

## **GSMO TASK ORDER**

Task No: **80**  
 Modification: **1**  
 Task Name: **QEMU Model Development and Integration**  
 Task Period of Performance: **09/16/2013 to 09/30/2014**  
 Modification Period of Performance: **06/01/2014 to 09/30/2014**  
 GSMO SOW Reference: **2.3.2.10**

### **I. Task Order History**

#### **Description of current modification (Modification 0):**

This is the first modification of task order statement of work for QEMU Model Development and Integration.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	09/16/2013	05/15/2013	Initial task order statement of work.
1	06/01/2014	09/30/2014	Extend period of performance of task order and 1553 model update

### **II. Background**

The NASA Independent Verification and Validation (IV&V) Program's purpose is to reduce the inherent risk in the Agency's ability to procure, develop, deploy, and operate software within desired cost, schedule, and performance goals by performing IV&V on safety and mission critical software; providing software expertise to the Agency's Software Mission Assurance (SMA) activities; and conducting research that improves IV&V and software assurance methods, practices, and tools.

Within the NASA IV&V organization, the Independent Test Capability (ITC) is responsible for acquiring, developing, and maintaining test environments for the IV&V Program to enable dynamic analysis of software behaviors for multiple NASA missions. The primary purpose of these test environments is to provide a means for IV&V project teams (e.g. MPCV, GPM, ISS) to exercise the flight system under nominal and off-nominal conditions. The ITC team is responsible for the development and maintenance of the environments, and the IV&V project teams are the end-users of the environments.

The ITC group is researching, developing and integrating open source processor emulation solutions into its test environments. In particular, the team is developing hardware models using QEMU, an open source processor emulator and virtualizer.

### **III. Scope of Work**

The Contractor shall develop processor models and supporting software applications using QEMU and similar technologies.

#### **A. Requirements**

A.1. The Contractor shall setup a QEMU software development and test environment on a virtual machine.

- A.2. The Contractor shall develop QEMU processor and hardware models.
  - a. The Contractor shall develop QEMU RAD750 processor models (3U and 6U equivalent boards).
  - b. The Contractor shall demonstrate the QEMU RAD750 model using the GSFC Core Flight System software.
  - c. The Contractor shall develop a QEMU MIL-STD-1553 model using ISIM flight software and JWST Housekeeping (HK) card.
- A.3. The Contractor shall interface model with NOS middleware and applications to allow integration with simulation efforts.
- A.4. The Contractor shall develop a set of unit tests to demonstrate functionality of the models.
- A.5. The Contractor shall capture and provide the following information:
  - a. Commands
  - b. Command Line Options
  - c. System bring-up directions
  - d. Development Environment Details
- A.6. The Contractor shall adhere to ITC Software Development Coding Standards and Best Practices
- A.7. The Contractor shall utilize the ITC development and configuration management resources (ITC Subversion for source code development and tests; Atlassian products for issue tracking and documentation)

## **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**

Government furnished software includes:

- User account and access to Subversion source code repository and Atlassian products (issue tracking system)

There are no Government furnished facilities or equipment 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 propose travel that they identify as necessary to perform the work associated with this Task Order.

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

Travel Description	Approximate Time Frame

## VII. Deliverables

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

ID	Deliverable Description	Due Date
1	Commented Source Code (ITC Subversion Repository)	Weekly check-ins
2	Unit tests for source code modules	Weekly check-ins
3	Product Demonstration	02/15/2014
4	Developer/User Documentation	03/15/2014
5	Product Demonstration and Progress Report. Progress Report should include status of work done to date, risks, issues, and recommendations	07/30/2014
6	Virtual machine with user and developer documentation	09/30/2014

End of Task Order Statement of Work

**GSMO TASK ORDER**

Task No: 82  
 Modification: 6  
 Task Name: Wallops Command and Data Acquisition Station 18 Meter Antenna Refurb  
 Task Period of Performance: October 1, 2013 to Feb 28, 2015  
 Modification Period of Performance: Dec 1, 2014 to Feb 28, 2015  
 GSMO SOW Reference: 2.3.2, 2.3.2.3, 2.3.2.11, 2.4

**I. Task Order History**

**Description of current modification:**

Mod #	Start	End	Brief Description
0	10/1/2013	6/30/2014	Initial task statement of work for DSCOVW WCDAS 18-Meter Antenna Feed Upgrade.
1	12/1/2013	7/31/14	<ul style="list-style-type: none"> <li>Deleted Requirement A1, The contractor shall perform initial tailored Receive G/T test.</li> <li>Initiating Requirement A9, i.e., Option 2, The contractor shall replace existing LNA and upgrade system to provide shorter waveguide run to the LNA input.</li> <li>Initiating Requirement A10, i.e. Option 3. The contractor shall verify the final transmit performance by measuring the transmit waveguide insertion loss.</li> </ul>
2	4/1/2014	7/31/2014	<ul style="list-style-type: none"> <li>Modifying Requirement A5 to specify manually-switched Left- and Right- Hand Circular Polarization (See 01/31/2014 Journal Entry)_</li> <li>Modifying Requirement A6. Removed option part and replaced “retune” with “replace with a diplexer” which the contractor did not price in Mod0 or Mod1 due to unknown performance of the current triplexor at that time and unknown specifications.</li> </ul>
3	6/1/2014	8/31/2014	<ul style="list-style-type: none"> <li>Added requirement for S-Band down converters and fiber optic links</li> </ul>
4	8/26/2014	11/30/2014	<ul style="list-style-type: none"> <li>Extended Task due to Diplexer and S-Band Down Converter materials delivery delays.</li> <li>Adding a Project RF Engineer</li> <li>Adding 3 Fiber Optic Transceivers</li> <li>Added two WR430 cross-guide couplers</li> </ul>

5	9/16/2014	11/30/2014	• Adding 2 S-Band UpConverters
6	12/1/14	2/28/2015	• RF Engineer is needed to complete RF components integration and support testing through Launch plus 1 month

**II. Background**

The Deep Space Climate Observatory (DSCOVER), formerly known as Triana, will collect space weather data for the National Oceanic and Atmospheric Administration (NOAA) while stationed in a Lissajous orbit around the first Sun-Earth Lagrangian point, or L1, ~1.6 Million km from the earth. The Observatory, provided by the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) and slated for launch in the January 2015 timeframe, will embark on a 2-year prime mission via a SpaceX Falcon 9 launch vehicle supplied by the United States Air Force (USAF). The mission will serve as the primary replacement for the NASA/GSFC Advanced Composition Explorer (ACE) mission for providing early warning of geomagnetic storm activity that may affect Earth-orbiting spacecraft and Earth-based systems, e.g., power grids, as well as for maintaining continuity in the solar wind data set currently produced by ACE. The Observatory will also collect full-Earth disk images in different wavelengths and radiometric data via the EPIC instrument.

The NOAA WCDAS, located at Wallops Island, VA, will support nominal DSCOVER operations in conjunction with the RTSWnet. Specifically, WCDAS will support DSCOVER observatory commanding, i.e., uplink, as well as science mission data downlink. WCDAS will support S-Band downlink up to approximately 140 kbps. This allows for downlink of the nominal data along with the stored EPIC images and any other stored data. EPIC imagery is only downlinked via CDAS and stored onboard when CDAS is not in view. The WCDAS is in view of DSCOVER for 7-14 hours, depending on the time of the year. The FCDAS will be available during portions of the year to serve as a backup to the WCDAS. The WCDAS interfaces with Mission Operations Center (MOC), Backup MOC, and SWPC, is defined in the DSCOVER Command and Data Acquisition Stations (CDAS) Interface Control Document (ICD).

The National Oceanic and Atmospheric Administration (NOAA) Environmental Satellite Data and Information Service (NESDIS) operates the Wallops Command and Data Acquisition Station (WCDAS) at Wallops, Virginia and is responsible for maintaining various antennas on site that support present and future missions.

Over the past 18 months an assessment of the NESDIS antenna assets to determine the most cost effective approach for DSCOVER mission was completed. While the initial report, "Ground Segment - Final Study Report (Task 16)" was completed, May 2012, ~~\_\_\_\_\_~~ a follow on addendum report, Antenna Assessment Addendum Report, (Task 21) dated April 2013 was prepared to refine the assumptions and correct misunderstandings in mission support requirements. This task implements the findings from these study reports for the upgrading of the existing

Wallops 18-Meter GOES-A Antenna feed and waveguide to support the DSCOVN Mission.

The DSCOVN Mission is planned for Launch in January 2015.

### III. Scope of Work

The purpose of this task is to facilitate the upgrading of the Wallops 18-Meter GOES-A Antenna for usage by the DSCOVN mission.

#### A. Requirements

The contractor shall provide qualified personnel and the incidental materials needed to perform the work activities shown below:

1. (DELETED)The contractor shall perform initial tailored Receive G/T test to verify the antenna can achieve a G/T of 28 dB/K (with 29 dB/K as design goal) at the DSCOVN downlink frequency of 2215.0 MHz with feed upgrade before committing to any other upgrades. This test shall be conducted within 30 days of receipt of order. (Task Mod 1 deleted this requirement because it was covered under a NOAA task.)
2. The contractor shall assess whether the existing triplexer can be retuned to support the DSCOVN Mission.
3. The contractor shall provide a report that describes the antenna gain and noise as a function of elevation from the G/T measurement and the retuned triplexer assessment. This assessment report shall be provided within 10 days of performing the G/T measurement (A1) and the retuned triplexer assessment (A2).
4. The contractor shall refurbish all hub waveguide sections behind the feed horn and mounting hardware.
5. The contractor shall upgrade the existing rotating polarizer with a rotating polarizer capable of supporting manually-switched Left- and Right- Hand Circular Polarizations.
6. The contractor shall replace the existing triplexer with a new diplexer and interconnecting waveguide that will support the DSCOVN mission and provide the required isolations between transmit and receive frequencies of 2215.0 MHz and 2039.65 MHz, respectively.
7. The contractor shall perform final tailored Receive G/T test after upgrades to demonstrate that the antenna achieves a G/T of at least 28 dB/K. This test shall be conducted within 30 days of completion of all upgrades. A test report shall be provided within 10 days of completion of the G/T test.

8. The contractor shall provide all associated Electronics Change Order (ECO) Documentation.
9. The contractor shall replace existing LNA and upgrade system to provide shorter waveguide run to the LNA input.
10. The contractor shall verify the final transmit performance by measuring the transmit waveguide insertion loss and VSWR, demonstrate that the 1 KW SSPA's (filters) and Phase combining will operate at the DSCOVER transmit frequency and provide a new calibration curve for the transmit loop coupler.
11. The contractor shall replace existing S-band down converters at Wallops CDAS and associated Fiber Optic transmitters and receivers. All fiber optic transmitters and receivers shall be single mode, wide bandwidth (>2.7 GHz). An appropriate fiber optic plug-in chassis with power supply shall be provided and installed as necessary.
12. The contractor shall provide on-site Project Engineering support for the technical oversight, coordination, and scheduling of the changes to the WCDAS 18-meter DSCOVER Antenna. The incumbent engineer shall be able to assist with equipment engineering, installation, testing, and integration, ground readiness, end-to-end testing, and equipment removal for repairing. The list of components being installed includes, but it not limited to, LNA, S-Band Down Converter and fiber optics, optical encoders, cross-guide couplers, and the Cortex & Frontend Workstation. The Project Engineering shall support RF component integration, testing, and verification through Launch.
13. The contractor shall provide 3 additional Fiber Optic Transceiver / Receiver pairs and associated cables (if needed) to support relocating existing 2 Up-Converters and the single Transmit monitor function to the NOAA Operations Building.
14. The contractor shall provide 2 cross-guide couplers for monitoring antenna transition power.
15. The contractor shall replace existing S-band upconverters at Wallops CDAS.

**B. Management Reporting**

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

Additionally, the contractor shall provide monthly status reports and support reviews for progress 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 of government owned property used by the Contractor on this Task Order. The Contractor shall support property audits as deemed necessary by the Government.

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

The Government will provide access to the NOAA/NESDIS WCDAS GOES 'A' 18M antenna to perform this work. The contractor may review Radiation Systems Operations and Maintenance Manual as needed. The WCDAS on hand test equipment maybe provided to the contractor on a non-interference basis – Sig Gen, Sig Anal, etc. but this must be coordinated at least 48 hours in advance with the facility staff.

