ATTACHMENT A

STATEMENT OF WORK

September 23, 2009

1. Introduction

This Statement of Work (SOW) details the work to be performed by the Contractor and its team members for a preliminary design phase commonly designated as Phase B. Phase B refines the concept and concludes with a critical milestone: the successful completion of the mission Preliminary Design Review (PDR). Based on the content and results of the IRIS PDR, IRIS will undergo a confirmation review by the GSFC Explorers Project and NASA Headquarters for final authorization to proceed with the subsequent development phases leading to launch and on-orbit operations.

2. Scope of Work

The Contractor shall provide the necessary resources and skills to perform and manage the tasks defined within this Statement of Work. The Contractor shall refine and evolve the Contractor's cost estimate for Phases B-F for the Interface Region Imaging Spectrograph (IRIS) mission submitted in response to NASA Announcement of Opportunity #NNH07ZDA003O for the Explorers Projects Division.

The primary tasks in Phase B will include the generation and presentation of the Systems Requirements Review (SRR) and the Preliminary Design Review (PDR). In order to support these reviews, the concept definition efforts shall encompass the work required to update and refine the proposal's science investigation objectives and plans (if necessary), instrument and spacecraft concepts and performance characteristics, and science operations and flight operations plans and concepts. These efforts shall identify the conditions and constraints necessary for the development of an integrated IRIS mission approach. The Contractor's mission integration efforts shall include considerations for the accommodation of the IRIS observatory onto the launch vehicle. The efforts above shall be consistent with the Level 1 requirements as defined in the IRIS Concept Study Report (CSR), dated 12/16/2008, and the IRIS Site Visit, held on 3/16/2009.

The Contractor's Phase B preliminary design efforts shall develop the CSR and Site Visit concepts into a preliminary design and definition of the IRIS mission, including its Mission Operations Center (MOC) and Science Operations Center (SOC). The Preliminary Design Review (PDR) shall be held in accordance with NPR 7120.5D, NPR 7123.1A, and GSFC STD 1001B.

The Contractor's efforts in Phase B shall form the basis for final confirmation of the remainder of the IRIS development and operational phases (C, D, E and F). Detailed cost and schedule estimates shall be prepared and submitted during Phase B, which defines the Contractor's updated budget for Phase B and the planned budgets for Phase C, D, E and F work.

Periodic technical and programmatic interchange meetings at both the Contractor's facility and at GSFC shall be required to coordinate efforts between the Contractor and the Explorers

Projects Office. These may be conducted as face-to-face meetings or teleconferences, as required.

3. Work Performed by Contractor

The Contractor shall apply the necessary personnel, expertise, materials, services, equipment, facilities, institutional systems and software, and technical and management processes to accomplish the following work.

3.1 Management

This section encompasses the management effort required to manage the administrative, business, science, engineering and operations elements of this project.

3.1.1 Work Breakdown Structure

The Contractor shall prepare and use a Work Breakdown Structure (WBS) and WBS dictionary to organize the project effort into manageable work elements. The WBS shall provide a clear organizational structure for the generation and monitoring of costs and lower level schedules. The WBS and companion element descriptions shall be provided at WBS level 3.

3.1.2 Cost and Schedule Plans

The Contractor shall prepare, maintain and manage Contractor cost plans and schedules. The Contractor shall submit 533M and 533Q financial reports during Phase B; delivery and format of these reports shall be directed by the CO.

Updated schedules and critical path analysis shall be summarized in the monthly presentation (see section 3.1.11).

The Contractor shall update the cost plan and master schedules that were included in the CSR and Site Visit. The cost detail shall be developed and provided consistent with the structure of the WBS. The Contractor's launch date for IRIS must be consistent with those presented in the CSR and at the Site Visit.

EVM

The appropriate EVM reporting system shall be defined during the Phase B contract period. The government will provide the Contractor with requirements for a modified EVM reporting system that meets the intent of the waiver to 7120.5D that was granted to the Explorers Project Office, titled "SMEX tailored Class D missions."

