Statement of Work

GSMO TASK ORDER

Task No: 8
 Modification: 7
 Task Name: ESMO Hardware Sustaining Engineering and Network Security
 Task Period of Performance: 11/01/2014 to 10/31/2015
 Modification Period of Performance: 5/01/2015 to 10/31/2015
 GSMO SOW Reference: Section 3.7.2 Ground System Sustaining Engineering Sub-elements 3.7.2.2 – 3.7.2.4

I. Task Order History

Description of current modification (Modification 7): This modification does not change the period of performance of this task. This modification adds additional hours to support TRMM Decommissioning and development upgrade of Network Management tools. This Modification includes the addition of Materials to support expansion of Collision Risk Management capabilities, migration of EOS Services from older hardware and upgrade of Windows Server from 2003 to 2008 R2, upgrade of old Network Devices, Addition of licenses for backups, VMware, Wyse thin clients, desktop software, hard drives, laptops, computer Accessories (keyboards and etc.) and miscellaneous spare parts. This Mod also includes Travel needs for Network upgrades at Svalbard, Norway.

Mod #	Start	End	Brief Description
0	03/01/2012	08/24/2012	Initial task order statement of work.
1	05/26/2012	05/24/2013	Extension of POP, addition of independent IT Security assessment, and Aqua/Aura Simulator enhancement analysis.
2	04/01/2013	11/30/2013	Extension of POP, and procurement of additional materials in the current period of performance through November 2013.
3	12/01/2013	11/30/2014	Extension of POP, and procurement of additional through November 2014.
4	04/15/2014	11/30/2014	Additional procurement of materials, increase in IT Security requirements for the existing POP, and addition of one trip.
5	11/01/2014	10/31/2015	Extension of POP, and procurement of additional material through October 2015.
6	1/01/2015	10/31/2015	Additional procurement of materials, increase in Network Management requirements for the existing POP.
7	5/1/2015	10/31/2015	Additional hours to support TRMM Decommissioning and Network System development, and additional materials. Mod includes Travel for Network upgrades in Svalbard, Norway.

II. Background

The Earth Science Mission Operations (ESMO) Project is responsible for operations, sustaining engineering and related re-engineering and development activities for the Earth Science satellites of Terra, Aqua, Aura, the Global Precipitation Measurement (GPM) Mission and the Tropical Rainfall Measuring Mission (TRMM). The ESMO Project also provides support to the Earth Observing-1 (EO-1), SORCE, QuikSCAT, CloudSat and GRACE missions, which are outside the scope of this Task Order.

The operations for the Aqua, Aura, Terra, GPM and TRMM missions are performed at either the prime operations centers at GSFC Bldg 32, or in the backup control centers in Bldg 13 and 3/14. The development, testing and simulations environments are distributed at GSFC and at some development team facilities. Hardware and network sustaining engineering, hardware maintenance, facility support, system administration, database administration and IT security support are necessary to ensure that these environments can satisfy mission requirements for the respective missions.

After the launches of the ESMO satellites, the ground system components were maintained at their launch hardware and operating system configurations. As these systems and networks were identified to have security risks, they were re-evaluated and went through a major modernization effort from 2008 through 2011. To avoid further degeneration of the ground systems, ESMO is working towards a plan of continuous upgrade to leverage new technology to minimize IT security risks, mitigate operations risks, and deploy automation to reduce recurring operational costs. The refresh of the equipment that was procured during the 2008 modernization effort is now underway.

This task is primarily funded by the collection of Earth Science Mission Operations (ESMO) missions of Aqua, Aura, Terra, GPM and TRMM. In most cases, the work on this task is in support of resources that are shared across all the missions. As a result, distinguishing subtasks by funding sources would cause additional accounting work that is of little value to the project.

III. Scope of Work

The Contractor shall provide hardware sustaining engineering, hardware maintenance (including vendor maintenance), network design, implementation & sustaining; network security to upgrade & maintain the existing ESMO and ESDIS network infrastructure; facility support; system administration; database administration; specifications for COTS products; provide IT security documentation and support; and strategic planning for system evolution and automation.

The contractor shall follow and, as necessary, update configuration management procedures for the controlled changes to the operational systems and networks. The systems and networks are in a maintenance mode using established practices and procedures that align with the applicable sections of 7150.2.

A. Requirements

The contractor shall provide support to satisfy the following requirements. Priorities of work items under each requirement, and schedule conflicts of work items across requirements shall be coordinated with the Task Monitor.

- A.1. Hardware Sustaining: The contractor shall provide hardware sustaining engineering and maintenance for all EMOS ground system components as defined in the following requirements:
 - a. Obtain, assess, install, and configure vendor hardware upgrades/replacements including COTS and GOTS as necessary to maintain the EMOS ground system.
 - b. Report on hardware obsolescence and provide engineering recommendations.
 - c. Detect, troubleshoot, and resolve system, hardware, and interface problems.
 - d. Coordinate with software, network Engineering, System Administration and database administration for the resolution of problems and upgrades.

- e. Provide analysis and impacts on DRs and Configuration Change Requests (CCRs) and participate in the Discrepancy Review Board (DRB) and EMOS CCR Review Board (ECRB).
 - f. Resolve discrepancy reports (DRs) and implement CCRs based on priorities.
 - g. Adhere to ESMO and element hardware configuration management (CM) practices for delivered changes.
 - h. Submit hardware transfer/move documents for property tracking & management.
 - i. Provide design updates, due to approved hardware changes, including as built design documentation, cabling, power, and network diagrams.
 - j. Provide hardware support and service for all EMOS equipment (including ESMO Development & Test Facility (EDTF), EOS Development Lab (EDL)).
 - k. Provide 24/7 on-call support for emergency on a best effort basis and support as required.
 - l. Build and Maintain development, test and operational environments, as required.
 - m. Provide vendor interface, support, coordination and escorting at GSFC.
 - n. Procure COTS products that include hardware and software in support of re-engineering and automation activities and security infrastructure changes for ESMO and ESDIS in support of Terra, Aqua, Aura, GPM and TRMM.
 - o. Procure vendor maintenance and/or support agreements as required. Obtain funding/approval from Government Task Monitor for new COTS/vendor support services as required.
 - p. Communicate any vendor provided renewal specific product information to the Government Task Monitor prior to service agreement renewal(s) decision.
 - q. Provide COTS software license management based on updates from Government Task Monitor.
 - r. Provide hardware equipment service for items without vendor service agreement support as directed and funded by Task Monitor.
 - s. Provide coordination for system video displays with GPM and EOS
- A.2. Network Management: The contractor shall provide network management for the EOS Backbone Network (EBNet) in support of ESMO and ESDIS as defined in the following requirements:
- a. Provide management and technical leadership of task assignment, prioritization, implementation, and completion of tasking assigned by the Task Monitor in support of ESMO and ESDIS
 - b. Lead Network Operations team personnel composed of GSMO and SES resources
 - c. Document current network configurations, match network requirements to the current implementation, and provide documentation of planned configuration changes, as required.
 - d. Perform baseline assessments of the EBNet including recommendations for improvements, as required.
 - e. Assess the impact of requirements changes by identifying, assessing, and reporting corresponding topology changes.
 - f. Participate in the design of the EBNet Local Area Network (LAN) and WAN requirements; maintain LAN design documentation; deliver the documentation, as required.
 - g. Participate in technical planning meetings and discussions regarding the EBnet, NISN network services implementation and operations, EOS Flight Projects, non-EOS research network organizations, and other external organizations to exchange technical and programmatic information.
 - h. Participate in the coordination, troubleshooting, and resolution of technical issues identified during implementation and testing of activities involving ESDIS systems and external organizations.

- i. Engineer network communications requirements (e.g., analysis, issue identification and resolution) for future missions based on project operations and interface requirements.
 - j. Coordinate review and maintenance of ESMO level 3 requirements, as necessary
 - k. Attend and support configuration control board meetings with NASA and other organizations, as required.
 - l. Participate in project planning and coordination of network implementation activities for EOS missions, and technical status reporting.
 - m. Development and deliver any new network design/topology jointly with SES contractor.
 - n. Manage network design and architectures, monitor network stability and activity; make recommendations for additional resources and equipment as necessary.
 - o. Maintain and renew IP Operational Network (IONET) gateway requests and waivers
 - p. Provide technical development support of significant modifications to existing network devices and support integration and interface of existing network equipment.
 - q. Stay abreast of changes to the backbone network, in addition to new technologies, to proactively plan for the future needs for the ESMO, TRMM and ESDIS network and to leverage the network in a direction that is compatible with NASA network architectures.
 - r. Network staff shall perform troubleshooting on any portion of the network, and to resolve problems covering protocol level, physical media, routing, switches and firewalls.
 - s. Network staff shall provide 24X7 emergency on-call support for network failures affecting production traffic flows on EBNet LAN and WAN.
 - t. Establish network baseline and detect and alert on deviations from the baseline from both a traffic and configuration perspective.
 - u. Integrate several IT related systems to provide a holistic view of health of the networking environment.
 - v. Provide network assets management through a relational database.
 - w. Provide and execute a EBNet network architecture change management process which involves ESMO and ESDIS customers via the COMET CM system.
 - x. Provide maintenance and training of the network traffic monitoring and analysis system.
 - y. Provide monitoring and reporting of network traffic.
 - z. Provide ongoing review and analysis of network traffic.
- A.3. Network Security and Administration: The contractor shall provide network security and server administration for the EOS Backbone Network (EBNet) in support of ESMO and ESDIS as defined in the following requirements:
- a. Implement ESMO and ESDIS IT Network security changes in response to changing project requirements
 - b. Maintain VPN concentrators configuration and procedures
 - c. Administer the VPN concentrators and RSA servers
 - d. Administer the KACE servers
 - e. Develop and maintain client software deployment procedures and provide them to the EOS System Administrators
 - f. Develop and maintain deployment architecture (i.e. groups, Admins, EOS contract facilities...)
 - g. Develop and adhere to reporting procedures per ESMO and Agency requirements
 - h. Work with EOS system administrators to resolve any KACE issues
 - i. Configure RSA ACE servers to perform RSA and Radius authentication