**V. Material Procurement**

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

**VI. Travel Support**

Contractor personnel will be required to travel to the WCDAS to perform this work. Five trips to Wallops from NSOF expected.

**VII. Deliverables**

DSCOV R WCDAS 18M Antenna Feed Upgrade

The Contractor shall provide the following deliverables in support of the Task Order beginning After Receipt of Order (ARO).

<u>Item</u>	<u>Quantity</u>	<u>Date</u>
Conduct initial tailored Receive G/T test & report	1	40 days ARO
Triplexer assessment & report	1	40 days ARO
Refurbish hub waveguide sections	1lot	130 days ARO
Upgrade Feed to Circular Polarization	1lot	150 days ARO
Replace Triplexer with Diplexer (A6)	1lot	150 days ARO
Replace & Upgrade existing LNA (A9)	1lot	150 days ARO
Conduct final tailored Receive G/T test & report (A7)	1lot	190 days ARO*
Replace S-Band Down Converters	2	90 days ARO
ECO Documentation	1lot	200 days ARO

\* Depends on LNA Schedule

End of Task Order Statement of Work

## **GSMO TASK ORDER**

Task No: 83  
 Modification: 5  
 Task Name: DSCOVR Validation Test Lead  
 Task Period of Performance: 10/1/2013 to 6/30/15  
 Modification Period of Performance: 3/1/2015 to 6/30/15  
 GSMO SOW Reference: 2.4 Integration and Test  
                                           C. Integration, Test, and Verification Services  
                                           C.i Spacecraft and science operations control rooms

### **I. Task Order History**

**Description of current modification (Modification 4):**

This is a modification to task order statement of work for DSCOVR ETE & Mission Rehearsal test lead task.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	10/1/2013	9/31/2014	Initial task order statement of work.
1	2/3/2014	9/31/2014	Mod 1 adds travel to NOAA WCDAS in VA for testing
2	10/1/2014	2/28/2015	Mod 2 extends task to Launch to include tests that have been postponed. Adds KSC travel. Adds SN Long-Loop Test.
3	9/8/2014	4/30/15	MOD 3 adds Mission Manager and extends this task through April 2015.
4	1/28/2015		Administrative Modification.
5	3/1/2015	6/30/15	MOD 4 extended mission support, added training coordination and on-console support for Mission Systems.

### **II. Background**

The Deep Space Climate Observatory (DSCOVR), formerly known as Triana, will collect space weather data for the National Oceanic and Atmospheric Administration (NOAA) while stationed in a Lissajous orbit around the first Sun-Earth Lagrangian point, or L1, ~1.6 Million km from the earth. The Observatory, provided by the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) and slated for launch in the January 2015 timeframe, will embark on a 2-year prime mission via a SpaceX Falcon 9 launch vehicle supplied by the United States Air Force (USAF). The mission will serve as the primary replacement for the NASA/GSFC Advanced Composition Explorer (ACE) mission for providing early warning of geomagnetic storm activity that may affect Earth-orbiting spacecraft and Earth-based systems, e.g., power grids, as well as for maintaining continuity in the solar wind data set currently produced by ACE. The Observatory will also collect full-Earth disk images in different wavelengths and radiometric data via the EPIC instrument.

The NOAA WCDAS, located at Wallops Island, VA, will support nominal DSCOVR operations in conjunction with the RTSWnet. Specifically, WCDAS will support DSCOVR observatory commanding, i.e., uplink, as well as science mission data downlink. WCDAS will support S-Band downlink up to approximately 140 kbps. This allows for downlink of the nominal data along with the stored EPIC images and any other stored data. EPIC imagery is only downlinked via CDAS

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and stored onboard when CDAS is not in view. The WCDAS is in view of DSCOVR for 7-14 hours, depending on the time of the year. The FCDAS will be available during portions of the year to serve as a backup to the WCDAS. The WCDAS interfaces with Mission Operations Center (MOC), Backup MOC, and SWPC, is defined in the DSCOVR Command and Data Acquisition Stations (CDAS) Interface Control Document (ICD).

The National Oceanic and Atmospheric Administration (NOAA) Environmental Satellite Data and Information Service (NESDIS) operates the Wallops Command and Data Acquisition Station (WCDAS) at Wallops, Virginia and is responsible for maintaining various antennas on site that support present and future missions.

Over the past 18 months an assessment of the NESDIS antenna assets to determine the most cost effective approach for DSCOVR mission was completed. While the initial report, "Ground Segment - Final Study Report (Task 16)" was completed, May 2012, [REDACTED] a follow on addendum report, Antenna Assessment Addendum Report, (Task 21) dated April 2013 was prepared to refine the assumptions and correct misunderstandings in mission support requirements. This task implements the findings from these study reports for the upgrading of the existing Wallops 18-Meter GOES-A Antenna feed and waveguide to support the DSCOVR Mission.

The DSCOVR Mission is planned for Launch in January 2015.

SUBTASKS: None

Subtask 1: N/A

### **III. Scope of Work**

The incumbent test lead shall plan for and conduct DSCOVR End to End tests (ETE), Mission Simulations (Sims), and Launch Day Dress Rehearsals.

End To End (ETE) tests are conducted to verify the GS to observatory interfaces and to validate compatibility between ground segment and observatory using ground stations and/or portable station test equipment located in observatory I&T facility. This verification includes preparation for the SC ground system tests associated with the releases. A small subset of GSL3RD requirements that span the Ground System and the Observatory and cannot be suitably verified during GRT or RF Compat testing alone are verified during ETES. Requirements previously verified during GRT are validated during the ETES.

Mission Simulations (SIMs) are conducted to verify that the systems, personnel, procedures, and operational products are ready to handle the operations scenarios to accomplish mission operations and contingencies. The SIMs are designed to ensure the launch readiness of the operations personnel, products (e.g., PROCs), and processes. They include activities such as L&EO, Day- In-The-Life (DITL), and contingency rehearsals. There are four primary mission simulations planned as well as multiple DITLs. SIMs are used primarily for system and operations validation, however they can also be used to execute and evaluate requirements that cannot be demonstrated on flight hardware.

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The launch day dress rehearsals exercise the sequence of launch preparation activities as they are planned to occur on launch day, incorporating activities from L-6 hours through Release and Safe Mode. Three launch rehearsals are planned in support of the DSCOVR mission. Each organization exercises the process for determining and declaring readiness to continue in the launch count activities.

### A. Requirements

- A.1. The contractor shall support the DSCVOR Ground Segment Project as the End to End, Mission Simulations, and Mission Rehearsal Test Lead, henceforth referred to as the Test Lead.
- A.2. As Test Lead, the Contractor shall facilitate and support Technical Interchange Meetings (TIMs) and key reviews to obtain knowledge in how operations are conducted.
- A.3. As Test Lead, the Contractor shall support the DSCOVR Mission Operations Review (**MOR**) by developing, delivering, and presenting presentation materials.
  - a. The Presentation materials shall be compliant with GSFC-STD-1001A and include details of plans for ETE Test events and how ETEs, Mission Simulations, and Mission Rehearsals, will be conducted. (Completed)
- A.4. As Test Lead, the Contractor shall support the DSCOVR Operations Readiness Review (**ORR**) by developing, delivering, and presenting presentation materials.
  - a. The Presentation materials shall be compliant with GSFC-STD-1001A and include status of the execution of the ETE events, Mission Rehearsals, and Simulation.
- A.5. As Test Lead, the Contractor shall plan and execute **4 simulations (Sims)**. (Sim 1 Completed)
  - a. The Mission Rehearsal support shall include, but is not limited to, leading, coordinating, preparing and distributing simulation briefings, facilitating the simulation event, leading a post simulation debrief, and generating a post simulation debrief report.
- A.6. As Test Lead, the Contractor shall plan and execute **3 End-to-End test events** following the 1<sup>st</sup> three GRTs. (ETE 1 Completed)
  - a. The End-to-End (ETE) test event support shall include, but is not limited to, leading, coordinating, preparing and distributing ETE briefings, facilitating the ETE event, leading a post ETE debrief, and generating a post ETE report.
- A.7. As Test Lead, the Contractor shall plan and execute **3 Launch Day Rehearsals**.
  - a. The Launch Day Rehearsal event support shall include, but is not limited to, leading rehearsal meetings, coordinating and distributing Rehearsals briefings, facilitating the Rehearsal event, leading a post event debrief, and generating a post event debrief report.
- A.8. As Test Lead, the Contractor shall conduct a Mission Rehearsal and Simulation Working Group to perform the detail planning for the Rehearsals and Simulations.
  - a. The lead will maintain and track action items from the working group meetings and from the simulation debriefs.
- A.9. As Test Lead, the Contractor shall conduct an ETE Working Group to perform the detail planning for the ETE events.
  - a. The lead will maintain and track action items from the working group meetings and from the ETE debriefs.
- A.10. As Test Lead, the Contractor shall facilitate an SN TDRSS Long-Loop RF-Compat and DSN Long-Loop RF-Compat test at KSC as part of ETE #4
- B.1. The contractor shall support the DSCVOR Ground Segment Project   
 Duties include:

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- a. Support the Mission Manager in the final readiness activities to ensure team readiness for Launch
  - i. Support the development of the Operations Processes to be used for the launch of DSCOVR.
  - ii. Review key processes.
  - iii. Support timeline development and review process.
- b. Support on-console during simulation and end-to-end tests.
- c. Support the Mission launch and checkout on console
- d. Provide console support as necessary for special events.
- e. Provide console support for Mission Systems Engineering Position.
- f. Provide training coordination for NOAA Mission Engineering Team & Flight Operators.

### **B. Management Reporting**

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

The contractor shall email a weekly status report, NLT COB Mondays, describing the technical, 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 weekly technical and schedule progress to the SEWG in the form of a ppt slide(s) and oral discussion. The meeting is Thursday's at 1:30 PM ET.

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

### **C. Contractor Controlled Property**

The Contractor shall assist the GSMO contract managers and property custodians in maintaining the overall list 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**

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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.

Trip #	Destination	Duration (days)	Approximate Dates
1	NOAA WCDAS, VA	4	Support GRT #1 Segment b-d, March 2014
2	NOAA WCDAS, VA	4	Support GRT #1 Segment b-d, March 2014
3	NASA KSC, FL	5 days ea.	5 trips, Support ETE #4, Sims, & Launch Rehearsals

**VII. Deliverables**

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

ID	Deliverable Description	Quick Look	Final Due Date	
1	MOR Slides (Completed)		MOR – 14 days	Complete
2	ORR Slides		ORR – 14 days	Complete
3	Post ETE report	ETE #1 + 3 days	ETE #1 + 30 days	Complete
4	Post ETE report	ETE #2 + 3 days	ETE #2 + 30 days	Complete
5	Post ETE report	ETE #3 + 3 days	ETE #3 + 30 days	Complete
5.5	Post ETE report	ETE #4 + 3 days	ETE #4 + 30 days	Complete
6	Post simulation report.	SIM #1 + 5 days	SIM #1 + 30 days	Complete
7	Post simulation report.	SIM #2 + 3 days	SIM #2 + 30 days	Complete
8	Post simulation report.	SIM #3 + 3 days	SIM #3 + 30 days	Complete
9	Post simulation report.	SIM #4 + 3 days	SIM #4 + 30 days	Complete
10	Launch Rehearsal report	Rehearsal #1 + 3 days	Rehearsal #1 + 30 days	Complete
11	Launch Rehearsal report	Rehearsal #2 + 3 days	Rehearsal #2 + 30 days	Complete
12	Launch Rehearsal report	Rehearsal #3 + 3 days	Rehearsal #3 + 30 days	Complete
13	Spacecraft Operations Handbook (SOH)	March 13, 2015	March 30, 2015	

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End of Task Order Statement of Work

## **GSMO TASK ORDER**

Task No: **84**  
 Modification: **5**  
 Task Name: **GOES-R Operations Engineering Support**  
 Task Period of Performance: **01/02/2014 to 12/31/2015**  
 Modification Period of Performance: **05/18/2015 to 12/31/2015**  
 GSMO SOW Reference **2.3**

### **I. Task Order History**

**Description of current modification (Modification 5):** Modification to increase in staff to support Enterprise Management functions for GOES-R Operations and Sustainment Engineering Support.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	01/02/2014	12/31/2014	Initial task order statement of work.
1	03/01/2014	12/31/2014	Change the nature of requirements from "represent/representing" to "support/supporting".
2			Administrative Mod
3	01/01/2015	12/31/2015	Extend the period of performance until December 31, 2015, with an increase in staff.
4			Administrative Mod
5	05/18/2015	12/31/2015	Increase in staff to support Enterprise Management functions.