3.1.3 Management Approach

The Contractor shall provide a Mission Implementation Plan (aka Program Plan) that will constitute the management agreement between the PI and the Explorer Projects Office. The Contractor shall denote in the monthly presentations and in the Mission Implementation Plan any changes to the management approach originally provided in the CSR and Site Visit, including organizational changes.

3.1.4 Financial Administration

The Contractor shall document in the monthly presentations any changes in its plans for financial administration of the contract originally provided in the CSR and Site Visit, including organizational changes.

3.1.5 Configuration Management Plan

The Contractor shall provide a Configuration Management Plan.

3.1.6 Performance Assurance Implementation Plan (PAIP)

The Contractor shall prepare and provide a Performance Assurance Implementation Plan (PAIP) written in response to the requirements of the Small Explorer (SMEX) Program Mission Assurance Requirements (MAR) document, #410-RQMT-0036, dated September 2007.

3.1.7 Risk Management and Descope Plans

The Contractor shall document project-specific implementation of its risk management process in a Risk Management Plan; per the MAR, DID 7.1D. Overall, risk management shall be used to ensure successful achievement of the investigation's objectives within the established resource, funding and schedule constraints.

The Contractor shall also refine and update its descope plan which shall identify their pre-defined prioritized actions to recover cost or schedule savings through a prudent reduction or deletion of requirements, science objectives, technical content or other effort.

3.1.8 ITAR Considerations

The requirements and regulations of the US law enforcing the International Trade in Arms Regulation are a serious obligation of all US participants in the Explorers Projects. The regulation is explicit and requires the existence of State Department approved authorization to engage in restricted technical dialogue and exchange of hardware and software. To this end, the Contractor shall initiate, as appropriate, the necessary legal application for licensing with foreign partners as required under US law. In addition, the Contractor shall provide to the Explorers Project the draft international Letters of Agreement that fall under the auspice of a NASA agreement for cooperative work with the Contractor's affiliated foreign partners.

3.1.9 Unique Property, Equipment and Facilities

The Contractor shall determine and identify all unique capital property, facilities or equipment, which have to be constructed or procured for the execution of Phases B, C, D, E and F. The Contractor shall discuss these facilities at PDR, along with the compelling motivation and need for such capabilities.

3.1.10 Technical Meetings and Reviews

The Contractor shall participate in technical and programmatic meetings with the Explorers Projects to provide real-time status of the mission. These exchanges are necessary in order to coordinate project strategies between the Contractor and the Explorers Project, and work between the Contractor and the Project Teams.

The Contractor shall conduct a mission level Systems Requirements Review (SRR) at the Contractor's location and shall prepare all materials for this review in accordance with NPR 7120.5D, NPR 7123.1A, and GSFC STD 1001B.

The Contractor shall conduct a mission level Preliminary Design Review (PDR) at the Contractor's location on the preliminary design status of the Contractor's flight instrument, spacecraft, mission operations center (MOC), and the science operations center (SOC). The Contractor shall prepare all materials for this review in accordance with NPR 7120.5D, NPR 7123.1A, and GSFC STD 1001B.

The Contractor shall support the preparations and present, as required by the COTR, at the IRIS Confirmation Review.

3.1.11 Weekly and Monthly Progress Reports

The Contractor shall provide weekly written progress reports followed by a weekly telecon with the Explorers Project Office. The weekly progress report shall cover the technical progress, issues, and upcoming plans along with any necessary cost, funding, or schedule status. These reports shall be submitted electronically at an agreed upon day/time with the COTR.

The Contractor shall present a monthly progress report covering all aspects of the mission; including, the project cost and schedule status, technical status, and staffing plans; including subcontractors' cost, schedule, technical, and staffing status. These monthly presentation reports shall be held at an agreed upon day/time and in an agreed upon format with the COTR.

The Contractor shall participate in bi-weekly telecons with the GSFC Explorers Project Office and the KSC Launch Services Program Office.