- j. Maintain the imported secure ID database from existing RSA server
 - k. Provide sustaining support of network devices to include VPN, RSA, and KACE servers
 - l. Network Administration staff shall assist troubleshooting on any portion of the network physical media, routing, switches and firewalls
 - m. Network Administration staff shall provide 24x7 emergency on call support of the ESMO network failures
 - n. If an external security audit of the ESMO infrastructure and systems is conducted, the contractor shall provide appropriate technical assistance in execution of the audit, and as prioritized by the task monitor will implement corrective actions to address any findings and recommendations
 - o. Remove or disable unnecessary network services
 - p. Configure network protocol parameters to prevent denial of service attack
- A.4. System and Database Administration: The contractor shall perform system and database administration as defined in the following requirements:
- a. User desktop administration support of all desktop and laptop computers on the administrative CNE network supporting ESMO
 - b. Provide Pacor-R, ERPS, MPS, ITPS and EDTF System Administration
 - i. With NASA's approval, install releases and patches of Operating Systems, Commercial Off-the-Shelf (COTS) software and other software products such as freeware
 - ii. Design, implement, and regulate system and network configurations
 - iii. Establish and implement a configuration management policy to ensure system and network integrity
 - iv. Manage system and network resources such as Central Processing Unit (CPU) usage, memory usage, disk space usage, Input/Output (I/O) activities, processes control and network loading
 - v. Monitor and tune system and network performance. Resolve potential performance issues by developing and implementing appropriate preemptive measures
 - vi. Automate routine and repetitive system administration tasks such as system monitoring and data collection by developing, scheduling and executing scripts
 - vii. Manage network printers, print queues/spooler and terminal devices
 - viii. Schedule and perform system backups and necessary recoveries
 - ix. Establish and execute disaster recovery plans
 - x. Coordinate with operations staff in scheduling and performing non-automated system administration tasks
 - xi. Research and recommend system/network software upgrades
 - xii. Centralize system monitoring and logging to eliminate the need to retrieve information from individual systems
 - xiii. Standardize software tools and utilities for system administration and security to avoid unnecessary system complexity
 - xiv. Respond to customer support requests
 - xv. Perform periodic audit of all OS and COTS software and maintain the vendor software database
 - xvi. Identify applicable software vendor maintenance licenses and assist in establishing and renewing licensing agreements
 - xvii. Configure and manage the operation of NetBackup to ensure the successful raw data archiving
 - xviii. Identify potential system problems and develop plans to avoid/mitigate them
 - xix. Provide 24x7 system administration for emergencies and scheduled critical activities

- xx. Take immediate action to troubleshoot and resolve critical system software and/or network problems
 - xxi. Work with relevant Goddard Space Flight Center (GSFC) network personnel to resolve any network or firewall problems
 - xxii. Create and maintain user log-in identifications, user accounts and password files
 - xxiii. Install the latest OS security patches
 - c. Provide Pacor-R and MIITS database administration:
 - i. Define database roles and enroll database users and control the access to the data
 - ii. Allocate system storage and plan future storage requirements
 - iii. Save the databases with automatic hot backup procedure to provide 24x7 database access
 - iv. Provide quick database recovery up to the minutes before system crash to minimize loss of data
 - v. Monitor the database sizes to prevent database fill-up and interruption of service
 - vi. Provide archival mechanism to keep the database in a manageable size
 - vii. Monitor degree of database fragmentation and apply remedial measures to optimize the database performance
 - viii. Validate the database integrity to ensure the overall database health
 - ix. Maintain and document the database configuration and the database management procedures in the database administration guide
 - x. Contact vendor for technical support and research Oracle issues using the online Oracle Metalink website
 - xi. The Pacor-R and MIITS implementations for TRMM are expected to be decommissioned by the end of September 2015 after TRMM passivation.
- A.5. System Security: The contract shall perform system security support according to the following list of requirements:
- -
 - a. Ensure compliance with NASA Procedural Requirement (NPR) 2810.1A for systems classified as Mission (MSN) for all ESMO IT systems, and all Federal Rules and Regulations and Agency/ESMO directives
 - b. Periodically review and update project security documents – security plan, contingency plan, risk management plan, assessment report, EOS Workbook, and Plan of Actions and Milestones (POA&M)
 - c. Periodically review system files and directories to ensure permissions are set properly
 - d. Periodically review system network services to ensure only necessary network services are running on systems
 - e. Periodically review system logging for any suspicious or abnormal activities
 - f. Run vulnerability-assessment tools periodically (such as TripWire, Tiger, COPS, snort, ISS Network Scanner, Nessus software) to identify security vulnerabilities or risks
 - g. Ensure network Transmission Control Protocol/Internet Protocol (TCP/IP) protocol parameters are set correctly to minimize network vulnerabilities and prevent denial of service attack
 - h. Review security notification E-mail for any related security vulnerabilities
 - i. Use encryption tunnel to prevent passwords, data and other sensitive information from crossing network in clear-text
 - j. Maintain the policies of the host-based or network-based filtering tools to restrict incoming and outgoing network traffic

- k. Maintain the configuration of the password aging and password tools to ensure passwords meet the password policy
 - l. Maintain system auditing and review auditing report to detect potential security breaches(Complete)
 - m. Provide support for the development and maintenance of EOS System Security Plans, perform EOS IT Security Assessments, create and maintain related IT Security Documentation, and ensure the compliance with NASA and Federal IT Security Requirements
 - n. Perform continuous monitoring tasks and support third-party A&A preparation
 - o. Perform NASA Security Assessment and Authorization Repository (NSAAR) migration from RMS to IT Security Center (ITSC) and ongoing/sustaining maintenance of IT Security documentation including Federal Information Security Management Act (FISMA) reporting (i.e. POA&Ms)
- A.6. Strategic Planning for System Evolution and Automation
- a. Work closely with NASA/ESMO and ESDIS leadership representatives and GSMO and associate contract personnel to ensure system evolution and automation activities meet NASA customer requirements and priorities.
 - b. Manage changes brought about by problems encountered, new and/or conflicting requirements, and reprioritization of plan objectives. To include the evolutionary upgrade of team developed tools and utilities.
 - c. Manage a fully integrated plan spanning two or more years, which is approved by ESMO leadership, routinely maintained, and successfully executed.
 - d. Identify improvements in technology that reduce recurring operational costs, and/or operations risks
 - e. Coordinate activities among the ESMO support groups to avoid schedule conflicts, and identify and optimize schedule dependencies
 - f. Apply a systems engineering approach to the various project automation efforts
 - g. Facilitate (plan, schedule, coordinate, track) project automation efforts across providers, developers, integrators, administrator and users
- A.7. TRMM Decommissioning Support
- a. Provide manpower to complete TRMM Network de-commissioning.
 - b. Provide manpower for physical decommissioning of equipment, furniture and associated physical components within the MOC and bMOC for TRMM.

B. Management Reporting

The Contractor shall provide monthly status reports and reviews on the technical, cost, schedule and operational performance in accordance with the WBS to adequately describe the activities of the task to the Task Monitor.

The contractor shall maintain and deliver a weekly materials procurement cost spreadsheet.

C. Contractor Controlled Property

The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list (NPROP) of government owned property used by the Contractor on this Task Order. The contractor shall track and maintain the records of all NASA property on-site at GSFC and off-site at contractor facilities that are associated with ESMO. This support includes preparation and cooperation during property audits.

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

The EMOS facilities and locations that require Maintenance and Sustaining Engineering support are identified below.

Facility	Locations
ETS/MPS	B32, Room C210H
ETSF	B32, Room C210 & B14, Room W224
PACOR-R	B32 Room S9 & TRMM MOC; B14 Room E249 & B13 Room 141
Terra Sim1 and Sim3	B32, Room C210
Terra Sim 2 & Flight Software Labs	B1, Rooms 12, 17, 19, 23, 25, 25B & 29
TRMM MOC and MPS	B32, Rooms C241 and C241A
GPM MOC	B32, Room N217
GPM FlatSat	B32, Room W030
GPM EMOC, Dev/Test	B3, Room S025E
ERPS	B32, Svalbard, Norway; Gilmore Creek, Alaska, Wallops Island, Virginia, and White Sands, New Mexico
ESMO Infrastructure servers	B32
EOC – Mission Operations System (EMOS). Includes Online Subsystem - Raytheon Eclipse Product with modifications, Mission Management Subsystem (MMS), Analysis and its replacement system ITPS	B32
EOC- Backup Mission Operations Center (BEOC)	B13
ESDIS (various network infrastructure)	B32
Code 420 Division Office	B16 and 16W

The contractor shall be responsible for maintaining the property list (hardware and software licenses) located in these facilities.

V. Material Procurement


 The contractor shall monitor hardware and software version obsolescence and propose material that will need to be procured proactively during the period of performance to avoid operational system outages and IT security risks. The procurement of these items is required to follow the process defined in the IT Procurement Information Circular, #13-04, dated June 6, 2013.