### **II. Background**

Geostationary Operational Environmental Satellite-R Series (GOES-R) is the first of the next generation of geostationary weather satellites, scheduled to launch in 2016. The program is a collaborative development and acquisition effort between the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA). The GOES-R satellite will provide continuous imagery and atmospheric measurements of the Earth's Western Hemisphere and provide space weather monitoring. GOES-R will be the primary tool for the detection and tracking of hurricanes and severe weather and provide new and improved applications and products for fulfilling NOAA's goals of Water and Weather, Climate, Commerce, and Ecosystem.

The GOES-R Program is managed by NOAA with an integrated NOAA-NASA program office organization, staffed with personnel from NOAA and NASA, and supported by industry contractors. The Program is located at NASA's Goddard Space Flight Center.

The purpose of this task is to support the GOES-R Ground System Project by providing sustainment and operations engineering support. This work includes, but is not limited to, the technical and management activities described in this SOW.

### **III. Statement of Work**

The Contractor shall support the GOES- R Ground System Project by performing operations and sustainment engineering tasks. Specific requirements are provided in Section A.

#### **A. Requirements**

##### **1) Ground System and Antenna Sustainment Engineering**

- a) Assist the Ground System Project Maintenance, Sustainment and Training (MST) lead by supporting the MST team during various Program meetings and working group meetings.
- b) Support the MST team in the review and finalization of operations and maintenance concepts, scenarios, and procedures as they evolve through the implementation, integration, and verification phases.
- c) Assist the MST lead in the coordination of efforts with other GOES-R groups, including the Mission Operation Support Team (MOST), the Flight Project, the Data Operations Support Team (DOST), the Ground Readiness Team (GRT) and the Antenna team. This requires contributing system engineering input and mission operations knowledge to find solution to various operational and system sustainability issues.
- d) Provide technical review of Ground System Project documents as applicable to maintenance and sustainment.
- e) Support the Incident Review Board (IRB) process: assist the MST lead who chairs the IRB, maintain incident records database, and produce meeting minutes.
- f) Support the Delivery Content Review Board (DCRB) process: assist the MST lead who chairs the DCRB and produce meeting minutes.
- g) Support Core Ground System, Antennas, and operations test planning and execution (e.g., end-to-end tests, mission operations simulations and rehearsals, antenna site acceptance tests).
- h) Support the establishment with NOAA of an Enterprise-level Configuration Management tool useable for GOES-R as well as heritage missions.
- i) Support resources scheduling and tracking: monitor hardware and commercial licenses, warranties, life cycle, and replacement approach; manage periodic status reports, maintain "resource

- calendar” for maintenance and sustainment activities, installations, and tests
- j) Support the deployment and integration of the Enterprise Management (EM) and Infrastructure System (IS) elements into the GOES-R Ground System. Define criteria, prepare for, and facilitate the successful transition of the EM/IS to the sustainment phase.
  - k) Ensure that the EM/IS delivered to the Project is properly functioning and all artifacts necessary for a successful transition to the maintenance phase are provided in support of the following EM/IS functionalities:
    - Provision of the services and infrastructure necessary to manage, monitor, and report on the operational systems, network components and communication assets.
    - Operators’ insight to monitor and manage the end-to-end Ground System, including spacecraft monitor and control, science data processing, and external interfaces. The complexity of the GOES-R Ground System is further increased by the three geographic sites and several operational environments at each site.
    - Generation of various reports and real-time device status information
    - Provision of software distribution systems, configuration management (CM) tools and asset management tools.

## **2) Data Operations Support Engineering**

- l) Assist the Ground Readiness Team (GRT) lead and the Data Operations Support Team (DOST) lead by supporting various Program meetings and working group meetings, preparing material, maintaining room schedule and calendar appointments, and providing minutes.
- m) Provide management and technical review of Project documents as applicable to GRT activities.
- n) Support GRT in the revision and finalization of operations concepts and scenarios as they evolve through the implementation, integration and verification phases.
- o) Assist the GRT lead in the coordination of effort with the MST team, MOST, the Ground Project, Ground System Integration Team and the NSOF operational users.
- p) Define and support GRT/DOST activities in mission operations end-to-end tests.
- q) Provide support in the generation of technical material for Data Operations Exercises and other test activities, including test readiness reviews, run for record, and test analysis.

### **3) Project Support**

- a) Provide support in the generation of technical presentation packages and follow up on any Requests For Action as required; reviews to be supported include but are not limited to the Operations Readiness Review (ORR) and Flight Operations Readiness (FOR).

#### **B. Management Reporting**

The Contractor shall provide monthly status reports on the technical, cost, and schedule performance 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. Work will be performed on-site

### **V. Material Procurement**

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

### **VI. Travel**

The performance of these duties will require periodic travel to the NOAA Satellite Operations Facility (NSOF) in Suitland, Maryland.

It may also require infrequent travel to Melbourne, Florida, to Wallops Island, Virginia, and to Fairmont, West Virginia.

End of Task Order Statement of Work

## **GSMO TASK ORDER**

Task No: **85**  
 Modification: **1**  
 Task Name: **ICESAT-2 ATLAS Instrument I&T Engineer/System Administrator Support**  
 Task Period of Performance: **04/15/2014 to 09/30/2015**  
 Modification Period of Performance: **11/01/2014 to 09/30/2015**  
 GSMO SOW Reference **2.4**

### **I. Task Order History**

**Description of current modification (Modification 1):** Task order modification statement of work for ICESAT-2 ATLAS Instrument I&T Engineer/System Administrator Support to extend the Period of Performance end date from 10/31/2014 to 9/30/2015.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	04/15/2014	10/31/2014	Initial task order statement of work.
1	11/01/2014	09/30/2015	Task order modification statement of work.

### **II. Background**

Provide integration and test support to the ICESat-2/ATLAS instrument project for the Ground Test Network.

The Ice, Cloud, and land Elevation Satellite-2 (ICESat-2) Mission is the follow-on mission to ICESat. The ICESat-2 Mission objective is the measure global ice sheet topography and vegetation canopy height. The Advanced Topographic Laser Altimeter System (ATLAS) is the only instrument on the ICESat-2 mission. The ATLAS instrument is the next generation of ice thickness measurement LIDAR altimeters being developed at Goddard Space Flight Center. This instrument will leverage heritage testing plans, procedures, and process developed for the GLAS altimeter and LOLA altimeter. This task supports the Integration and Test effort for IT network administrative support for the ATLAS Ground Test Network.

### **III. Statement of Work**

- A. The contractor shall continue supporting the ATLAS GSFC in-house instrument integration and test effort by providing experienced System Administrator support.

This task includes (but is not limited to):

- Installing an firewall on the CNE at the SCA for the ATLAS I&T effort that will host all the ATLAS GSE and related hardware such as the NTP server, with some specific provisions for access to Minsk and other RedHat servers (for maintenance)
  - Providing support to the ATLAS I&T Programmatic Lead during instrument-level integration and testing.
- B. Contractor shall continue providing System Administrator support to the ICESat-II/ATLAS instrument effort during instrument-level I&T. The contractor will be required to work directly with the ATLAS I&T Programmatic Lead and I&T Team, as well as the GSFC CNE personnel, ATLAS systems engineering and other ATLAS Subsystem Leads.

#### IV. Deliverable Items and Schedule

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

Deliverable	Due Date	Recipient
MPR	Monthly	NASA GSFC TM
Weekly input via email to the I Weekly Status Report	Weekly	ATLAS Instrument I&T Programmatic Lead
ATLAS System Admin IT documentation	As specified by GSFC IT network security policy and requirements and ATLAS Instrument Project Management	ATLAS Configuration Management

#### V. Skill Set/Knowledge Requirement

The contractor shall staff this work item with the appropriate skill mix and staffing level for the work. The contractor staff must have direct System Administrator experience in managing information systems and IT network security. The contractor staff must also be knowledgeable with the GSFC IT moderate security plan. Contractor staff must have prior experience in the following:

- Build, configure and maintenance of a ground system test network
  - o Installing, securing, configuring and maintaining RedHat, Linux, and Windows

- o Installing, patching, configuring and testing COTS and GOTS software, including but not limited to ASIST, MPISS, MPS, FDS, FEDS, ITOS, ITPS, Matlab, RSA, Splunk, SNAS,
  - o ITOS, IDL, ITPS, and other test databases
  - o Utilizing SVN systems in ground test network
- Hardware: Dell Desktops and Servers, RAID Arrays, Firewalls, Video Camera systems, Fiber Optics, Internal and External Hard drives, Wireless routers, Mac Pro, CISCO switches, Firewire, SCSI, and USB.
  - Producing a Network Block Diagram

## **VI. Travel**

No additional travel is required for this Task Order.

## **VII. Work Location**

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

## **VIII. Contractor/Government Furnished Property/Government Furnished Equipment**

Office and phone are provided by the Government.

## **IX. Reporting Requirements**

There are no reporting requirements specific to the staffing support for this work item beyond those identified in Section IV.

## **X. Security Requirements**

There are no special security requirements beyond compliance with the GSMO flow-down provisions already identified in the Terms and Conditions.

End of Task Order Statement of Work

## **GSMO TASK ORDER**

Task No: 87  
 Modification: 2  
 Task Name: GOES-R Launch and Early Orbit Planning and Ground System Engineering Support  
 Task Period of Performance: 5/19/2014 to 4/30/2016  
 Modification Period of Performance: 5/1/2015 to 4/30/2016  
 GSMO SOW Reference: 2.4, 3.1, 3.2

### **I. Task Order History**

**Description of current modification (Modification 1):** This modification to the task order statement of work for GOES-R Launch and Early Orbit Planning and Ground System Engineering Support Task provides for ground system operations readiness support.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	5/19/2014	4/30/2015	Initial task order statement of work.
1	7/7/2014	4/30/2015	Ground system operations readiness support.
2	5/1/2015	4/30/2016	Renew task order for 1 year

### **II. Background**

The Geostationary Operational Environmental Satellite-R Series (GOES-R) is the next generation of geostationary weather satellites, scheduled to launch in 2015. The program is a collaborative development and acquisition effort between the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA). The GOES-R satellite will provide continuous imagery and atmospheric measurements of Earth's Western Hemisphere and space weather monitoring. It will be the primary tool for the detection and tracking of hurricanes and severe weather, and will provide new and improved applications and products for fulfilling NOAA's goals of Water and Weather, Climate, Commerce, and Ecosystem.

The GOES-R Program is managed by NOAA with an integrated NOAA-NASA program office organization, staffed with personnel from NOAA and NASA and co-located at NASA's Goddard Space Flight Center. GOES-R is composed of the GOES-R Program Office and two integrated NOAA-NASA project offices: the Flight Project and the Ground Segment Project. The Flight Project oversees the development of the Space Segment, which consists of the spacecraft, the instruments, launch vehicle, and the auxiliary communication payloads. The Ground Segment Project consists of the entire ground system, including the facilities, antenna sites, software and hardware for satellite command and control and to process, create, and distribute end user products.

### **III. Scope of Work**

The Contractor shall provide subject matter expertise to support GOES-R launch, early orbit, and mission handover planning, including coordination of activities across the GOS-R Program, Flight Project, and Ground Segment Project (GSP).