All financial management reports and presentations shall contain explanations of variances from planned expenditures.

The Contractor shall submit electronic copies of all weekly and monthly reports and presentations, including the financial management reports.

3.2 Systems Engineering and Management

The Contractor shall perform the systems management and systems engineering functions necessary for the effective identification, integration and control of requirements, interfaces, resources, and technical risk. The Contractor shall denote in the monthly presentations and in the Mission Implementation Plan any changes to the systems management plans originally provided in the CSR and Site Visit, including organizational changes.

Specific systems management and systems engineering tasks are:

3.2.1 Consolidation of Systems Requirements and Identification of Design Drivers

The Contractor shall identify, consolidate and document all relevant technical requirements (including derived requirements). The Contractor shall ensure these requirements are consistent and compatible with the over-arching mission requirements.

Key design drivers shall be identified and discussed at the SRR and PDR. Configuration management of these requirements shall be consistent with the Contractor's configuration management practices. The requirements, including traceability documentation, shall be provided per the deliverables list.

3.2.2 Systems Model and Error Budgets

The Contractor shall define its plans for generation and use of a mathematical systems model and companion error analyses. The Contractor shall describe its approach for modeling and budgeting of system performance margins and errors at the SRR and PDR.

3.2.3 System Test, Sparing and Redundancy Philosophies

The Contractor shall present and describe at the PDR the governing guidelines for testing, sparing, redundancy and fault tolerance.

3.2.4 Trade Studies

The Contractor shall employ systems engineering methods and tools, consistent with the scope of a SMEX mission, to refine and trade performance characteristics of the instrument and spacecraft designs in order to optimize science measurement capabilities and technical performance within the allocated resources.

The Contractor shall identify and report at the monthly progress reviews (or more frequently), the status and changes in the physical resources; e.g., mass, power, volume, data rate, etc.

The Contractor shall inform the COTR immediately of any engineering trades or other

changes affecting the launch vehicle's ability to accommodate the mission. The proposed change must be approved by the CO/COTR prior to the Contractor making design modifications.

The Contractor shall report at the SRR and PDR a summary of all trade analyses, the results, and which ones have issues requiring further study.

Changes in the capabilities of the "as proposed" mission or observatory resulting from completed trade analyses shall also be noted in the SRR and PDR.

3.2.5 Information and Data to Explorers Office

The Contractor shall prepare the information and data required for the Explorers Project to complete a Probabilistic Risk Assessment (PRA), a Preliminary Failure Modes and Effects Analysis (FMEA), and a Fault Tree Analysis (FTA). The FTA will identify only the mission critical single point failures. The Contractor shall provide the inputs to support these analyses three (3) months prior to PDR and the input shall comply with MAR DID 4.1D, 4.2D, 4.3D, and 4.6D.

The Contractor shall prepare the information and data required for the Explorers Project to complete an Orbital Debris Analysis. The Contractor shall provide the inputs to support a preliminary analysis completed for SRR, and the final analysis at PDR.

The Contractor shall prepare a Mission System Pre-Launch Safety Data Package (MSPSP) that includes "tailored" Range Safety Requirements in response to EWR127 Chapter 3. A draft is due at one month prior to PDR and shall comply with MAR DID 3.2D and 3.5D.

The Contractor shall prepare the information and data required for the Explorers Project to complete the spacecraft to ground system/radio frequency (S/C to GS/RF) ICD and the Project Service level agreement (PSLA), if necessary.

3.3 Mission Assurance

The Contractor shall provide the personnel, materials, and facilities necessary to develop, implement, and maintain a Performance Assurance System. This system shall be consistent with the requirements of the Small Explorer (SMEX) Program Mission Assurance Requirements (MAR) document, #410-RQMT-0036, dated September 2007 and as reflected in the Explorers Project approved Contractor's Performance Assurance Implementation Plan (PAIP).