VI. Travel Support

The Contractor shall propose travel that they identify as necessary to perform the work associated with this Task Order. The contractor should plan for one 2-day trip to the EOS Development Lab (EDL) in Aurora, Colorado in August 2015 to perform hardware

maintenance and/or audit. The contractor should plan for a 9 day trip for one team member to Svalbard, Norway for Ground Station Network upgrades.

VII. Deliverables

The Contractor shall provide the following deliverables in support of the Task Order:

ID	Deliverable Description	Due Date
1	Hardware and other procurements for system maintenance/upgrades and vendor maintenance agreements	As required
2	Network, System Interface, and power diagram updates	As required
3	Updated System Security documentation - Risk Assessment Plans, SAIVs, Contingency Plans, EOS Workbooks, POA&M Report	As required

End of Task Order Statement of Work

GSMO TASK ORDER

Task No: 9
 Modification: 6
 Task Name: ESMO Software Systems and Requirements Management
 Task Period of Performance: 03/01/2012 to 01/31/2016
 Modification Period of Performance: 02/01/2015 to 01/31/2016
 GSMO SOW Reference: Section 3.7.2 Ground System Sustaining Engineering
 Sub-element 3.7.2.1 and 3.7.2.4

I. Task Order History

Description of current modification (Modification 5): This modification extends the current statement of work requirements for ESMO Software Systems and Requirements Management task for one year and adds scope for Global Participation Measurement (GPM) software sustaining engineering and testing, development and maintenance of conjunction avoidance tools, ESMO Project support including development of the ESMO Project Plan and documentation of the ESMO architecture.

Mod #	Start	End	Brief Description
0	03/01/2012	02/28/2013	Initial task order statement of work.
1	09/01/2012	02/28/2013	Modification for design, development and testing of defined content for ITPS and Pacor-R software releases.
2	03/01/2013	02/28/2014	Modification to extend the period of performance for one year with the removal of TRMM MOPSS support.
3	03/15/2013	02/28/2014	Administrative modification to change Branch Head from Chris Wilkinson to Eric Moyer
4	08/01/2013	02/28/2014	Modification to add scope to maintain EOS network baseline requirements database and to provide web page development and maintenance for ESDIS and ESMO tools
5	02/01/2014	01/31/2015	Modification to extend the period of performance through Jan 2015, and add development of a license tracking tool, and TRMM end of mission rehearsal support.
6	02/1/2015	01/31/2016	Modification to extend the period of performance through January 2016 and add scope for Global Participation Measurement (GPM) software sustaining engineering and testing, development and maintenance of conjunction avoidance tools, ESMO Project support including development of the ESMO Project Plan and documentation of the ESMO architecture.

II. Background

The Earth Science Mission Operations (ESMO) Project is responsible for operations, sustaining engineering and related re-engineering and development activities for the Earth Science satellites of Terra, Aqua, Aura, Global Precipitation Measurement (GPM) and the Tropical Rainfall Measuring Mission (TRMM). The ESMO Project also provides support to the Earth Observing-1 (EO1), SORCE missions.

The operations for the three Earth Observing System (EOS) satellites (Aqua, Aura, Terra), GPM and TRMM missions are performed using a collection of systems that comprise the ground systems for each mission. The development and testing of each of the ground system

components is distributed at GSFC and at contractor facilities. The key systems for each mission include:

Function	Product	Comment
Command and Telemetry	Eclipse – OnLine	Proprietary application delivered to ESMO as modified COTS under separate contract
Planning and Scheduling (EOS)	Mission Management System (MMS)	Maintained on this task primarily on-site at GSFC
Planning and Scheduling (TRMM)	Mission Planning and Scheduling System (MPSS)	Database support only provided under this task order. MPSS software is maintained for TRMM under a separate contract
Planning and Scheduling (GPM)	Mission Planning Subsystem (MPS)	Maintained on this task primarily on-site at GSFC
Precipitation Processing System (PPS) Interface	Mission Operations Center (MOC)-PPS Interface Software Subsystem (MPISS)	Development system moving from Code 583 Configuration control to GPM Dev/Test lab located in B3 and maintained on this task primarily off-site at the contractor facility.
Trending and Analysis	Integrated Plotting and Trending System (ITPS)	Maintained on this task primarily off-site at the contractor facility
Command and Telemetry Interface	EOS Real-time Processing System (ERPS)	Maintained on this task primarily on-site at GSFC
Science Data Processing (TRMM)	Pacor-R	Maintained on this task primarily on-site at GSFC
Data Distribution	Data Distribution System (DDS)	Maintained on-site under a separate contract.
Automated Maneuver Plan development	Automated Maneuver Planning Tool	Maintained at sub-contractor facility at Colorado Spring, CO.

After the launches of the ESMO satellites, the ground system components were maintained as independent mission ground systems. As the ground systems were identified to have security risks, they were re-evaluated and completed a major modernization effort from 2008 through 2011 during which the ground systems for Terra, Aqua and Aura were combined into common mission builds with mission unique configurations. To avoid further degeneration of the ground systems, ESMO is working towards a plan of continuous upgrade to leverage new technology to minimize IT security risks, mitigate operations risks, and deploy automation to reduce recurring operational costs.

This task is primarily funded by the collection of Earth Science Mission Operations (ESMO) missions of Aqua, Aura, Terra, TRMM and GPM. In most cases, the work on this task is in support of resources that are shared across all the missions. As a result, distinguishing subtasks by funding sources would cause additional accounting work that is of little value to the project.

III. Scope of Work

The Contractor shall provide software sustaining engineering, requirements management, database maintenance, and independent test team support for the Aqua, Terra, Aura, and TRMM missions.

The contractor shall follow and, as necessary, update configuration management procedures for the controlled changes to the operational software, requirements and databases. Since the software efforts on this task are purely in a sustainment mode, the complete implementation of the full set of CMMI processes would require more effort than would be of return benefit. As a result, the contract requirement for CMMI should be waived for this task; however the contractor

shall work with the Task Monitor to ensure that the processes for software sustainment align with the applicable sections of 7150.2.

A. Requirements

The contractor shall provide support to satisfy the following requirements. Priorities of work items under each requirement, and schedule conflicts of work items across requirements shall be coordinated with the Task Monitor.

- A.1. Software Development and Maintenance: The contractor shall perform corrective maintenance of operational custom software systems, propose enhancements for the purpose of technology refresh and maintenance cost reduction, make modifications to existing operational custom software systems, support test and integration of new or modified software, document software changes and problems, maintain operational parameter databases, and control software system configurations as defined in the following requirements:
 - a. Maintain the custom software components of:
 - Mission Management System (MMS) including interface to the Network Attached Storage (NAS)
 - Integrated Plotting and Trending System (ITPS)
 - EOS Real-time Processing System (ERPS)
 - Pacor-R (if required)
 - Data Distribution System (DDS)
 - Mission Planning Subsystem (MPS)
 - Mission Operations Center (MOC) – Precipitation Processing System (PPS) Interface Software Subsystem (MPISS)
 - Maneuver planning tools
 - Mission Incident and Information Tracking System (MIITS)
 - Other utilities and automation tools (i.e., PDB, PMDB)
 - b. Support the operational configuration of the mission applications including ensuring that the life of mission data is loaded onto the ITPS deployments.
 - c. Provide content and schedules for software releases including detailed schedules reflecting workload, task duration, and resource allocation. Also include dependencies and critical path in detailed schedule.
 - d. Resolve discrepancy reports (DRs) based on priorities set by the appropriate ESMO review board and according to staff skill mix.
 - e. Implement software and database enhancements based on priorities set by the appropriate ESMO review board and according to staff resource levels.
 - f. Detect, troubleshoot, and resolve system, software, database, and interface problems.
 - g. Participate in Discrepancy Review Board (DRB) and Project Configuration Management Board (PCMB) as required by each element.
 - h. Provide analysis and impacts on Discrepancy Reports and Configuration Change Requests (CCRs).
 - i. Adhere to ESMO and element software configuration management (CM) practices for delivered changes.
 - j. Update User's Guides, as necessary, to reflect approved software changes.
 - k. Provide design updates, as necessary, due to approved software changes including the "as built" detailed design document.
 - l. Adhere to element Functional and Performance Requirements Specification (F&PS), Interface Control Document (ICD), and Operations Agreement (OA) documents.
 - m. Provide user assistance.