## A. Requirements

- A.1. The contractor shall support the GOES-R Launch and Handover Coordination Group (LHCG) in the oversight of launch preparation planning activities, documentation development, and the disposition GOES-R inter-segment issues.
- a. The contractor shall assist in planning, scheduling, and facilitating LHCG meetings and in assigning and tracking LHCG-related action items.
  - b. The contractor shall support development of the GOES-R Launch and Early Orbit Management Plans (LEOMP).
  - c. The contractor shall support development, review and/or provide comments on the following, in support of the LHCG:
    - o Overall progress of launch preparation activities
    - o Launch and early orbit operations team (MOST, DOST, POSST) organizations and decision flows
    - o Minimum GOES-R functional performance at launch
    - o Coordination of MOST, DOST and POSST activities
    - o Handover criteria
    - o Anomaly response process including Notification Tree and status reporting
    - o Management reporting and communications flow
    - o Key documents:
      - o Transition, Handover and System Acceptance Plan
      - o Integrated Mission Timeline
      - o GOES-R Pre-launch Countdown Script
      - o Mission Rules
      - o Launch Commit Criteria
      - o Launch Day Count Down Polling Organization
- A.2. The contractor shall provide Core ground system engineering support to the GOES-R mission, including serving as the GOES-R Ground Systems Engineer. The GOES-R Ground Systems Engineer (GSE) will reside primarily at the NOAA Satellite Operations Facility (NSOF) in Suitland, Maryland to provide Core operations support to the GSP and Mission Operations Support Team (MOST). The GSE will be responsible for coordinating activities with the MOST team and communicating any issues to the GSP. The GSE will ~~be~~ the Ground Readiness Manager, but also take direction from the Mission Operations Manager (MOM). This effort shall not involve the review, evaluation, or oversight of work performed under the GOES-R Antenna contract. Duties will include, but are not limited to:
- a. Serve as the primary GSP "hands on" engineer at NSOF to support operations
  - b. Participate in ground software release integration and test activities including site acceptance testing, day-in-the-life testing, and regression testing
  - c. Assist in planning and conduct pre-launch data operations external interface testing
  - d. Coordinate the development of data and product operations procedures
  - e. Participate in pre-launch interface tests with external product and data interfaces
  - f. Participate in product generation and product distribution system acceptance and regression testing

- g. Identify and report operations concept, design, or other issues to MOST/GSP team for awareness and resolution.
- h. Request/coordinate resource use with MOST team. E.g. scheduling training time, operations product validation, staffing and systems to support testing/exercises, etc.
- i. Participate in End-to-End tests, Mission Rehearsals, and other activities. Support/ensure proper ground staffing, understand ops con issues, system issues and support anomalies. Ensure proper resources are made available and prioritized.
- j. Identify ground tasks that are recommended for insertion into the Post-Launch Test (PLT) phase
- k. Participate in Incident Review Board(s) (IRBs) and recommend Incident Report (IR) priority/severity
- l. Work any assigned IRs to closure
- m. Present as needed at Mission Reviews
- n. Support/lead ground anomaly resolution teams
- o. Participate in hand-over and transition of mission/ground operations from the GOES-R Program to the NOAA operations team/organization.

#### **B. Management Reporting**

The Contractor shall provide monthly status reports 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**

There are no requirements for the Contractor to control or manage government property.

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

There are no specific Government furnished facilities, equipment, or software required with this Task Order

#### **V. Material Procurement**

The Contractor shall procure materials that are identified 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	Assessment of Launch and Early Orbit Management Plans	GOES-R Operations Readiness Review (~Launch – 3 months)

End of Task Order Statement of Work

## **GSMO TASK ORDER**

Task No: **89**  
 Modification: **1**  
 Task Name: **SET Project Mission Operations**  
 Task Period of Performance: **May 15, 2014 to April 30, 2016**  
 Modification Period of Performance: **May 1, 2015 to April 30, 2016**  
 GSMO SOW Reference: **3.1, 3.2, 3.3**

### **I. Task Order History**

**Description of current modification (Modification 1):** Extension for the Mission Preparation, Systems Engineering, and Documentation Support services for the Space Environment Testbeds (SET) Project.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	05/15/2014	04/30/2015	Initial task order statement of work.
1	05/01/2015	04/30/2106	One-year extension. No new requirements.

### **II. Background**

The SET-1 carrier is targeted to launch with the Air Force Research Lab (AFRL) Demonstration and Science Experiments (DSX) spacecraft on a Falcon Heavy rocket no earlier than mid-2016. The SET-1 carrier was delivered to the DSX Program in August 2008. SET-1-to-DSX spacecraft integration was completed in November 2009.

### **III. Scope of Work**

The Contractor shall provide mission operations preparation support, systems engineering support, and documentation support for the SET Project in the interim period following SET-1 delivery to the DSX Program, launch (no earlier than mid-2016), and one-year of operations. The Contractor shall be located on-site at GSFC.

#### **A. Requirements**

- A.1. The contractor shall support testing of Ground Data Systems as directed by the Ground Data Systems Manager.
- A.2. The contractor shall participate in Fault Tree Analysis (FTA) and Failure Modes and Effects Analysis (FMEA) generation.
- A.3. The contractor shall conduct a pre-launch simulation and training program. The DSX Program will be responsible for scheduling mission simulations.
- A.4. The Contractor shall support the maintenance of programmatic documents and quality records for the SET Project.
- A.5. The Contractor shall provide engineering support for meetings including, but not limited to, Test Conductor meetings, and Operations Working Group meetings, as needed.
- A.6. The Contractor shall support the DSX Flight Readiness Review (no earlier than mid-2016).

A.7. The contractor shall provide analytical support to ensure that the SET Project requirements are verified and met for operations activities.

## 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.

### 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

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.

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

Travel Description	Approximate Time Frame
DSX Flight Readiness Review	Spring 2016

### VII. Deliverables

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

ID	Deliverable Description	Due Date
	None	

End of Task Order Statement of Work

## **GSMO TASK ORDER**

Task No: **90**  
Modification: **1**  
Task Name: **Earth Science Division Program Support**  
Task Period of Performance: **5/15/2014 to 12/31/2014**  
Modification Period of Performance: **10/1/2014 to 12/31/2014**  
GSMO SOW Reference: **2.1, 2.2**

### **I. Task Order History**

**Description of current modification (Modification 1):** 3-month extension of work for the Earth Science Division Program support task.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	5/15/2014	9/30/2014	Initial task order statement of work.
1	10/1/2014	12/31/2014	Extend period of performance for 3-months to December 31, 2014.

#### **1.0 PURPOSE**

The purpose of this task is to provide systems engineering services, including technical writing, in support of the Earth Science Division programs.

#### **2.0 SCOPE OF WORK**

The scope of work includes developing program planning documents, performing trade studies and technical analyses, strategic communications, organization planning and analysis, and conducting studies and business implementation analyses and research to support execution of program goals. Further activities may be required within the overall scope.

#### **3.0 REQUIREMENTS**

The contractor shall ...

##### **3.1 Program Management, Planning and Reporting Support**

- 3.1.1 Support development of documents and plans (e.g. mission studies) to support program management and mission planning.
- 3.1.2 Support preparation of program/mission technical documents and briefings for reporting to various stakeholders.
- 3.1.3 Assist in planning and documenting actions and implementation steps to accomplish program goals and objectives.

- 3.1.4 Conduct ad-hoc studies and analyses, as requested, of mission and program issues to support planning and decision making; Provide recommendations for implementation.

### **3.2 Technical Writing and Organizational Support**

- 3.2.1 Provide technical writing, review and editing for program plans and documents; Evaluate existing plans/documents and provide recommended revisions based on program environment and direction
- 3.2.2 Support planning and facilitation of meetings or workshops with HQ program staff, staff from NASA Centers and key stakeholders as requested; Assist with developing agenda and materials, defining breakout sessions, facilitating workshop and documenting results
- 3.2.3 Provide recommendations to Program Director on program strategy and changes to support program goals and desired direction

### **4.0 TRAVEL**

Travel required to provide support under this task will be approved by the TM or designee.

### **5.0 PROJECT DELIVERABLES:**

The following deliverables will be provided under this task order.

- Monthly Progress Reports
- Informal Biweekly Progress Reports with task leads or designees
- A final written report(s)

### **6.0 WORK LOCATION:**

The primary location for the required support described in this task is at NASA Headquarters, though some work may be performed remotely. A work space at NASA Headquarters may be provided for contractor staff.

## **GSMO TASK ORDER**

Task No: **93**  
 Modification: **5**  
 Task Name: **Space Geodesy Satellite Laser Ranging Design and Development**  
 Task Period of Performance: **August 1, 2014 to July 31, 2016**  
 Modification 5 Period of Performance: **August 1, 2015 to July 31, 2016**  
 GSMO SOW Reference: **{SOW 2.2, 2.3, 2.4}**

### **I. Task Order History**

#### **Description of current modification (Modification 5):**

This modification is for task year 2.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	8/1/2014	7/31/2015	Initial task order statement of work.
1	9/8/2014	7/31/2015	Modification for MCR preparation and Workshop support.
2	1/23/2015	7/31/2015	Modification for additional work, travel and procurement.
3	5/7/2015	7/31/2016	Procurement of 2 Gimbal & Telescope Systems for SGSLR.
4	5/19/2015		Administrative modification
5	8/1/2015	7/31/2016	Task year 2

### **II. Background**

Satellite Laser Ranging (SLR) began at Goddard in 1964 with the first successful ranging ever to the Beacon Explorer B satellite. SLR is now performed in approximately 30 countries, and NASA has expanded its SLR network to 8 associated stations. These stations are all over 35 years old and need to be replaced with systems that can support the increased performance requirements of current and future science missions, and that are more automated, have less down time, and cost less to operate.

SLR is now part of NASA's Space Geodesy Project (SGP) which is a single project under the Space Geodesy Program at NASA HQ. SGP is part of the Solar System Exploration Division (code 690) and the SGSLR work is being done out of this division.

NASA has developed in-house a prototype system for the future SLR Network, NGSLR. This system has demonstrated the performance requirements required, but it is not an operational system. SGSLR will build upon the NGSLR design, advancing the operational robustness of the prototype and replacing some of the NGSLR equipment with even more advanced commercial components.

The first SGSLR system will be built and tested at the Goddard Geophysical and Astronomical Observatory (GGAO). As part of this task, a pad and shelter will be built at GGAO for the first system. Lab space at the 1.2 meter telescope will be used to develop and test the subsystems which will eventually be integrated into the facility. After integration of the system, testing will be performed, ending in collocated simultaneous ranging to satellites with the current NASA Network Standard MOBLAS-7 (also at GGAO) which is the final test for system performance. Multiple reviews will be held throughout the system design, development and testing of the system.

### III. Scope of Work

The Contractor shall support the design, development, build, testing and deployment up to two SGSLR systems as part of a Government led in-house team that consists of [REDACTED] and other contractors.

#### A. Requirements

***Mod 05 (August 2015 through July 2016)***

- A.1. The Contractor shall be governed, for this task order, by GSMO Contract Clause I.91, 52.227-17, Rights in Data-Special Works (Dec 2007) as modified by NASA FAR Supplement 1852.227-17, which will be the applicable Data Rights Clause. [REDACTED]
- A.2. This task is not required to follow NPR 7150.2A.
- A.3. The contractor shall support this project with a team that has expertise in SLR system design and development.
- A.4. The contractor shall support the Government to complete and maintain a schedule and budget, for the design, build, test and deployment of up to two SGSLR systems, and to include a third system to be deployed to Norway.
- A.5. The contractor shall support the Government to develop a detailed design, for SGSLR starting from the NGSLR prototype design.
- A.6. The contractor shall support the government in the selection of the GTA Vendor.
- A.7. The contractor shall support the Government in the testing and verification of the gimbal and telescope for SGSLR. This includes travel to the Gimbal & Telescope (GTA) Vendor, including GTA TIMS and Reviews (this travel is listed again below).
- A.8. The contractor shall support the Government in the procurement of materials and instrumentation as needed to do testing in support of the SGSLR design.
- A.9. The contractor shall support the government in the integration of the SGSLR system, including the integration of the overall system design.
- A.10. The contractor shall support the preparation of slides and other materials needed for the SGSLR Preliminary Design Review (PDR) in late 2015, and the Critical Design Review (CDR) in summer of 2016.
- A.11. The contractor shall support reviews for SGP management and for NASA HQ related to SGSLR and future SLR activities.
- A.12. The contractor shall support the development of the SGP Concept of Operations in so far as it relates to SGSLR.
- A.13. The contractor shall support the design and development of the interface to the Operations Center for SGSLR.
- A.14. The contractor shall support the modifications needed to the NGSLR software to work with the SGSLR systems.
- A.15. The contractor shall provide safety and laser safety support for the SGSLR work.
- A.16. The contractor shall provide the interface to the ILRS for the SGSLR work.
- A.17. The contractor shall support the Government in the planning, layout and design of the pads, pier, and facility, and installation of power, HVAC, and communications at GGAO, as well as support the planning for the Texas and Hawaii sites.

- A.18. The contractor shall support the development and use of the building 34 lab space as well as the development and use of the SGSLR lab space at the 1.2 meter telescope.
- A.19. The contractor shall provide additional lab and/or storage space if/as needed beyond the on-Center labs that the government will supply.
- A.20. The contractor shall support the ILRS Workshop in late October 2015. Travel will be required for three people to the Workshop in Matera.
- A.21. The contractor shall complete the upgrade to the timing distribution infrastructure at GGAO. This work shall be coordinated with the SLR, VLBI and GNSS leads and the technical teams at GGAO who comprise the GGAO timing team. Work includes making the topology of the timing distribution simpler, adding diagnostic capability, and purchasing spares.
- A.22. The contractor shall provide facility engineering support for the final design, construction planning, and implementation of an SGSLR shelter concrete pad, telescope pier, meteorological sensor foundations with power and communication hookups, and potential calibration piers. This work is to be coordinated with the Goddard FMD Code 221 Planning Branch and Code 224 Engineering Branch and with the concurrence of the SGSLR project lead.
- A.23. Procurement of materials, equipment and design support for SGSLR:
- a. Three MET4A units for testing
  - b. Test laser for use in hardware lab (B34 clean room lab)
  - c. Procurements for the design/development of the IO chassis.
- A.24. Survey support:
- a. VTS operations support for GGAO and McDonald planning.
  - b. Continuing site development planning / implementation at GGAO & McDonald.
  - c. SLR site development planning at Maui.
  - d. VTS equipment maintenance.
  - e. Travel to McDonald and Maui (not in the travel below):
    - i. 1 trip to McDonald for 4 days [REDACTED] (dates TBD)
    - ii. 1 trip to Maui for 4 days : [REDACTED] (dates TBD)
- A.25. Travel in support of SGSLR:
- a. SAEG10T FAA meeting for [REDACTED] in August to participate in generation of aircraft safety requirements for one week.
  - b. SAEG10T FAA meeting for [REDACTED] in January/February timeframe.
  - c. Future SGSLR site visit to Haleakala in Hawaii for [REDACTED] for 1 week (was task on previous year, but was not completed due to Government delays).
  - d. Travel to the GTA Vendor for support of Kick-Off meeting, TIMS and Reviews. Five trips of 3 days each for [REDACTED]
  - e. Three people to the ILRS Matera Workshop in October 2015 for one week.
- Mod 03/04 (May 2015 to July 2016) continues***
- A.26. Procure two (2) Gimbal and Telescope Assemblies (GTAs) for SGSLR.

## 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

The government will furnish laboratory space at GGAO (area 200), access and use of NGSLR and the 1.2 meter telescope for testing of SGSLR subsystems, and use of code 690 test equipment at GGAO.

## 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. Specifically, the contractor shall support the travel requirements as described in the table below. Travel reports must be delivered to TM after all travel in 2015.

Travel Description	Approximate Time Frame
Matera, Italy ILRS Workshop ( [REDACTED] 1 week)	October 2015
GTA Vendor TMS & Reviews ( [REDACTED] 3 days each times 5 trips, assume Pittsburgh)	Fall 2015 thru summer 2016
SAEG10T in San Diego [REDACTED]	August 2015
SAEG10T in Florida for 1 person	February 2015
Haleakala, Hawaii for SGSLR site selection [REDACTED]	TBD
McDonald Observatory, Texas for site/survey work (4 days [REDACTED])	TBD
Haleakala, Hawaii for site/survey work (4 days [REDACTED])	TBD

## VII. Deliverables

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

ID	Deliverable Description	Due Date
1	Timing upgrades to GGAO	Sep 30, 2015

2	Selection of GTA Vendor	Sep 30, 2015
3	SGSLR design preparation & slide generation for PDR	October 2015
4	Presentation prep for Matera Workshop and Trip Report	November 2015
5	Prep and review of GTA PDR	March 2016
6	Prep and review of GTA CDR	June 2016
7	SGSLR design preparation & slide generation for CDR	July 2016
8	Hold at least 3 TIMS with GTA Vendor	July 2016

End of Task Order Statement of Work

**GSMO TASK ORDER**  
**Statement of Work (SOW)**  
**For the**  
**Magnetospheric Multi-scale (MMS) Mission**  
**Team Activity Coordination Tool (tACT) Sustaining Engineering Support**

Task No: 95  
 Modification: 0  
 Task Name: MMS Mission tACT Sustaining Engineering Support  
 Task Period of Performance: 08/01/2014 - 07/31/2015  
 Modification Period of Performance: 08/01/2014 - 07/31/2015  
 GSMO SOW Reference: 2.1

**I. Task Order History**

**Description of current modification (Modification 0):** This is the initial task order statement of work for the MMS Mission team Activity Coordination Tool (tACT) Sustaining Engineering Support

Mod #	Start	End	Brief Description
0	08/01/2014	07/31/2015	Initial task order statement of work.

**II. Background**

The Magnetospheric Multi-scale (MMS) mission is a Solar Terrestrial Probe mission comprising four identically instrumented observatories that will use Earth's magnetosphere as a laboratory to study the microphysics of three fundamental plasma processes; magnetic reconnection, energetic particle acceleration, and turbulence. These processes occur in all astrophysical plasma systems but can be studied *in situ* only in our solar system and most efficiently only in Earth's magnetosphere, where they control the dynamics of the geo-space environment and play an important role in the processes known as "space weather".

All four observatories will be operated from a single Mission Operations Center (MOC) located at GSFC. The MOC will be staffed and operated by a dedicated Flight Operations Team (FOT). The Flight Dynamics team will be collocated with the FOT in the MOC. The Science Operations Center (SOC), located at the Laboratory for Atmospheric and Space Physics (LASP) in Boulder, CO, will provide the interface with the instrument teams and is responsible for Instrument Suite (IS) operations.

**Assumptions:**

- The Advanced Spacecraft Integration and System Test (ASIST) telemetry and command system baselined to support the spacecraft Integration and Test (I&T) activities will also be used to support mission operations;

development and technical support for the ASIST and Front End Data System (FEDS) will be provided by Design America Inc., under a separate contract.

- The Flight Dynamics functions are developed, implemented and operated under a separate Flight Dynamics Support Services (FDSS) contract.
- MOC will provide the interface between the SOC and the observatories; the SOC performs all Instrument Suite (IS) health and safety monitoring, science planning and data processing, and resolves all inter-instrument conflicts.

### **III. Scope of Work**

Under this task, the contractor is asked to provide sustaining engineering support to the Magnetospheric MultiScale Mission Operations Center at GSFC for the team Activity Coordination Tool (tACT) scheduling tool.

The contractor shall expect to work with NASA as well as NASA's partners in other government agencies, industry, academia, and other contractors in the accomplishment of the technical and programmatic objectives of the task. As work results are evaluated, work priorities may change. The contractor shall be expected to provide timely support to meet the deadlines for operations preparations and operational mission support.

#### **A. Requirements**

##### **A-1 Management Approach**

The Contractor shall create and maintain a Task Plan that describes the manner in which the Contractor will manage the work for each of the elements identified in this SOW. The task plan will identify major milestones, and resource allocations.

Management responsibility will at a minimum include the following areas:

##### **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 of this Task Order. The Contractor shall manage staff allocation to the required tasks specified.

##### **b. Configuration Management**

The Contractor shall support standard NASA/GSFC Configuration Management (CM) policies and procedures.

##### **c. Information Technology Security**

The Contractor shall perform the work specified in this SOW in compliance

with standard NASA/GSFC security procedures.

**A-2. Technical**

The contractor shall provide sustaining engineering support for the tACT Commissioning Scheduling tool for the Magnetospheric MultiScale mission (MMS). Sustaining engineering includes maintenance of the software based on discrepancies found by the Technical Representative (TR) and the Commissioning team, updates made by the development contractor for product improvement, and usage and technical support to the MMS team. The contractor shall provide a mechanism for reporting the discrepancies and shall monitor and report status of each discrepancy as well as statistics of open, closed, overdue discrepancies.

In addition, under this task, the contractor shall provide development support for requested enhancements to tACT. At a minimum, the enhancements include the items listed below.

	Enhancement	Description
1	Activity Linking	Ability to tie an activity to an event or another activity such that the relationship and its associated linkage constraints are maintained when the event or activity is moved. Specific to the antenna contact activities, linkage to a given activity should be maintained across network schedule updates. E.g. Instrument activity Inst_A is a downstream link to DSN contact D1. When a new DSN contact schedule is loaded that shows a D1' activity (D1 shifted by 5 seconds), Inst_A should remain associated with D1' and also shift by 5 sec. (The definition of association from D1 to D1' is TBD, but will be something on the order of D1' = All of D1 attributes, with a +/- Xsec time shift.). These contacts are identified by an Event ID in the MPS Events File.
2	Dynamic time delineation	Ability to modify the time divisions to something other than 24 segments; dynamic scaling depending on full time period viewed or user-defined inputs
3	Constraint text displayed on main Activity Template Editor page.	Add Constraint text to main Activity Template window, instead of a separate window. When building an activity template, it would make it easier to see the existing constraint text in the window rather than having to open a separate window.
4	Separate window for constraint report	Constraint report generated as a new window so that when looking at the constraint report in order to fix violations one does not have to keep closing and opening the report.
5	Expand/Contract	Develop an option to Expand All/Contract All in the

	All option	constraint editor and constraint reports; needed for ease of visual review.
6	Dropdown option of existing Activities/Events/Attributes for constraints	Include a dropdown list of existing Events, Activities, or Constraints (selectable categories) from which the user can select for inclusion in a new template or Activity definition. Reduces the risk of incorrectly typing the name of the Activity or Event and giving a false result on the constraint violation.
7	Add constraint text to hover	Include the constraint information (TBD format) in the text box that shows when hovering over an activity to more easily see that information when updating an activity or verifying the placement.
8	Hover text box toggle	Include an option to toggle off/on whether the text box pops up when you hover over an activity.
9	Consistent time entry	Time currently shows up in different formats for input; prefer user enter time in hh:mm:ss.sss format (microseconds optional); similarly for dates allow both calendar formats (mm/dd/yyyy or yyyy:mm:dd) and Julian day formats (yyyy-jjj).
10	GUI updates	Include a GUI for the Custom Style Sheet and row editor to increase user friendliness; optionally display row labels so you know the contents of the row without having to open the editor
11	Define status and apply CSS	Define the completion status and the constraint status in the HTML class definition to be able to apply Custom Style Sheet to activities based on status; helps to visually identify Activities based on status so it's easier to see what needs to be moved or re-worked.
12	Print	Ability to print each report type; include ability to print to large-scale plotter printer, especially useful for monthly calendar view to eliminate real-estate constraints in the longer-duration views.

The task TR will provide the task with the initial version of the tACT Users' Guide. For each deliverable set of updates to tACT, the contractor shall provide commensurate updates to the tACT Users' Guide with the software delivery. The contractor shall provide training on the tACT updates to the TR and other MMS team personnel.

The contractor shall consult with the task TR regularly throughout the task to provide status on the tool updates and discrepancy report responses and to ensure that implemented features meet the intended need. Times are to be arranged with the TR.

**B. Management Reporting**

The contractor shall report status in person to the Technical Representative (TR) or designated alternates on a weekly basis, or as determined by the TR. The report shall address technical, cost, and schedule performance versus plans. Reports shall include, but are not limited to, informal presentation of interim results, status of development activities, and discrepancy item status. The contractor shall provide all reports in advance of the weekly meeting via email. The tACT team may include civil servants, academia, and other contractors with whom the contractor on this task will need to work and coordinate.

**IV. Travel Support**

There is no travel for this SOW.

**V. Deliverables**

Deliverable	Date
tACT Enhancement Delivery #1	October 1, 2014
Version updates to tACT	As negotiated with task Technical Representative

**VI. Reference Material**

No reference material is needed for this SOW.

## **GSMO TASK ORDER**

Task No: **96**  
 Modification: **2**  
 Task Name: **DSCOVER Mission Operations Manager**  
 Task Period of Performance: **Sept 1, 2014 – September 30, 2015**  
 Modification Period of Performance: **July 1, 2015 – September 30, 2015**  
 GSMO SOW Reference: **2.3.2.1 TT&C, 2.3.2.2 Mission Planning**

### **I. Task Order History**

#### **Description of current modification (Modification 2)**

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	9/1/2014	6/31/2015	Initial task order statement of work.
1	1/28/2015		Administrative Modification
2	7/1/15	9/30/15	Continued Mission Operations Support through end of Sept.