- n. Coordinate with hardware and network maintenance for the resolution of problems, upgrades, and cross-impact items.
- o. Review and comment on relevant documentation.
- p. Recommend updates to documents, including those documents not directly updated in this task, that are deemed necessary by the software upgrades and changes performed in this task
- q. Coordinate across the ESMO elements the update and delivery of the EMOS Operations & Maintenance (O&M) Manual.
- r. Develop and provide training to the FOT including demonstrations of new capability and assisting FOT in modifying local procedures as required.
- s. Maintain NASA websites in support of ESDIS and ESMO tools and libraries. Ensure supported systems are secure and comply with NASA security regulations. Such tools include:
 - i. ESDIS Data Management Library
 - ii. EDOS Data Management Library
 - iii. Network Requirements System
 - iv. System Status database
 - v. EDOS Data Reorder Tools
 - vi. Waiver Request System
 - vii. Mission Operations Change request (MOCR) for TRMM
 - viii. EDOS Operations Log
 - ix. Data Loss Tool
 - x. Application License Tracking Tool
- t. Provide an ESMO offline maneuver planning tool that integrates JSpOC cataloged orbital debris avoidance to determine the optimum delta-V and generates the optimal maneuver ephemeris to mitigate potential close approaches. The tool should be database driven, run on a Windows machine, and have some probability calculation capability. The contractor shall utilize their team with proven experience in developing and deploying satellite collision risk management capability to the government. The contractor shall propose the use of an existing maneuver planning and risk mitigation tool which can be customized to meet the needs of ESMO. The Government shall have full use and access to the tool source code. Users of this tool include the Terra, Aqua, and Aura Flight Operations Teams; Mission Directors; and Conjunction FOT Lead. Specifics tasks to be performed include:
 - i. Develop detailed software requirements which will meet ESMO's operational needs
 - ii. Develop architecture design showing how proposed tools(s) fit into the EOS virtual environment
 - iii. Develop an operations concept
 - iv. Draft interface agreements with the JSpOC and Flight Dynamics System (FDS)
 - v. Develop software models to adapt the proposed tools for ESMO needs
 - vi. Develop and execute test procedures
 - vii. Quantify overall operational performance
 - viii. Develop training material and provide training on new tools
 - ix. Develop and test a method to generate a statistical representation of prediction uncertainty
 - x. Integrate configuration management requirements into the ESMO configuration management plans
- u.

- A.2. Requirements Management: The contractor shall support requirements management including supporting ESMO Science Interface Manager and Mission Directors in working with Instrument Operations Teams (IOTs) and FOTs to coordinate requirements changes, clarifications in requirements and resolution of deviations as defined in the following:
- a. Participate in the management of requirements, from a total-system perspective throughout the life cycle, perform analysis and develop management plans, as necessary
 - b. Maintain the EMOS software requirements in the MIITS ERIS database based on the results of ECRB
 - c. Support the ESMO Science Interface Manager and provide a science team interface for the EOS missions, including:
 - Coordinate special requests for information
 - Investigate and resolve technical problems identified by the science teams
 - Participate in Afternoon Constellation activities
 - Manage instrument operations agreements
 - Assist the FOT and the IOTs to coordinate, plan and implement non-nominal/special instrument activities and procedures, calibration activities, observational campaigns, etc. Verify that all such activities comply with established constraints
 - Resolve scheduling conflicts between instruments and/or spacecraft activities as they may occur.
 - Participate in command authorization meetings (CAMs), as well as other operational meetings requiring instrument representation/participation
 - Provide operational input to the instrument anomaly investigations.
 - Produce any needed operational products to troubleshoot and/or resolve instrument anomalies.
 - Support the IOTs in documenting instrument anomalies and resolution.
 - Produce data analysis and/or reports to document instrument health and performance and present results as needed.
 - Generate presentations and reporting documentation as required by the ESMO SIM and the ESMO Mission Director (MD).
 - d. Maintain EOS network baseline requirements database; track and maintain changes to interface requirements documents to ensure database properly reflects updated requirements.
 - e. The contractor shall assist the ESMO MD and Ground System Manager (GSM) in the maintenance of the baseline GPM requirements and interface documentation listed below. The government serves as lead author for document i, JAXA serves as the lead author for document xii, and the contractor is the lead author of the remaining documents.
 - i. GPM Ground System Requirements Document
 - ii. GPM MOC Level 4 requirements specification
 - iii. GPM Core Spacecraft Space-Ground ICD
 - iv. GPM MOC-Precipitation Processing System (PPS) ICD
 - v. GPM MOC-Flight Dynamics Facility (FDF) ICD
 - vi. GPM MOC-NASA Near Earth Network (NEN) ICD
 - vii. GPM MOC-SN Gateway ICD
 - viii. Robotic Systems Protection Program (RSPP) to GPM ICD
 - ix. GPM MOC-Conjunction Assessment Risk Analysis (CARA) ICD
 - x. GPM Intra-MOC ICD
 - xi. GPM MOC Design Specification

- xii. NASA-JAXA Mission Operations and Interface Specification (MOIS) – FOT document
 - xiii. GPM Ground System Configuration Management Plan – FOT document
- f.
- A.3. Database Maintenance: The contractor shall perform database maintenance as defined in the following requirements:
- a. Provide database administration (Access, Sybase, Oracle, Filemaker Pro, etc.) as necessary for operation of:
 - Pacor-R
 - MIITS
 - MMS
 - MPSS
 - Project Database (PDB)
 - EMOS Requirements Information System (ERIS)
 - ESDIS and ESMO libraries and tools identified in A.1 above
 - b. For ERIS support, provide biannual reports on requirements and deliveries and backups of the database, and provide additional reports on special request.
 - c. Implement database and related software tool enhancements based on priorities set by the appropriate ESMO review board and according to staff resource levels.
 - d. Detect, troubleshoot, and resolve system, software, database, and interface problems associated with the databases
 - e. Modify the database structure, as necessary, from information given by application developers and users
 - f. Maintain and monitor database export, archiving and deletion scripts
 - g. Create and execute database scripts that are needed for operations
 - h. Create, modify, and delete MIITS user and group accounts at the direction of the responsible NASA official via IdMax requests
 - i. Assist users with database problems and questions such as account password and access problems.
 - j. Provide database security/watchdog activities such as checking the active/inactive users and providing user activity lists
 - k. Develop and provide training to the FOT including demonstrations of new capability and assisting FOT in modifying local procedures as required.
- A.4. Independent Testing: The contractor shall provide test engineering support to the FOT as defined in the following requirements:
- a. Ensure the following systems and infrastructures that support the EOS FOT are fully verified prior to deployment into Operations:
 - Integrated Trending and Plotting System (ITPS)
 - MMS
 - Online
 - ERPS CRPs
 - ERPS GSIPs
 - Flight Dynamics System (FDS)
 - Constellation Coordination System (CCS)
 - Network Architecture
 - FOT Infrastructure tools
 - EOS Automation (EA)
 - MPS
 - MPISS
 - Maneuver Planning Tools
 - b. Maintain the overall ESMO Test Plan developed under the EMP effort
 - c. Analyze system and functional requirements, including mapping of requirements to test cases

- d. Re-use or modify existing FOT test procedures as applicable
 - e. Maintain and support the execution of test plans and procedures for individual systems/subsystems
 - f. Support Test Readiness Reviews for major deliveries
 - g. Maintain and execute integrated test plans and procedures based on operational requirements, processes, procedures
 - h. Support system and functional tests, including findings from testing activity, requirements that were verified, new DRs opened, and recommendation to accept or reject release
 - i. Support analysis, documentation, and reporting of test results
 - j. Develop and provide training to the FOT, including demonstrations of new testing capability and/or modified procedures, and assist FOT in modifying local test procedures as required.
 - k. Provide test planning and reporting support for TRMM Pacor-R releases to ensure full verification prior to deployment for operational use.
 - l. Update test procedures to include IT security testing at the application level.
- A.5. Project Support
- a. Facilitate the EOS Change Review Board (ECRB) preparing and distributing agendas and minutes
 - b. Facilitate the EMOS and TRMM Discrepancy Review Boards (DRBs) preparing and distributing agendas and minutes
 - c. Coordinate, track and update the contents and status of EMOS and TRMM DRs in MIITS
 - d. Coordinate, track and update the ESMO master schedule
 - e. Provide support for the management of schedules for specific activities such as automation.
 - f. Provide systems engineering support to the EOS Aqua and Aura Mission Director and the ESMO Science Interface Manager, as necessary. The systems engineers shall be technically qualified and sufficiently experienced to provide support, as follows:
 - Support the MD Collision Avoidance activities, such as coordinating/conducting a Debris Analysis working group to establish processes and agreements with other agencies to coordinate debris analysis/avoidance.
 - Conduct an Aqua/Aura COMM working group to resolve network-related issues and data losses.
 - [REDACTED]
 - [REDACTED]
 - Lead working groups in support of operations related issues, as needed.
 - Support the Anomaly Resolution Teams by coordinating actions and providing operations support and meeting/telecon summaries.
 - Generate presentations and reporting documentation (weekly, monthly, formal reviews) as required.
 - g. Provide systems engineering support to the ESMO Project. The systems engineer shall be technically qualified and sufficiently experienced to provide support, as follows:
 - Lead working groups in support of ESMO ground system efforts such as requirements analysis, development, sustaining engineering, evolution of system components, deployment, and testing.
 - Coordinate and track progress of activities for assigned ESMO ground systems.
 - Develop and maintain schedules.
 - Generate presentations and reporting documentation (weekly, monthly, formal reviews) as required.

- h. Support review and documentation of the enterprise architecture, including:
 - Identify all flows and system interfaces
 - Search for potential security concerns
 - Update architecture and dataflow diagrams
 - Review configuration management and software baselines
- i. Provide technical writing and documentation support for Earth Observing System (EOS) Mission Operations System (EMOS) Project plans and documentation, which includes:
 - developing and finalizing the ESMO Project Management Plan in compliance with NPR 7120 (NASA Space Flight Program and Project Management Handbook)
 - coordinating input, data, and peer reviews from multiple subject matter experts
 - adherence to ESMO Configuration Management (CM) procedures for documentation (ESMO Project CM Procedures, 428-PG-1410.2.2)

A.6. TRMM Mission Rehearsal Management

Perform Passivation and Descent Activities Rehearsal Management and implementation with the TRMM Flight Operations Team, the TRMM Flight Software Sustaining Engineering Team and the TRMM Flight Dynamics Team, where;

- Descent Activities are the specific and unique spacecraft bus activities that the Precipitation Radar (PR) instrument would like to conduct during descent from 402.5km to 335km. This will occur by natural orbit decay once fuel is depleted.
- Passivation is the final phase of the mission when the TRMM observatory is turned off and components are passivated. This is to happen when the descent of TRMM reaches 335km.

The Contractor shall provide rehearsal management support that is scheduled to be completed in July 2014 and includes:

- a. Provide Mission Operations support necessary to organize, plan and oversee the implementation of the Passivation and Descent Activities Mission Rehearsals at the direction of the Mission Director.
- b. Deliver the Mission Rehearsal products needed to document and successfully execute the Mission Rehearsals. These are detailed in the deliverables section, and include Mission Rehearsal Plan, Readiness Review Presentations, Rehearsal Scripts and Rehearsal Debrief Presentations.
- c. Document any deviations from the Mission Rehearsal script and document any system or team deficiencies that would impact a safe execution of the Passivation or Descent Activities on orbit.
- d. Coordinate with the Mission Director for scheduling of the Mission Rehearsals.
minutes

B. Management Reporting

The Contractor shall provide monthly status reports and reviews on the technical, cost, schedule and operational performance in accordance with the WBS to adequately describe the activities of the task to the Task Monitor.

The Contractor shall meet with the Task Monitor weekly to discuss task status and schedule of deliverables, and shall meet with the Task Monitor on an as needed basis to review technical items such as build contents, test approaches, and design implementations.

C. Contractor Controlled Property

The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list (NPROP) of government owned property used by the Contractor on this Task Order. This support includes preparation and cooperation during property audits. The primary responsibility for maintaining property tracking records for ESMO will be on GSMO Task Order 8.

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

The government shall provide contractor access to ESMO facilities for the development, test and deployment of software systems. The equipment and facilities are located on-site at GSFC as defined in the following table.

Facility	Locations
EDTF MMS Development and Test	B13, Room 141
ETSF	B32, Room C210 & B14, Room W224
PACOR-R	B32 Room S9 & TRMM MOC; B14 Room E249 & B13 Room 141
TRMM MOC	B32, Rooms C241 and C241A
TRMM Back-up MOC	B14, Room E239B
ERPS GSIPs	Svalbard, Norway; Gilmore Creek, Alaska, Wallops Island, Virginia, and White Sands, New Mexico
ESMO Infrastructure servers	B32 Room E139
EOC – Mission Operations System (EMOS). Includes Online Subsystem – Raytheon Eclipse Product with modifications, Mission Management Subsystem (MMS), Analysis and its replacement system ITPS, Data Distribution System (DDS), ERPS CRPs and test GSIPs, EOS Automation Integration and Test	B32 Room C210
Backup Mission Operations Center (BEOC)	B13 Room 141
ERPS Development and Test	B32 Room S009
GPM MOC	B32 Room N217
GPM FlatSat	B32 Room W030
GPM EMOC, Development and Test	B3 Room S205E
Maneuver Planning Tools	B32 Room C210

V. Material Procurement

The Contractor shall forward to the Task Monitor for ESMO Hardware Sustaining Task (GSMO Task Order 8) any material that they identify as necessary to perform the work associated with this Task Order. No materials will be procured under this Task Order.

VI. Travel Support

The Contractor shall propose travel that they identify as necessary to perform the work associated with this Task Order.

For budget planning, the contractor shall propose support for the assumed travel requirements as described in the table below:

Travel Description	Approximate Time Frame
MOWG support – Tokyo	September 2015
Maneuver planning Requirements verification	February 2014
Maneuver planning design and database discussion	April, 2015
Deployment support of Automated Maneuver Planning Tool	July, 2015
Training and follow-on Requirements Activities	August, 2015

VII. Deliverables

The Contractor shall provide the following deliverables in support of the Task Order:

ID	Deliverable Description	Due Date
1	Software System Deliveries: <ul style="list-style-type: none"> - Source and executable code - Release Notes - Build and Install procedures - Design documentation - Documentation of interfaces - EMOS O&M Manual updates - Updated user's guide (if necessary) 	Per each delivery
2	Testing Documentation: <ul style="list-style-type: none"> - Test records - Test Report 	At ORR ORR + 2 weeks
3	Process Reviews <ul style="list-style-type: none"> - Content Review - Design Reviews - Ops Readiness Review - Test Readiness Review - Pre-ship Review 	As necessary for each software system release
4	List of maintained software applications with operational release number	March 30, 2013 (and updates upon request)
5	Documentation for Maneuver Planning Tool <ul style="list-style-type: none"> - Operations Concept - Release 1 Delivery - Final Requirements document - Final Design document - ESMO-FDS ICD - ESMO-JSpoc ICD - Training 	April 2015 July 31, 2015 August 2015 August 2015 August 2015 August 2015 August 2015

For planning purposes, the contractor should follow the primary software system release schedule of:

System Release	Schedule
ITPS 4.4 (Terra/Aqua/Aura)	March 2015
MMS 21.0	February 2015
ITPS 4.5 (Terra/Aqua/Aura)	September 2015
MMS 22.0	July 2015
ITPS 4.2 (GPM)	November 2015
MPS 5.3	April 2015
MPISS	May 2015
Maneuver Planning Tools Release 1	July 2015
MMS 23.0	January 2016

End of Task Order Statement of Work

GSMO TASK ORDER

Task No: #010
 Modification: 08
 Task Name: TRMM Flight Operations Support
 Task Period of Performance: 03/01/2012 to 08/31/2015
 Modification Period of Performance: 03/01/2014 to 08/31/2015
 GSMO SOW Reference: 3.3, 3.4, 3.6, 3.7

I. Task Order History

Description of current modification (Modification 8): Added required travel to the GSIM #26 in Tokyo, Japan.

Mod #	Start	End	Brief Description
0	03/01/2012	02/28/2013	Initial task order statement of work.
1	03/01/2012	02/28/2012	Added required travel to the JPST Meeting in Tokyo, Japan
2	03/01/2013	02/28/2014	<ul style="list-style-type: none"> • Extension of Task Period of Performance into second contract year. • Added Flight Operations Plan deliverable (3.13, A.3.50 & VII, ID 15). • Altered FOT to Contractor in sections A.3.49. • Corrected capitalization in A.5.4.
3	03/01/2013	02/28/2014	• Changed Program Manager from Chris Wilkinson to Eric Moyer
4	03/01/2013	02/28/2014	• Added required travel to the Descent Activities Operations Meeting in Tsukuba, Japan
5	03/01/2014	02/28/2015	• Extension of Task Period of Performance into third contract year.
6	03/01/2014	02/28/2015	• Added required travel to the Descent and Passivation Activities in Tokyo, Japan.
7	03/01/2015	08/31/2015	• Extension of Task Period of Performance for six (6) months into third contract year. Added deliverables "Final Spacecraft Operations Report" and "Operations Archive".
8	03/01/2015	08/31/2015	• Added required travel to the GSIM #26 in Tokyo, Japan.

II. Background

The GSFC's Earth Science Mission Operations (ESMO) Project (GSFC Code 428) is responsible for mission operations and mission support services for the Tropical Rainfall Measuring Mission (TRMM).

The Mission Director will provide technical leadership for all mission operations activities, and will be the Task Monitor. All issues, technical, financial and administrative, related to this task shall be coordinated with the Task Manager.

The Contractor shall perform mission operations of the TRMM spacecraft. Mission operations for the TRMM mission includes console operations to monitor the health and safety of the spacecraft; mission planning and scheduling to plan and schedule routine and special mission operations activities; spacecraft subsystem engineering to perform day-to-day analysis of the spacecraft

health and science payloads; responding to anomalies, events, or special scheduled mission operations activities, and performing level-zero science data capture, processing, product distribution, and data analysis. Overall the TRMM mission operations contractor will be responsible for the health and safety of the spacecraft.

The work associated with this Task Order is supported through only one funding source. There are no subtasks.

The TRMM Spacecraft is expected to be passivated in April 2015, and operations will cease by May 2015. Operations support will be required to assist ESMO in compiling the TRMM Operations Archive and the Final Spacecraft Operations Report. This is expected 3 months past passivation.

III. Scope of Work

The Contractor shall perform flight operations of the TRMM spacecraft consistent with established mission operations standard operating procedures and level-zero science data processing using Pacor-R.

A. Requirements

1 Management

- A.1.1 The Contractor shall provide mission management support necessary to ensure staff availability, competence, reliability, performance, and reporting of the work force required to operate the TRMM spacecraft and associated ground system elements.
- A.1.2 The Contractor shall perform technical management of the Mission Operations Center (MOC) that is utilized to conduct flight operations and of Pacor-R that is utilized to conduct data processing.
- A.1.3 Technical management activities shall include, but not be limited to, the following functions:
- A.1.4 The Contractor shall coordinate with Task Monitor for operations scheduling, budgeting, and staffing.
- A.1.5 The Contractor shall plan, manage, and coordinate TRMM Operations and related functions specified within this task. This includes ensuring that spacecraft operations meet the requirements of this SOW, and includes performing appropriate staffing, scheduling, and budget planning activities.
- A.1.6 The Contractor shall coordinate configuration tracking for all mission operations changes with the TRMM Mission Director.
- A.1.7 The Contractor shall participate in engineering studies and recommend system and procedural (hardware/software upgrades, staffing adjustments, procedure modifications, facility enhancement, etc) changes to meet future mission requirements and/or improve ongoing operations.
- A.1.8 The Contractor shall maintain awareness of TRMM mission development and maintenance activities.
- A.1.9 The Contractor shall participate in all TRMM Discrepancy Review (DR) Board and Project Configuration Management Board (PCMB) Meetings. Provide analysis and impacts on Discrepancy Reports (DRs) and Configuration Change Requests (CCRs) as required and with approval of the Mission Director.