### **II. Background**

DSCOVER is an operational mission that collects space weather data for the National Oceanic and Atmospheric Administration (NOAA) while stationed in a Lissajous orbit about the first Sun Earth Libration point. The mission will serve as the primary replacement for the National Aeronautics and Space Administration (NASA) / Goddard Space Flight Center (GSFC) Advanced Composition Explorer (ACE) mission that provides early warning of geomagnetic storm activity that may affect Earth-orbiting spacecraft and Earth-based systems such as the power grids. The Observatory will also collect images and radiometric data on a best effort basis. The Mission Operations Center (MOC) will be located at NOAA Satellite Operations Facility (NSOF) with a backup MOC at Wallops Command and Data Acquisition Station (WCDAS). The MOC will interface with the SN, NEN, DSN, for tracking, commanding, and low-rate telemetry and the and CDAS for commanding and full-rate telemetry.

There are no subtasks planned for this task. All the work on this task will be via a single funding source.

### **III. Scope of Work**

In Summary contractor shall provide, Mission Management services for the DSCOVER Mission. The Mission Manager is responsible for organizing, planning, directing, and coordinating the mission operations during the prelaunch testing, Launch, and post launch phases of the mission.

#### **A. Requirements**

- A.1. The contractor shall serve as the DSCOVER Mission Manager. Specifically, the Mission Manager is responsible for organizing, planning, directing, and coordinating the technical management operations of the DSCOVER Mission
- A.2. The contractor shall support Pre-Launch, Launch, and on-orbit operations. Specifically, the contractor shall chair FOT working group meetings. Additionally, the contractor shall develop, or oversee development of, all Standard Operating

Procedures (SOP) and contingency procedures. This involves coordinating assignments with the FOT and PDLs.

- A.3. The contractor shall ensure and oversee Mission Rehearsals and Simulations and interface with the Incumbent ETE, Sim, & Mission Rehearsal leads.
- A.4. The contractor shall chair the Mission Operations Procedure CCB.
- A.5. The contractor shall interface with the Flight and I&T teams for prelaunch I&T testing, operations readiness testing, and troubleshooting as necessary
- A.6. The contractor shall develop, deliver, maintain, and lead transition of the DSCOVr MOC Operations to NOAA as defined in the NASA DSCOVr to NOAA OSPO Transition Plan.
- A.7. The contractor shall develop, deliver, maintain, the Sustaining Engineering Plan.

## **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**

The Government shall provide a desk, office, chair, and computer at NASA/GSFC.

## **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:

<b>ID</b>	<b>Deliverable Description</b>	<b>Due Date</b>
<i>1</i>	<i>Weekly Status Reports (text email)</i>	<i>Mondays, COB</i>
<i>2</i>	<i>Weekly SEWG Report (MS PPT)</i>	<i>Wednesdays, COB</i>
<i>3</i>	<i>533 Spending Report</i>	<i>Monthly, 2<sup>nd</sup> week.</i>
<i>4</i>	<i>GS Monthly Status Report (MSR) (MS PPT)</i>	<i>Wednesday COB Monthly, the week before Project Status Review (PSR)</i>
<i>5</i>	<i>DSCOVR to NOAA Transition Plan</i>	<i>Review Oct 31, 14 Final Feb, 28, 2015</i>

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End of Task Order Statement of Work

## ***GSMO TASK ORDER***

Task No: 097 Mod 01  
 Task Name: NICER Ground Systems & Operations  
 Period of Performance: 09/29/2014 – 12/31/2015  
 Mod Period of Perf: 07/13/2015 – 12/31/2015  
 GSMO SOW Reference: 2.1 Systems Engineering  
                                   2.3.1 Facility Engineering  
                                   2.3.2 Ground System  
                                   2.3.2.9 Information Technology Support  
                                   2.3.3 Operations Products  
                                   2.4 Integration and Test

### **I. Task Order History**

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
01	07/13/2015	12/31/2015	Mod 01 adds hardware/software purchases and labor

This Task Order (TO) represents the first mod (Mod 01) to the task order statement of work for GSMO Task 097, NICER Ground System & Operations Support. TO 097 implements requirements for establishing network connectivity, deploying ground systems, interfacing ground system facilities, and providing operations support for the Neutron star Interior Composition Explorer (NICER) mission, specifically to the NICER Science and Mission Operations Center (SMOC) to be deployed within the Science & Planetary Operations Control Center (SPOCC) in GSFC Building 32 and to the NICER development and test facilities in GSFC Buildings 5, 7/10, 11, and 23. Task Mod 01 increases labor to perform work highlighted in YELLOW under Section III., Part A; requests specific hardware purchases in Section III., Part A (Item 7); and divides the task into three (3) subtasks: Subtask 1 to encompass the labor summarized above; Subtask 2 to provide specific support to the EPIC power interface controller development; and Subtask 3 to cover hardware and software license purchases.

### **II. Background**

NICER is a Mission of Opportunity payload that will be launched in the trunk of a SpaceX Dragon in August 2016 to be attached to an EXPRESS Logistics Carrier (ELC) for external payloads on-board the International Space Station (ISS). NICER is composed of an array of X-ray telescopes that will gather data to explore the nature of the interior of neutron stars. The NICER Principal Investigator (PI) is located at GSFC, and the NICER instrument payload will be developed, integrated, and tested at GSFC

with support from various co-investigator and contractor organizations. The Science and Mission Operations Center (SMOC), to be hosted in the SPOCC in GSFC Bldg. 32, will interface with the Payload Operations Integration Center (POIC) in the Huntsville Operations Support Center (HOSC) located at NASA's MSFC, from where command and telemetry data will be exchanged directly with the Space Station Control Center (SSCC) at NASA's JSC.

### **III. Scope of Work**

The specific work in support of NICER on TO 097 Mod 01 is described in the Requirements subsection below. All work in progress that was initiated via the initial TO 097 (Mod 00) should be continued to completion. The labor increase as part of this mod (Mod 01) enables the contractor to aggressively pursue the completion of previously initiated work.

#### **A. Requirements**

##### **Subtask 1**

###### **1. *NICER Network Interfaces***

- Establishment of data network connectivity with NICER ground elements required to interface with the SMOC. These elements include, but are not limited to, the list of ground facilities below, and will require connections to be made via the SEN and/or CNE networks:
  - Payload Operations Integration Center (POIC) at NASA's MSFC
  - Flight Software (FSW) Lab in GSFC Bldg. 23, Room E414
  - Payload I&T Lab in GSFC Bldg. 5A, Room 005
  - Environmental Test Facilities in GSFC Bldg. 7/10
  - Formation Flying Testbed (FFTB) Lab in GSFC Bldg. 11, Room 332C
  - High Energy Astrophysics Science Archive Research Center (HEASARC)
  - Flight Dynamics Facility (FDF) server for ISS Ephemerides, Solar, Lunar, and Planetary Ephemerides, Time Coefficient Files, and associated support products
- Full implementation of VoIP for NICER via the GSFC Science and Engineering Network (SEN) and the MSFC-provided IVoDS system for required:
  - Voice nets with MSFC
  - Voice nets with JSC
  - Voice nets with White Sands
- Full implementation, via the GSFC Science and Engineering Network (SEN), of the capability to view 6 separate ISS video feeds provided by MSFC
- Full implementation of I&T Camera System

## **2. *NICER Integrated Trending and Plotting System (ITPS) Support***

- Personnel support to:
  - Ingest the NICER Telemetry & Command Database via ASIST Record Definition Language (RDL) files
  - Implement the capability to ingest the appropriate Telemetry parameters and mission / orbital events to support the generation of trending plots using ITPS in the NICER Payload I&T Facility in Bldg. 5A and in the SMOC in GSFC Bldg. 32

## **3. *Test Conductor and Flight Operations Preparation / Support***

- Specific ground system, Test Conductor and Flight Operations support required for GSFC Labs involved in the NICER payload development and test effort and mission operations:
  - Pointing Lab in Bldg. 5
  - Payload I&T Lab in Bldg. 5A
  - Environmental Test Facilities in Bldg. 7/10
  - Electrical Lab GSE Development Support in Bldg. 23
  - SMOC in Bldg. 32
- Support for the development of the NICER Telemetry & Command (T&C) Database via ASIST Record Definition Language (RDL) files
  - Support to FSW Lab for T&C database development
  - Support to I&T Lab for T&C database development
- Population of the NICER Payload Data Library (PDL)
  - Population with required telemetry parameters from the NICER Health & Status Packet (derived from the ASIST Record Definition Language (RDL) files
  - Population of required subset of commands for critical NICER operations to be commanded directly via the ISS Payload Operations Integration Center (POIC) at MSFC
- Support in the development of Systems Test and Operations Language (STOL) procedures for test and operations of the NICER payload
  - Development of test procedures
  - Transition/translation of procedures developed in the I&T environment to the operations environment in the SMOC
- Support to help define the Telemetry parameters and types of trending, plotting, and analysis to be performed with ITPS in the NICER Payload I&T Facility in Bldg. 5 and in the SMOC in GSFC Bldg. 32
- Support in the development of documentation related to NICER Ground System & Operations (GS&O)
  - Interface Control Documents (ICD)
  - Operating Plans and Processes
  - Requirements

#### **4. *Support of the Attitude Ground System (AGS)***

- Support for deployment of the Multi-mission Three Axis Stabilized Support System (MTASS) and associated tools, licenses, and config files in the SMOC to comprise the NICER Attitude Ground System (AGS)
  - Perform Acceptance Testing in coordination with the MTASS development team and other NICER SMOC support personnel
  - Review and provide feedback on associated documentation

#### **5. *Additional Task Support***

- General support to the NICER GS&O development effort including, but not limited to:
  - Attendance at GS&O-related meetings
  - Support in maintenance of the NICER GS&O Project Schedule items
  - Support in the development of viewgraphs and presentation materials
  - Review/commenting on documents and presentations
  - Support in the development of NICER GS&O requirements and other documentation

### **Subtask 2**

#### **6. *EPIC Development Support***

- Provide labor in support of the ExPRESS Payload Assembly (ExPA) Power Interface Controller (EPIC) development.

### **Subtask 3**

#### **7. *Hardware/Software Procurements***

The following items are required to be purchased for the NICER SMOC:

- Microsoft Licenses to support IVoDS VoIP System
- Kinesix Sammi License Renewals past November 2015
- Barracuda - SEN VPN Appliance Renewal
- Satellite Tool Kit (STK) Licensing

The following items are required to be purchased in support of the I&T Lab:

- Dell workstation to serve as a backup Front End Data System (FEDS)
- Fixed Mount PTZ Camera
- High Power Injector (PoE+)
- USB Joystick
- 64GB Micro SDXC Card
- Dell Optiplex PC, Windows 7/8, 4GB, 2GB Video Card, 1TB HD
- Windows 7 Ultimate OEM 32/64 Bit to support I&T Camera system
- Windows 7 Ultimate OEM 32/64 Bit for clean tent admin system
- Microsoft Office 2013 for clean tent admin system

For the upgrade of ELVIS (ExPRESS Logistics Carrier Verification and Instrument Simulator) now operating in the NICER electrical test lab, the following equipment is also required:

- PXIe-1082, 8-Slot 3U PXI Express Chassis
- 8 GB Upgrade/Replacement RAM for PXIe-8840 and PXI-8840
- 500 GB 2.5 in SATA Hard Drive Upgrade
- NI PXIe-8840 Core i5-4400E 2.7GHz, Dual Core, Win 7 (64)-bit
- NI PXI 8-Slot Front Rack Mount Kit
- NI PXI 8-Slot Rear Rack Mount
- Standard Service Program for PXI Systems (3 years)
- DisplayPort to VGA Adapter Cable
- Power Cord, AC, U.S., 120 VAC, 2.3 meters

***Prior to finalizing any hardware purchase, the Task Monitor (TM) should be notified of the plan and the final cost to the Government.***

Hardware procurements should be initiated as soon as possible upon task award unless otherwise indicated.

## **B. Management Reporting**

The Contractor shall continue to provide monthly status reports and reviews on the technical, cost, schedule and operational performance of the task in accordance with the WBS to adequately describe the activities of the task to the Task Monitor. Reporting shall encompass activity on each of the Subtasks on this Task Order.

The Contractor shall perform Technical Management of task resources. The Contractor shall plan, manage, and execute task activities in coordination with the Task Monitor. Informal Technical Reporting shall include verbal briefings by the Contractor to the Task Monitor on a weekly basis and/or as needed. As stated in the SOW Requirements sub-

section above, prior to finalizing any procurement activity, GSMO personnel shall inform the Task Monitor of any revisions to the cost estimate and/or delivery/deployment plan.