- A.1.10 The Contractor shall participate in Anomaly Review Boards and other regular activities related to spacecraft operations.

1.2 Staff Allocation, Expertise, and Level of Effort

- A.1.11 TRMM mission operations activities require expertise in on-console operations, spacecraft engineering data analysis, generation of operations scripts, level-zero science data processing and analysis, and reporting. The contractor shall provide the proper staffing levels to safely and effectively operate the mission.
- A.1.12 Due to the reduced nature of staffing for mission operations of older missions, the contractor shall ensure prompt staff replacement of departing certified staff. This should be completed through efficient government approved training and certification process and also leveraging and utilizing upcoming talent of local educational institutions in the operations team.

1.3 Management Reporting

- A.1.13 The Contractor shall provide monthly status reports and reviews on the technical, cost, schedule and operational performance to adequately describe the TRMM mission operations and mission support services activities that were provided to the ESMO Project.
- A.1.14 The Contractor shall provide monthly financial report to the Mission Director and the ESMO Project unique to TRMM. Reporting will be using the 533M and 533Q form level of information to allow long-term budget planning.

1.4 Operations Facilities

- A.1.15 The TRMM Mission Operations Center (MOC) is currently located in Building 32, with a backup Mission Operations Center (BMOC) facility located in Building 14 at GSFC and another facility at Capitol College. From time to time the Contractor shall to relocate the FOT, and any other required portions of the mission operations workforce, to the BMOC at the direction of the Mission Director.
- A.1.16 The Contractor shall perform proficiency flight operations testing in the BMOC.
- A.1.17 The Contractor shall maintain the BMOC systems to provide a ready capability for relocation of operations and resumption of nominal flight operations within 2 hours of the loss of Building 32's MOC flight support functionality.
- A.1.18 The Contractor shall exercise the BMOC on a weekly basis to demonstrate support capability and readiness status.
- A.1.19 Pacor-R data processing prime system is located in Building 32, Room S009 and is operated from the EDOS Operations area in Building 32 Room C210. The Pacor-R backup system is located in Building 13, Room R141. The Contractor shall exercise the backup Pacor-R system at least monthly to ensure proficiency of staff and facilities.

1.5 Risk Management and Best Practices

- A.1.20 The Contractor shall apply continuous Risk Management and Best Practices compliant with NPR 7120.5. In addition, the Contractor shall comply with all Agency, Center, and ESMO directives regarding Risk Management and Best Practices.

1.6 Information Technology Security

- A.1.21 The Contractor shall apply Information Technology (IT) security standards as defined by NPR 2810.1 for systems classified as Mission (MSN) for all ESMO IT systems. In addition, the Contractor shall comply with all Federal Rules and Regulations and

Agency/ESMO directives. The TRMM MOC is classified as an MSN system.

1.7 Organizational Interfaces

A.1.22 The Contractor shall interface with all MOC service providers, and customers as specified in the Operations procedures, Interface Control Documents (ICDs) and Operations Agreements (OAs). This includes interfaces with the ESMO, NENS, METS, and MSES-II contracts.

A.1.23 The Contractor shall also interface with GSFC Security Office as required.

2 Spacecraft Operations

2.1 Coordination with other entities

2.1.1 Coordination with PACOR:

A.2.1 The Contractor shall coordinate all activities related to science data acquisition and capturing to verify proper data acquisition for level-zero processing, distribution and archiving.

2.1.2 Coordination with TSDIS/PPS:

A.2.2 The Contractor shall coordinate all activities related to the Precipitation Radar (PR) science data acquisition and instrument activities.

2.1.3 Coordination of Non-nominal and/or Special Instrument Activities

A.2.3 The Contractor shall inform the Mission Director regarding any instrument team request to perform special or non-nominal activities.

A.2.4 The Contractor shall support instrument teams in testing and checking of new or modified procedures.

A.2.5 Simulations shall be performed to the extent possible prior to the uplink of any new commands/procedures.

A.2.6 Any activity requiring the concurrence of the instrument teams and/or Project Scientists shall be coordinated with the Mission Director.

2.1.4 Coordination with External Users and/or Science Teams:

A.2.7 The Contractor shall inform and coordinate any specific payload activities with the instrument operation team. This includes analysis, consultation and resolution of any anomalous events or out of limit conditions observed during analysis and real-time events.

2.2 Planning and Scheduling

A.2.8 The Contractor shall secure adequate communications services through the Ground Network (GN) and Space Network (SN), or other government provided communications networks for the delivery of spacecraft and instrument telemetry to the ground and the commanding and tracking of TRMM spacecraft.

A.2.9 The Contractor shall ensure a conflict-free schedule of activities for all spacecraft contacts, spacecraft activities, and instrument operations that is consistent with the overall TRMM mission operations requirements.

2.3 Real-time and Support Operations

A.2.10 The Contractor shall support all real-time operations of the TRMM spacecraft from both ground and space networks, as necessary to meet mission objectives. Real-time operations consist of those activities that are necessary to support direct communication with the spacecraft and include: telemetry, tracking and command

activities, health and safety monitoring, orbital maintenance maneuvers, system configuration, housekeeping telemetry processing, command load uplink and verification, onboard table and memory load/dump operations, and management of the Solid State Recorder (SSR) to capture and downlink all science and spacecraft engineering data. Support operations are those offline activities that are necessary to support the safe and nominal operation of the spacecraft and include, but not limited to: planning and scheduling, stored command load generation, maneuver planning support, and any spacecraft maintenance activity.

3 Spacecraft Engineering

3.1 Staffing

- A.3.1 The Contractor shall provide a dedicated staff of experts to monitor and maintain the health of the TRMM spacecraft, collect telemetry data and process all health and status telemetry data to assess the performance of each spacecraft subsystem and instrument.
- A.3.2 The off-line engineering staff shall be the technical leadership of the Flight Operations Team (FOT) and shall be responsible for ensuring all aspects of spacecraft performance and safety.

3.2 Anomaly Detection, Isolation, Analysis, Recovery and Reporting

- A.3.3 The Contractor shall monitor and maintain the health of the TRMM spacecraft by collecting telemetry data and processing all health and status telemetry data and assess the performance of each spacecraft subsystem and instrument.

3.2.5 Event Reports

- A.3.4 In response to any deviation to normal spacecraft operations, the Contractor shall immediately issue an Event Report (ER) to document the deviation. ERs are to be issued immediately upon detection, within operational constraints.
- A.3.5 The ER shall contain the following information:
- Time of Anomaly
 - Pass information
 - Service information
 - Problem and impact description
 - Spacecraft Lat/Lon
 - Location of failure
 - Cause if known
 - Anomaly description
 - Action taken
- A.3.6 The ER is an informational notification, and not a problem report or other discrepancy report to be tracked to full closure. However, some ERs will necessarily lead to ground system, spacecraft or other problem report to be tracked in the respective process. ERs that are deemed to be Operator Errors will be identified as such and tracked by the contractor.
- A.3.7 In response to any spacecraft anomaly the Contractor shall execute government approved standard operating procedures and and/or spacecraft commands.

3.2.6 Spacecraft Anomalies

- A.3.8 In response to spacecraft anomalies that do not have a pre-approved response and the spacecraft is not in imminent danger of loss of mission, the Contractor shall defer sending corrective action spacecraft commands without the approval of the Mission

Director. The Mission Director may require the Contractor to conduct anomaly investigations as needed to assess on-orbit problems and formulate a response using the appropriate in-house and corporate expertise.

- A.3.9 An anomaly is defined as the occurrence of any event that causes the spacecraft, its instruments, or any of the ground-based support systems to perform in a non-standard manner during any normal or special operation. An anomaly may occur in either on-orbit or ground-based elements of the mission operations system.
- A.3.10 The Contractor shall be responsible for support of anomaly resolution activities as defined in this section.
- A.3.11 The Contractor shall report all anomalies that occur to the spacecraft, the instruments, the mission operations facilities, or other areas that impact the operation or safety of personnel and equipment.
- A.3.12 The anomaly report shall be in accordance with NASA/GSFC's Code 400 Flight Programs and Projects Directorate Anomaly Notification Procedures and Guidelines and ESMO's Anomaly Management Procedures.
- A.3.13 This report shall be made to the Mission Director within one business day; unless the anomaly is mission threatening in which case the Mission Director shall be notified immediately.
- A.3.14 A summary of the anomaly shall be received via e-mail within one business day. The definition of an anomaly for the operational phase of the mission is as follows:
- Any spacecraft or ground system component not operating or functioning as expected does not perform as expected, or exhibits behavior considered being different than normal.
 - Any flight operations procedure, or stored command activity, that produces unexpected results or fails to produce its desired results.
 - Any yellow or red limit violation on any telemetry parameter, or status flags in telemetry, which indicate an error has occurred, or abnormal trends in telemetry data.
 - Any configuration or state of the spacecraft that is unexpected or potentially harmful to the health and safety of the spacecraft or instruments.
 - Any other abnormal event or behavior that could potentially indicate a malfunction of the flight or ground system hardware or software.
- A.3.15 The Mission Director, or designee, is responsible for generation of all formal NASA Anomaly Reports. For each anomaly the Contractor shall generate an Anomaly Closeout Report.
- A.3.16 This report shall describe how the anomaly was discovered, what were the results of the anomaly investigation, the impact of the anomaly, any interim work-around (if required), and the final resolution of the anomaly.
- A.3.17 The Anomaly Closeout Report shall be provided to the Mission Director within 10 business days of resolution of the anomaly.
- A.3.18 The Contractor shall maintain a database of all spacecraft and ground-based flight operations anomalies.
- A.3.19 The Contractor shall report on the status of all open anomaly investigations at all monthly status reviews or as requested by the Mission Director.
- A.3.20 As required, the Contractor shall enter spacecraft anomalies on a case-by-case basis into the GSFC Spacecraft Orbital Anomaly Reporting System (SOARS).

3.2.7 Support for Resolution of On-Orbit Anomalies

- A.3.21 The Government is responsible for maintaining and managing an Anomaly Support Team (AST). In addition, the Government shall be responsible for any augmentation of technical staff to support anomaly analysis. The AST shall have lead responsibility for analysis of anomalies that are determined to be the result of the performance of an on-orbit system or subsystem, or a result of a procedural error. The AST is also responsible for development of a corrective action recommendation to be given to the Mission Director. The Contractor shall participate in the analysis of such anomalies in support of the AST, when requested by and under the oversight of Mission Director.
- A.3.22 The Contractor shall implement corrective actions as authorized by the Mission Director.

3.2.8 Support for Resolution of Ground-Based Anomalies

- A.3.23 Under the oversight of the Mission Director, the Contractor shall have responsibility for analysis and resolution of anomalies that are determined to be the result of performance or failure of a ground-based system or subsystem, or a result of procedural error.

3.3 Performance Analysis and Trending

- A.3.24 The Contractor shall collect and store the housekeeping and health and safety data from the TRMM spacecraft.
- A.3.25 The Contractor shall also process, trend and analyze these data on a short-term, long-term and periodic basis depending on the specific parameters and objectives.
- A.3.26 The Contractor shall identify any parameters that might demonstrate unacceptable performance degradation with time and trends that could lead to future performance loss or degradation of flight hardware in the Weekly Spacecraft Performance Report.
- A.3.27 In addition, special reports shall be generated as needed to support anomaly investigations, maneuver planning, and any special reports requested by the Mission Director.

3.4 Spacecraft & Instrument Off-Line Engineering Support

- A.3.28 The Contractor shall provide off-line engineering support for the spacecraft and its instruments for all special engineering activities and contingency operations.
- A.3.29 Off-line, in-depth analysis shall be performed in order to validate spacecraft subsystem and instrument performance as well as to investigate any anomalies or trends that may occur.
- A.3.30 This includes support to investigation of any instrument anomalies.
- A.3.31 The contractor shall maintain a set of configuration controlled flight operations procedures, which include procedures for nominal, special and contingency operations.
- A.3.32 The Contractor shall maintain and update documentation, plans and procedures as required supporting mission operations and mission support activities.
- A.3.33 The Contractor shall maintain and update the spacecraft manufacturer provided documentation.
- A.3.34 The Contractor shall maintain and update flight team training plans and provide the necessary training as classroom training, training exercises, and simulations.
- A.3.35 The Contractor shall develop and maintain spacecraft models and analysis tools as

required for off-line engineering support of normal and special flight operations activities and contingency analysis activities.

3.5 End of Mission Activities

A.3.36 The Contractor shall develop and maintain, on an annual basis, all End of Mission materials, including the TRMM Interim End of Mission Plan, End of Mission Scripts (including all maneuvers and passivation activities), End of Mission Rehearsal documentation, and End of Mission Review materials.

3.6 Support Ground System Upgrades and Technology Refresh Activities

A.3.37 The contractor shall participate and provide support to all activities related to ground system changes or technology refresh activities.

A.3.38 The Contractor shall assess the potential level of impacts and risk to normal mission operations activities for all ground system changes.

A.3.39 The Contractors shall raise any issues of concerns and risk to the Mission Director as results of changes to the ground system.

3.7 Instrument and Science Support

A.3.40 The Contractor shall support all instruments and sciences activities related to calibrations, anomaly resolution, reconfiguration and planning of instrument sciences activities

3.8 Configuration Management Process

A.3.41 The Contractor will follow established configuration management processes for all FOT products including documentation of new or updated products, peer review and internal sign off.

A.3.42 The products will be presented to the Configuration Manager at the in-house Configuration Control Board meeting prior to being finalized.

3.9 Automation Support

A.3.43 The contractor shall support automation development and ground system implementation activities.

3.10 Proficiency Simulations

A.3.44 The contractor shall support at least one annual simulation of a recovery from a safe mode. Exercising of the team, system and products is essential to maintain readiness, if needed.

3.11 Flight Operations Mission Library

A.3.45 The contractor shall maintain a library of current operating documents and reports for the TRMM mission. This library shall serve as a repository for:

- The mission history as captured in the weekly, monthly and anomaly reports
- Flight operations training materials and certification records
- On-console reference materials for flight operations activities

A.3.46 The contractor shall maintain an archive of all flight operations procedures, activity plans, timelines, and Command Authorization Meeting (CAM) presentations.

3.12 Ground System Engineering Support

A.3.47 The Contractor shall work closely with the Ground Systems Maintenance and Operations Contractors, provided under separate contracts and/or ESMO Tasks, to ensure that planned IT Security-related ground system re-engineering activities and

planned system upgrades do not interrupt on-going mission operations of the TRMM spacecraft.

- A.3.48 The FOT Manager shall participate in all Infrastructure Control Board (ICB) Meetings as defined in the ESMO System Management Plan.
- A.3.49 The Contractor will report all ground system anomalies in accordance with the ESMO System Management Plan, in near real-time during staffed shifts, and by close of business following a non-staffed shift.

3.13 Operations Documentation

- A.3.50 The Contractor shall update and revise the TRMM Flight Operations Plan as required to address changes in the procedures and/or operational concepts for the TRMM flight and ground systems.

3.14 Final Spacecraft Documentation and Operations Archive

- A.3.51 The Contractor shall compile a Final Spacecraft Operations Report deliverable at Passivation + 3 months.
- A.3.52 The Contractor shall coordinated with the Mission Director, TRMM instrument teams, Flight Dynamics Team, Flight Software Maintenance Team, Applied Engineering Technology Directorate (AETD) and other entities to compile the above report.
- A.3.53 The Contractor shall participate in the Decommissioning Review and the Disposal Readiness Review at the Mission Directors request.
- A.3.54 The Contractor shall compile a complete Operations Archive to include, but not limited to: Operations Reports, Event Reports, Anomaly Reports, Operations Documentation, Spacecraft Documentation and Operations Products.

4 Data Processing

4.1 Requirements

- A.4.1 The contractor will operate the Pacor-R system to receive, archive, process, analyze and distribute data according to data delivery timeliness and completeness requirements for the TRMM mission. This task also includes process development, documentation, and training; and production status metrics reporting.
- A.4.2 The Contractor shall assure that raw telemetry data is ingested by the Real Time System, and then forwarded to the Data Processing System and to a Raw Data Archive after the end of the process session.
- A.4.3 The Contractor shall assure that raw telemetry shall be properly stored in long-term storage.
- A.4.4 The Contractor shall assure that data is pushed to the Precipitation Processing System (PPS).
- A.4.5 The Contractor shall assure that initial routine quick look and products specifications for TRMM are properly created and distributed.
- A.4.6 The Contractor shall assure that periodic monitoring of telemetry receipt, archival and processing is performed.
- A.4.7 The Contractor shall assure that product-level analysis is performed.
- A.4.8 The Contractor shall assure that TRMM data is created and distributed electronically and/or in hard-media.
- A.4.9 The Contractor shall assure that reports of data processing and availability are

generated and properly distributed as required by the users.

- A.4.10 The Contractor shall support the Mission Director as required for meetings, reports, coordination and planning, anomaly and problem resolution.
- A.4.11 The Contractor shall assure that during mission contingency operations, data retransmission is performed in a timely manner.
- A.4.12 The Contractor shall assure that reprocessing of archived raw data is done in a timely manner when requested by Flight Operations or users.

5 TRMM Data Capture, Raw Data and Product Archival, Level-Zero Processing, Analysis and Data Delivery

5.1 Level-Zero Spacecraft Housekeeping Products

- A.5.1 One 24-hour (DOY/00:00:00 - 23:59:59) spacecraft housekeeping data product shall be provided daily to each of the five TRMM users (LaRC, MSFC, TRMM MOC, and PPS) within 24 hours of receipt of the last data bit needed to complete the product.
- A.5.2 The TRMM MOC shall receive mini-multiplexed level-zero products for each I-channel and Q-channel TDRSS contact. There is no delivery requirement for this product (best effort).

5.2 Level-Zero Science Products

- A.5.3 Four six-hour Precipitation Radar instrument science data products (APID 53) shall be provided daily to the PPS within 24 hours of receipt of the last data bit needed to complete the product. The time ranges of the data within the four products shall be as follows:
 - PR-1 = DOY/00:00:00 - 05:59:59
 - PR-2 = DOY/06:00:00 - 11:59:59
 - PR-3 = DOY/12:00:00 - 17:59:59
 - PR-4 = DOY/18:00:00 - 23:59:59
- A.5.4 One 24-hour (DOY/00:00:00 - 23:59:59) Lightning Imaging Sensor science data product (APID 61) shall be available daily on the DDS for retrieval by the MSFC facility within 24 hours of receipt of the last data bit needed to complete the product.
- A.5.5 One 24-hour (DOY/00:00:00 - 23:59:59) TRMM Microwave Imager (APID 52) and one 24-hour Visible Infrared Radiometer (APID 51) science data product shall be provided daily to the PPS facility within 24 hours of receipt of the last data bit needed to complete the product.
- A.5.6 The PPS and MSFC facilities shall receive real-time quick looks for every Q-channel TDRSS contact to assist in providing real-time weather forecasting for the shipping industry.
- A.5.7 These real-time quick looks shall be provided to the users within two hours of receipt of the data at Pacor-R.