Formal Management Reporting shall consist of preparation and delivery of brief managerial and technical status reports delivered by email that will include:

- 533
- Technical, managerial, and schedule status summary
- Budget planning data as required

### **C. Contractor Controlled Property**

The Contractor shall assist the Task Monitor and Property Custodian in maintaining the overall list (NPROP) of government owned property purchased and/or used on this Task Order. This support includes preparations for and cooperation during property audits.

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

Government-furnished facilities associated with this Task Order and all subordinate subtasks reside primarily in Building 32 Room C101 and Room C101c at NASA's Goddard Space Flight Center (GSFC). The focal point of the activity will be inside Room C101c which is the SPOCC facility, and in the adjacent SPOCC Equipment Room that is accessible through the SPOCC but is within the primary computing facility, Room C101. Equipment will also be deployed in the Payload I&T Lab in GSFC Bldg. 5A, Room 005 and within Environmental Test Facilities in GSFC Bldg. 7/10.

Personnel interactions, interfacing and associated work will occur within the Government-furnished facilities associated with this Task Order and described above. The Contractor will be required to interact with the Task Monitor for planning and guidance on requirements of the task and task activities. The Contractor will also be required to interface with other mission representatives to define and understand mission-specific requirements and to perform the necessary work.

## **V. Material Procurement**

The Government has identified equipment that may need to be procured by the Contractor in order to perform the work associated with this Task Order mod. In some instances the utilization of excess equipment or leveraging of other equipment already in the SPOCC may be able to satisfy the requirements, thereby eliminating the need for new procurements. Accordingly, the Task Monitor shall be informed of any revision to

the cost estimate and delivery/deployment plan resulting from the Contractor's identification of excess equipment that can meet NICER requirements.

#### **VI. Travel Support**

The Task Monitor *has not* identified any travel as being required within the performance period of this mod (Mod 01).

#### **VII. Deliverables**

The Contractor shall provide the deliverables described in Section III above in support of this Task Order. Deliverables are confined to the procurement of the described equipment and the management reports described in Section III, Part B.

**End of Task Order Statement of Work**

## **GSMO TASK ORDER**

Task No: 99  
 Modification: 0  
 Task Name: cFS Software Development  
 Task Period of Performance: 05/11/2015 to 08/31/2015  
 Modification Period of Performance: 05/11/2015 to 08/31/2015  
 GSMO SOW Reference: 2.3.2.7, 2.3.2.10

### **I. Task Order History**

#### **Description of current modification (Modification 0)**

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	05/11/2015	08/31/2015	Initial task order statement of work.

### **II. Background**

The contractor will be working on flight and ground software along with associated development tools for the core Flight Systems (cFS). The cFS includes a common framework and suite of application software for flight systems that has flown on several missions and is currently in use at multiple NASA centers.

### **III. Scope of Work**

The Contractor shall develop flight and ground system software for potential use on missions and technology prototypes as directed. The work includes application, operating system and device driver software with a focus on real-time embedded Linux.

#### **A. Requirements**

- A.1. The contractor shall develop software consistent with the relevant software classification level in NPR 7150.2B
- A.2. The contractor shall assist in installing and configuring development and ground system tools
- A.3. The contractor shall deliver all source code, test procedures and software artifacts developed under this SOW.

#### **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**

The contractor will use software development workstations and associated hardware located primarily in the Building 23 flight software technology lab.

#### **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 the travel requirements as described in the table below:

<b>Travel Description</b>	<b>Approximate Time Frame</b>
None	

#### **VII. Deliverables**

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

<b>ID</b>	<b>Deliverable Description</b>	<b>Due Date</b>
1	All source code, test procedures, install scripts and software artifacts developed under this SOW for the cFS real-time Linux instantiation.	8/31/2015

End of Task Order Statement of Work

## **GSMO TASK ORDER**

Task No: 100  
Modification: 0  
Task Name: Hawaii Optical Communications Ground Station  
Requirements Definition, and Design Task  
Task Period of Performance: 06/15/2015 to 02/29/2016  
Modification Period of Performance: 06/15/2015 to 02/29/2016  
GSMO SOW Reference: 2.3.1

### **I. Task Order History**

#### **Description of current modification (Modification 0):**

This is the initial (Modification 0) Task Order (TO) Statement of Work (SOW) for the Hawaii Optical Communications Ground Station Requirements Definition and Design Task. This Task Order will cover requirements and design-related activities, through completion of 100% design, "ready-for-bid" documents, and subcontractor bid packages, for a new station on Maui. This Task Order is a "design and bid" task in preparation of a "build" task modification, to provide NASA with the estimate of costs to complete the entire implementation.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	06/15/2015	2/29/2016	Initial task order statement of work.

### **II. Background**

The Laser Communications Relay Demonstration (LCRD) will demonstrate optical communications relay services between Geosynchronous Earth Orbit (GEO) and Earth over an extended period, and thereby gain the knowledge and experience base that will enable NASA to design, procure, and operate cost-effective, future optical communications systems and relay networks. LCRD is the next step in NASA eventually providing an optical communications service on the Next Generation Tracking and Data Relay Satellites.

LCRD will have two Optical Communications Ground Stations (OGS). OGS-1 will be located at the Jet Propulsion Laboratory (JPL) Optical Communication Telescope Laboratory (OCTL) on Table Mountain, CA. OGS-2 will be located at the Air Force Maui Optical and Supercomputing Site (AMOS) / Maui Space Surveillance Complex (MSSC) on Haleakala, HI.

This TO will involve the development of an implementation concept and a Facilities Requirements Document (FRD) and completion of the design and subcontractor bid packages for future OGS-2 facility implementation/construction at AMOS / MSSC. The implementation concept will describe the approach for removing an existing telescope dome/pier located on the MSSC roof and installing the new OGS-2 system. An FRD will be developed to detail the interface of the OGS-2 with the site infrastructure. The OGS-2 design will then be completed, resulting in the generation of 100% design, "ready-for-bid" documents and bid packages for the future construction/installation of the OGS-2.

### **III. Scope of Work**

The contractor shall complete the implementation concept, requirements definition, design, and subcontractor bid packages for the OGS-2 facility. All work will be in accordance with the requirements and guidelines specified in the sections below.

#### **A. Requirements**

##### **A.1. Task Management**

- a. The contractor shall organize the work according to a Work Breakdown Structure (WBS), which shall be proposed in the Task Implementation Plan (TIP).
- b. The contractor shall develop and update an integrated task schedule covering all TO activities and deliverables.
- c. The contractor shall consider and use, as deemed appropriate by the contractor's and industry's standards, innovative methods, techniques, technologies, and/or process improvements that advance requirements, and Design activities, reduce schedule, or save the Government money. The contractor shall share information pertaining to these innovations and improvements it is considering/using during execution of this TO with the Task Monitor.
- d. The contractor shall propose and perform any other work (activities not specifically identified in this SOW) that must be accomplished to ensure TO objectives are met.
- e. The contractor shall conduct a task kick-off meeting, with participation from OGS-2 facility requirements and design team members, NASA representatives, and any other key task stakeholders, to communicate/finalize task plans.
- f. The contractor shall ensure all personnel and activities on this TO comply with relevant NASA safety and security requirements. Furthermore, each person conducting on-site TO activities at AMOS / MSSC location must be a US citizen and possess a Secret Clearance or be escorted.
- g. The contractor shall support and attend NASA meetings, as required, including periodic status meetings. The contractor shall complete action items as assigned by NASA and as directly related to this Task Order.
- h. The contractor shall provide all deliverables in their native file format for the software program used to complete the deliverable (e.g., Microsoft Word, Microsoft Power Point, Microsoft Excel, Microsoft Project, etc.) and in Adobe Portable Document Format (PDF).
- i. The contractor shall define and use a standard naming convention for documents delivered to NASA.

##### **A.2. OGS-2 Implementation Concept**

- a. The contractor shall develop and document the approach for the removal of the existing telescope dome/pier currently located on the MSSC roof.
- b. The contractor shall update and finalize the conceptual architecture description for the OGS-2 facility, initiated under GSMO TO 40, that contains the following:
  - i. An OGS-2 facility overview
  - ii. An OGS-2 facility architecture diagram
  - iii. Descriptions of the OGS-2 facility structural, mechanical, electrical, heating/cooling, fire protection, and security components.

- c. The contractor shall develop and document the approach for implementing/constructing the new OGS-2 facility and integrating, in the future, the Massachusetts Institute of Technology (MIT) Lincoln Lab-supplied OGS-2 equipment.

A.3. OGS-2 Facility Requirements Definition

- a. The contractor shall develop detailed structural, mechanical, electrical, heating/cooling, fire protection, and security requirements necessary to proceed with the OGS-2 facility design. The requirements shall be documented in an OGS-2 Facility Requirements Document (FRD)
- b. The contractor shall identify the Unified Facility Criteria (UFC) codes and standards applicable to OGS-2 implementation/construction.
- c. The contractor shall generate a Requirements Traceability Verification Matrix (RTVM) containing the OGS-2 requirements defined/decomposed/allocated to the appropriate components and to a level suitable for component specifications. In addition, the RTVM shall correlate the OGS-2 design verification and construction validation methodology.
- d. The contractor shall conduct a review of the FRD to demonstrate that the GSMO contract team has sufficiently defined all relevant OGS-2 facility requirements, and identified the applicable UFC codes/standards, and is ready to proceed to the design phase.

A.4. OGS-2 Facility Design

- a. The contractor shall conduct a detailed site survey to obtain necessary information regarding the existing soils and the structural, architectural, mechanical, heating, ventilation, and air conditioning (HVAC), fire protection, electrical power, backup power, lighting, communication conveyances, grounding, lightning protection, supervisory control and data acquisition (SCADA), and security components and configuration to perform the OGS-2 facility design.
- b. The contractor shall complete the preliminary design of the OGS-2 facility, including the 50% design drawings.
- c. The contractor shall develop a preliminary OGS-2 facility implementation/ construction cost estimate and schedule. This information will be considered a rough order of magnitude (ROM) estimate to be finalized upon the receipt of a Task Order modification authorizing the build portion of the construction.
- d. The contractor shall conduct an OGS-2 facility Preliminary Design Review (PDR) to demonstrate that the GSMO contract team's preliminary design meets all requirements with acceptable risk. It will show that the optimal facility design option has been selected and it will fully accommodate the future installation of MIT Lincoln Lab-supplied OGS-2 equipment. It will also show that facility verification methods have been satisfactorily described and establish the basis for proceeding with OGS-2 facility detailed design.
- e. The contractor shall complete the detailed design of the OGS-2 facility, including the 90% design drawings, specifications, detailed engineering construction cost estimate, engineering calculations, and catalog cuts.
- f. The contractor shall conduct an OGS-2 facility Critical Design Review (CDR) to demonstrate that the GSMO contract team's detailed design meets all requirements with acceptable risk. It will disclose the contract team's facility design in full detail; demonstrate that the design meets all relevant requirements;

ascertain that technical problems and design anomalies have been resolved; ensure that the design maturity justifies the decision to initiate facility implementation/construction; and provide a detailed implementation/construction schedule.

- g. The contractor shall update the RTVM with OGS-2 final design and verification methods information, ensuring traceability to all relevant requirements/specifications.
- h. The contractor shall complete the OGS-2 facility 100% design, "ready-for-bid" documents, including the final specifications and design drawings.

#### A.5. OGS-2 Facility Pre-Procurement

- a. For each planned, open OGS-2 procurement, the contractor shall take appropriate actions to maximize the interest and participation by the contractor's pre-approved, qualified candidate implementation/construction subcontractor community, per the GSMO contractor's best practices for competitive construction bids/procurements.
- b. For each planned, open OGS-2 procurement, the contractor shall develop in accordance with their approved procurement processes a Bid Package for the purpose of openly soliciting build and cost proposals from prospective OGS-2 implementation/construction subcontractors. At a minimum the bid packages will contain the following:
  - i. A letter of invitation and general bidder instructions.
  - ii. The 100% design, "ready-for-bid" documents, including the final specifications and design drawings.
  - iii. A detailed SOW and supporting information to cover all aspects of the expected subcontractor participation in OGS-2 facility implementation/construction. The SOW shall contain descriptions of all contract/end-item deliverables and a schedule. The SOW shall state the proposal and contractual instructions, content, terms, and conditions to the subcontractor associated with the implementation/construction; state the approach and actions being taken by the GSMO contractor associated with this implementation/construction; and include the implementation/construction approach, subcontract structure, milestone payment schedule, evaluation criteria, construction/material procurement process steps, and procurement schedule.
- c. For each planned open procurement, the contractor will, in accordance with their approved procurement process:
  - i. Issue the Bid Package to the candidate OGS-2 facility implementation/construction subcontractors/vendors.
  - ii. Receive and evaluate OGS-2 facility implementation/construction and cost proposals from prospective vendors/subcontractors.