B. Management Reporting

- B.1.1 The Contractor shall provide monthly status reports and reviews on the technical, cost, schedule and operational performance in accordance with the WBS to adequately describe the activities of the TRMM Mission operations and mission support services activities that were provided to the ESMO Project.
- B.1.2 The Contractor shall provide monthly financial report to the Mission Director and the ESMO Project unique to TRMM. Reporting will be using the 533M form level of information to allow long-term budget planning.

C. Contractor Controlled Property

- C.1.1 The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list (NPROP) of government owned property used by the Contractor on this Task Order. This support includes preparation and cooperation during property audits.

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

The government shall provide contractor access to the MOC facilities at GSFC. The maintenance of the MOC software and hardware is provided through other tasks.

V. Material Procurement

The Contractor shall propose material that they identify as necessary to perform the work associated with this Task Order.

VI. Travel Support

The Contractor shall propose travel that they identify as necessary to perform the work associated with this Task Order, and travel as directed by the Mission Director.

The contractor shall support the travel necessary for the support of the development of End of Mission and Descent activities for the TRMM mission that will take place over the next several years.

- Specifically, the TRMM/GPM Joint Precipitation Measuring Mission (PMM) Science Team Meeting (JPST) in Tokyo, Japan will discuss pertinent information to the TRMM mission. One FOT member, preferably, the FOT System Manager, is requested to attend TRMM & GPM Science Team Meeting in Tokyo, Japan from 11/12/2012-11/16/2012. During this time, the Instrument Team from JAXA will discuss Precipitation Radar (PR) instrument plans for End of Mission.
- Additionally, attend the JAXA/NASA TRMM Descent Activities Operations development Meeting at the Tsukuba Space Center outside of Tokyo, Japan from 12/03/13-12/07/13 for End of Mission. Two FOT members, the FOT Systems Manager and the FOT Lead for Descent Activities, are requested to attend.
- Additionally, the NASA TRMM team will be attending three days of meetings in Tokyo, Japan to discuss upcoming Descent Activities, Passivation Activities and Battery Status with JAXA. The meeting dates are 12/15/2014-12/18-2014. Three (3) FOT members; the FOT Systems Manager, the FOT Descent Activities Lead, and the FOT Power Engineer are requested to attend.

This travel is described in the table below:

Travel Description	Location	Approximate Time Frame
Joint Precipitation Measuring Mission (PMM) Science Team (JPST)	Tokyo, Japan	November 12-16, 2012
JAXA/NASA TRMM Descent Activities Operations development Meeting	Tsukuba, Japan	December 3-7, 2013
JAXA/NASA TRMM Descent Activities & Passivation Meetings	Tokyo, Japan	December 15-18, 2014
JAXA/NASA Ground System Interface Meeting (GSIM) #26	Tokyo, Japan	June 16-18, 2015

VII. Deliverables

The Contractor shall provide the following deliverables in support of the Task Order:

ID	Deliverable Description	Due Date
1	<p>Weekly Operations FOT Priorities List</p> <p>The Contractor shall generate a Weekly list of FOT priorities and status of on-going tasks, anomalies, and investigations. This list will be reviewed with the Mission director at the start of the week to prioritize work assignments and coordinate activities.</p>	10:30am Monday, Weekly, unless otherwise deferred due to holiday or extenuating circumstances.
2	<p>Weekly Spacecraft Performance Report</p> <p>The Contractor shall generate Weekly Status Reports. The report shall include, as a minimum, a summary of the overall status and performance of the spacecraft and its instruments for the week, operational statistics, major upcoming activities, and status, performance, and plans for each spacecraft subsystem, flight software, and all spacecraft instruments.</p>	Tuesday, COB following week ending past Sunday
3	<p>Monthly Status Report</p> <p>On a monthly basis, the Contractor shall present a report on the activities of the preceding month. This report shall contain, but is not limited to, a summation of standard operational events, a listing of special activities, an accounting of instrument activities including non-nominal events, issues from the month, Non-nominal events due to FOT errors, science data collection statistics, anomaly metrics, staffing status, training/certification metrics, special initiatives, planned activities and cost/budget status. The Mission Director may require additional items to be addressed on a periodic basis. A softcopy of this report will be provided to the Mission Director and ESMO Management on the day of the presentation.</p>	Normally scheduled the first week of the following month
4	<p>Annual Operations Status Review</p> <p>On an annual basis, the Contractor shall present a report on the activities of the preceding year. This report shall contain, but is not limited to, a summary of Monthly Status Report items, as well as status of all operational products with regard to configuration management as well as updates to the Flight Operations Plan that have occurred as a result of events of the past year.</p>	Scheduled in the first quarter of the year following
5	<p>Command Authorization Meetings</p> <p>The Contractor shall collect and present technical support data for the preparation and implementation of all special spacecraft engineering activities. All special spacecraft engineering activities will be preceded by a Command Authorization Meeting (CAM). Presentation materials and products relevant to the CAM will be distributed as early as practical prior to the CAM, so that CAM attendees can review them for accuracy and prepare questions and comments in advance of the CAM.</p>	Prior to scheduled activity, nominally the day preceding the activity

6	<p>Anomaly Reports For each anomaly, the Contractor shall generate an Anomaly Report. This report shall describe how the anomaly was discovered, what were the results of the anomaly investigation, the impact of the anomaly, any interim work-around (if required), and the final resolution of the anomaly. The Anomaly Report shall be provided to the Mission Director within 10 business days of the resolution of the anomaly.</p>	10 business days following resolution of the anomaly
7	<p>Event Reports In response to any deviation to normal spacecraft operations, the Contractor shall immediately issue an Event Report (ER) to document the deviation.</p>	Within 1 orbit of incident, within operational constraints
8	<p>End-of-Mission Plan The Contractor shall review and update the End-of-Life Plan on a yearly basis or as requested by the Mission Director.</p>	Annually, as requested
9	<p>Training and Certification Plan The Contractor shall establish, maintain and execute a formal training and certification program. The objective of this program shall be to assure mission success by cultivating a diverse, competent staff of FOT professionals. This program shall include an active process of progressive skills enhancement, cross-training and contingency operations readiness. The program shall include a matrix of FOT positions and skills with defined certification levels and targeted staff certification goals. The program shall be documented in the Training and Certification Plan. The plan shall identify what positions within the FOT are considered certifiable and what frequency of re-certification is necessary to maintain competency. The plan shall specifically address formal (classroom) training, on-the-job training (OJT), simulations and rehearsal training and cross-training. The plan shall address assumed certifications, post-training certifications, cross-position certifications and the currency of all certifiable positions. The Contractor shall report metrics on training and certification on a monthly basis.</p>	As required and Monthly metrics report
10	<p>Anomaly Response Plan The Contractor shall establish, implement and maintain a mission-level Anomaly Response Plan that's consistent with NASA/GSFC's Code 400 Flight Programs and Projects Directorate Anomaly Notification Procedures and Guidelines and ESMO's Anomaly Management Procedures.</p>	As needed, annual review minimum.
11	<p>Mission Risk Management and Best Practices The Contractor shall establish, implement and maintain a mission-level Risk Management Plan that's compliant with NPG 7120.5. In addition, the Contractor shall comply with all Agency, Center and ESMO directives regarding Risk Management and Best Practices.</p>	As needed, annual review minimum.

12	<p>Operations Procedures The Contractor shall update and revise the Operations Procedures as required to address changes in the procedures and/or operational concepts for the TRMM flight and ground systems.</p>	As required and Monthly metrics report
13	<p>Test Reports The Contractor shall provide findings from ground system-related testing activities performed by the FOT. The Test Report shall include Discrepancy Reports (DRs) corrected and verified, new DRs opened, and the FOT recommendation to accept and/or reject the release being tested. Test reports shall be delivered within 10 business days following test completion.</p>	10 business days following test completion
14	<p>Financial Reports The Contractor shall provide monthly 533M reports, 533Q reports and any other financial reports required to perform task planning and administrative budget planning.</p>	<p>533M: Monthly not later than 10 working days following the close of the contractors' monthly accounting period 533Q: Quarterly not later than the 15th day of the month preceding the quarter being reported Other: as required</p>
15	<p>Flight Operations Plan The Contractor shall update and revise the TRMM Flight Operations Plan as required to address changes in the procedures and/or operational concepts for the TRMM flight and ground systems.</p>	As needed, annual review minimum.
16	<p>Final Spacecraft Operations Report The Contractor shall compile a Final Spacecraft Operations Report to include a detailed summary of the mission from launch to passivation. It shall include subsystem and instrument activities, events, anomalies and performance as well as control center activities and events.</p>	Passivation + 3 months.
17	<p>Flight Operations Archive The Contractor shall compile a complete Operations Archive to include, but not limited to: Operations Reports, Event Reports, Anomaly Reports, Operations Documentation, Spacecraft Documentation and Operations Products.</p>	Passivation + 3 months.

End of Task Order Statement of Work