## B. Management Reporting

### B.1. Task Activity Reporting

- a. Weekly Progress Reports: The contractor shall submit a weekly progress report of all OGS-2 implementation concept, facility requirements definition, and design work accomplished during each week of TO performance. Weekly Progress

Reports shall address, at a minimum, the accomplishments and progress of all work performed under the TO for the period being reported. The report shall be in narrative form and brief in content. The report shall include a description of overall TO progress to include technical accomplishments and the status of deliverables associated with task activities. The report shall also provide a quantitative description of overall progress and identify any risks or problems, which may impede performance, and proposed corrective actions. The report shall have a discussion of the projected work activities to be performed during the next reporting period. In addition, the report shall conform to GSMO weekly reporting requirements. The report shall be submitted to the Task Monitor.

- b. Bi-Weekly Status Meetings: The contractor shall schedule and conduct a bi-weekly status meeting to describe the status of OGS-2 implementation concept, facility requirements definition, and facility design-related activities.

**B.2. Cost Reporting**

The contractor shall deliver a monthly cost report, partitioned in accordance with the WBS, 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 shall include preparation and cooperation during property audits.

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

The Government will provide the contractor with access to the portions of the AMOS / MSSC on Haleakala, HI required to complete TO activities. There are no other Government-furnished facilities associated with this Task Order. In addition, there is no Government-furnished equipment or software associated with this Task Order.

**V. Material Procurement**

The contractor shall propose material identified as necessary, by the contractor, to perform the work associated with this Task Order.

**VI. Travel Support**

The contractor shall propose travel identified as necessary, by the contractor, to perform the work associated with this Task Order.

**VII. Deliverables**

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

<b>ID</b>	<b>Deliverable Description</b>	<b>Due Date</b>
1	<b>Integrated Task Schedule</b> – A comprehensive, detailed task schedule covering all TO activities, including OGS-2	2 weeks after receipt of TO

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Hawaii OGS Requirements Definition and Design Task  
Modification Start: 06/15/2015

	implementation concept development, facility requirements definition and design, and implementation/construction pre-procurement activities.	(ARTO); updates as required (and at least monthly)
2	<b>OGS-2 Implementation Concept Description</b> – A document containing a description of the approach for removing the existing telescope dome/pier located on the MSSC roof; a description of the OGS-2 facility conceptual architecture (as specified in A.2-b); and a description of the approach for implementing/constructing the new OGS-2 facility and integrating, in the future, the MIT Lincoln Lab-supplied OGS-2 equipment.	Draft - 4 weeks ARTO  Final -Incorporating NASA requirements as set forth in the Task Order SOW – 8 weeks ARTO
3	<b>OGS-2 Facility Requirements Document</b> – A document containing detailed structural, mechanical, electrical, heating/cooling, fire protection, and security requirements necessary to proceed with the OGS-2 facility design.	Draft – 6 weeks ARTO Final – 10 weeks ARTO
4	<b>OGS-2 RTVM Report (Requirements Phase)</b> – An RTVM-generated report describing OGS-2 facility requirements defined/decomposed and allocated to the appropriate components and to a level suitable for development of the component specifications.	10 weeks ARTO
5	<b>OGS-2 FRD Review Package</b> – A list of all comments received during the review cycle of the OGS-2 FRD, the associated responses, and confirmations that the issue resolution actions have been completed.	11 weeks ARTO
6	<b>OGS-2 Site Survey Trip Report</b> – A detailed report of the site survey activities described in A.4-a.	11 weeks ARTO
7	<b>OGS-2 Facility Preliminary Cost Estimate and Construction Schedule</b> – [REDACTED] and schedule for the OGS-2 facility’s future implementation/construction phase.	14 weeks ARTO
8	<b>OGS-2 Facility PDR Package</b> – Presentation materials, including 50% design drawings, associated with execution of the OGS-2 Facility PDR.	14 weeks ARTO
9	<b>OGS-2 Facility CDR Package</b> – Presentation materials, including 90% design drawings, associated with execution of the OGS-2 Facility CDR.	24 weeks ARTO
10	<b>OGS-2 RTVM Report (Design Phase)</b> – An RTVM-generated report describing OGS-2 final design and verification methods information and sufficient evidence that adequate traceability has been maintained.	25 weeks ARTO
11	<b>OGS-2 Facility Ready-for-Bid Package/ Design Documents</b> – The OGS-2 facility 100% design, “ready-for-bid” documents, including the final specifications and design drawings, and the [REDACTED] calculations, cut sheets, and schedule.	Draft - 26 weeks ARTO Final -Incorporating NASA requirements as set forth in the Task Order SOW – 30 weeks ARTO
13	<b>OGS-2 Bid Package(s)</b> – A solicitation for technical and cost proposals from prospective OGS-2 facility implementation/construction subcontractors/vendors that contains the letter of invitation, design/specification documents, and SOW, as described in A.5-b.	30 weeks ARTO
14	<b>Weekly Progress Reports</b> – Reports as specified in B.1-a.	Weekly

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Hawaii OGS Requirements Definition and Design Task  
Modification Start: 06/15/2015

End of Task Order Statement of Work

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Hawaii OGS Requirements Definition and Design Task  
Modification Start: 06/15/2015

**Acronyms:**

ADA	American Disabilities Act
AMOS	Air Force Maui Optical and Supercomputing Site
ARTO	After Receipt of Task Order
CDR	Critical Design Review
CO	Contracting Officer
FRD	Facility Requirements Document
GEO	Geosynchronous Earth Orbit
GSMO	Ground Systems and Mission Operations
HI	Hawaii
HVAC	Heating, Ventilation, and Air Conditioning
JPL	Jet Propulsion Laboratory
LCRD	Laser Communications Relay Demonstration
MIT	Massachusetts Institute of Technology
MSSC	Maui Space Surveillance Complex
NASA	National Aeronautics and Space Administration
OCTL	Optical Communication Telescope Laboratory
OGS	Optical Communications Ground Station
PDF	Portable Document Format
PDR	Preliminary Design Review
RTVM	Requirements Traceability and Verification Matrix
SN	Space Network
SCADA	Supervisory Control and Data Acquisition
SOW	Statement of Work
TIP	Task Implementation Plan
TO	Task Order
UFC	Unified Facility Criteria
WBS	Work Breakdown Structure

## **GSMO TASK ORDER**

Task No: #0101  
 Modification: 00  
 Task Name: **GPM GMI Instrument Sustaining Engineering**  
 Task Period of Performance: **07/01/2015 to 06/30/2016**  
 Modification Period of Performance: **07/01/2015 to 06/30/2016**  
 GSMO SOW Reference: **3.3, 3.4, 3.6, 3.7**

### **I. Task Order History**

**Description of current modification (Modification 0):** Initial Statement of Work.

Mod #	Start	End	Brief Description
0	07/01/2015	06/30/2016	Initial task order statement of work.

### **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 Global Precipitation Measurement Core spacecraft (GPM).

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

### **III. Scope of Work**

The Contractor shall provide GPM Microwave Imager (GMI) instrument engineering expertise to ESMO and the GPM Flight Operations Team in support of GMI Operations, Anomaly Resolution and long term trending of critical parameters.

#### **A. Requirements**

##### **1 Management**

- A.1.1 The Contractor shall provide support and conduct analysis of GMI instrument anomalies and special spacecraft/instrument activities.
- A.1.2 The Contractor shall participate in Anomaly Review Boards when requested by the GPM Mission Director, review and advise on proposed recovery activities, and may be asked to provide other discipline experts as needed to support anomaly investigation and resolution.
- A.1.3 The Contractor shall ensure availability and competency of the work force necessary to execute the management and technical activities required to support the GMI operations.
- A.1.4 The Contractor shall review any special GPM maneuvers or GMI special activities

and instrument performance.

- A.1.5 The Contractor shall support monthly FOT-led Monthly Status Reviews to stay current on GPM and GMI operations.
- A.1.6 The Contractor shall support GMI Performance review meetings three (3) times per year to review instrument trending and life limiting items.
- A.1.7 The Contractor shall provide review of all new, updated or altered GMI command procedures to ensure correct execution, as requested.
- A.1.8 The Contractor shall provide an annual engineering report detailing the performance of the GMI instrument with input from the Flight Operations Team (FOT) that shall specifically detail the long term performance, identify any anomalous trends in the instrument performance and show life limiting items.

## **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 task to the Task Monitor.
- B.1.2 The Contractor shall provide monthly financial report to the Task Monitor and the ESMO Project. 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**

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, and travel as directed by the Task Monitor.

## **VII. Deliverables**

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

<b>ID</b>	<b>Deliverable Description</b>	<b>Due Date</b>
1	<b>Monthly Technical Report</b> The Contractor shall generate a Technical report summarizing support provided to FOT, and other operations personnel.	Last work day of the month

2	<p><b>Annual Performance Report</b> The Contractor shall provide an annual (CY) long term performance report of the GMI instrument including mission trending of critical parameters and life limiting items as applicable.</p>	Last work day of January
3	<p><b>Financial Reports</b> 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><b>533M:</b> Monthly not later than 10 working days following the close of the contractors' monthly accounting period <b>533Q:</b> Quarterly not later than the 15th day of the month preceding the quarter being reported <b>Other:</b> as required</p>

End of Task Order Statement of Work

## **GSMO TASK ORDER**

Task No: 102  
Modification: 0  
Task Name: GEDI Project Systems and I&T Engineering Support  
Task Period of Performance: 6/22/2015 to 12/31/2015  
Modification Period of Performance: 6/22/2015 to 12/31/2015  
GSMO SOW Reference: 2.1, 2.2, 2.3, 2.4

### **I. Task Order History**

**Description of current modification (Modification 0):** This is the initial task order statement of work for the GEDI Project Systems and I&T Engineering Support task.

<b>Mod #</b>	<b>Start</b>	<b>End</b>	<b>Brief Description</b>
0	06/22/2015	12/31/2015	Initial task order statement of work.

### **II. Background**

The contractor shall provide Mission Operations Development support for the Global Ecosystem Dynamics Investigation (GEDI) Project. GEDI is an in-house instrument development, mission operations, and science data processing project at GSFC. GEDI is a multi-beam laser altimeter, which will be designed, analyzed, fabricated, tested, and delivered from GSFC to JSC, then to KSC for launch to the International Space Station (ISS) Japanese Experiment Module – External Facility. There is no host spacecraft, and the launch vehicle/access-to-space is provided by NASA HQ; the instrument is the complete mission. The mission and ground system will be operated from GSFC, and science data products returned from the ISS will be processed and archived from GSFC. It is expected that the contractor personnel will be co-located with GEDI project personnel on-site at GSFC.

### **III. Scope of Work**

The contractor shall provide Systems Engineering, and Integration and Test Engineering support for the GEDI Project.

#### **A. Requirements**

- A.1. The contractor shall support Systems Engineering development activities, including developing requirements, performing analyses, participation in Risk Management, and defining/executing development, qualification, verification, and validation tests.
- A.2. The contractor shall support Integration and Test Engineering activities, including identifying and confirming facilities, performing I&T planning and execution, overall instrument integration and test flows, and coordination of Electrical Ground Support Equipment (EGSE), Engineering Test Unit (ETU), and Flight Model (FM) hardware and software for flat-sat and software test beds.
- A.3. The contractor shall assist GEDI team in completing engineering peer, NASA formal life cycle (PDR, CDR, etc), Key Decision Point (KDP), and JSC/ISS Safety reviews.

**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 attend the weekly project meeting and give a brief verbal status of relevant progress and issues.

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

**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.

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

<b>Travel Description</b>	<b>Approximate Time Frame</b>
1 trip for ██████████ 5 days, JSC Houston, TX, for Sys Eng Verification Interface Meeting with ISS	Oct 2015

**VII. Deliverables**

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

<b>ID</b>	<b>Deliverable Description</b>	<b>Due Date</b>
1	Monthly Status Report	Not later than the 5th of the Month

End of Task Order Statement of Work