The PAIP shall document the Contractor's quality assurance program for the planning, execution, monitoring and control of reliability, quality assurance, workmanship, safety, parts and materials, software development, contamination control and failure investigation and reporting. If necessary, the Contractor shall tailor their normal procedure(s) in order to comply with the modified Class D SMEX mission described in the MAR.

A draft PAIP shall be submitted at the SRR and an approved PAIP shall be baselined by PDR.

The assurance program shall apply to all phases of the Contractor's efforts, including requirements definition and verification, design and development, procurement, manufacturing and fabrication, assembly, integration and test and shall encompass ancillary support functions such as handling and shipping, test record keeping and associated documentation of test data analyses, and all aspects of configured flight article control.

The MAR is written to address both internal interactions within the Government as well as obligations of contractors to the Government. The MAR is included in this contract only for the purpose of establishing the Contractor's obligations to the Government, and thus provisions of the MAR concerning internal arrangements within the Government not impacting the Contractor's performance are not applicable to this contract.

The references to any Government action affecting the Contractor shall not be construed as establishing any contractual authority, commitment, or obligation, except as properly issued in accordance with the authority of the Contracting Officer (CO) or Contracting Officer's Technical Representative (COTR), which authority is established elsewhere under the terms of this contract. Any interaction reflected in this MAR, other than by such Government contract officials, shall be deemed advisory only, and the Contractor is not relieved from any responsibility or accountability under this contract related to such interaction.

3.4 Science Investigation

The Contractor shall refine and update their science investigation requirements, plans and concepts, if necessary. The Contractor shall note at the SRR any modifications or enhancements to the investigation from the original proposal; including, but not limited to, science objectives, plans and science operations concepts.

3.4.1 Principle Investigator and Science Working Group

The IRIS Science Team is led by the IRIS Principle Investigator, and, together, they form the Science Working Group (SWG). The purpose of the IRIS SWG is to provide a working forum for the IRIS scientists with the common goal of maximizing the scientific return of the mission within the existing resources.

The Contractor shall provide support, argument, evidence and other scientific input to reconcile and resolve IRIS science priorities, Level 1 requirements, coordinated on-orbit operations and integrated IRIS data plans and policies.

The IRIS SWG provides a forum to address open issues and conflicts resulting from ongoing mission analyses and trade studies. The Contractor shall hold and chair periodic meetings with the SWG, and shall define and develop the working agendas for this group.

3.4.2 Science Requirements

The Contractor shall generate the Level 1 science requirements for the IRIS investigation. In addition, the Contractor shall identify a minimal subset of the Level 1 requirements, which shall represent a minimally successful investigation. The minimal subset provides a reference point for potential descope options that may be invoked to offset risk or restore programmatic reserves.

The Contractor shall also develop and document the Level 2 IRIS science investigation requirements in a separate configuration controlled document. A draft version of the IRIS science requirements document shall be prepared per the deliverables list.

3.4.3 Science Operations

The Contractor shall refine the flight operations concepts, including but not limited to the acquisition and routing of the raw science data stream and any temporary buffering of this data in order to minimize the risk of data loss once on the ground.

The Contractor shall also refine its implementation plans for the conversion of the raw data into valid research quality data and data products.

The Contractor shall describe in the PDR its implementation approach for the acquisition, validation, data processing and eventual data distribution and archiving of the investigation's science data including public access concepts.

The Contractor shall describe at the PDR the hardware and software required to conduct the science operations.

3.4.4 IRIS Science Team

The Contractor shall confirm the makeup of the Principal Investigator science team including Co-Investigators. The team membership shall be provided in the PDR and additions and deletions from the team originally provided in the CSR and Site Visit shall be noted.

3.5 Spacecraft and Instrument Design Concept and Accommodation

The Contractor shall confirm or update the spacecraft and instrument design concepts originally provided in the CSR and Site Visit. The Contractor shall identify any known design changes or reconfigurations and describe reliability enhancements that are deemed cost effective and risk offsetting. The results of these efforts shall be presented in the SRR and PDR packages.

3.5.1 IRIS Observatory to Launch Vehicle Accommodation Engineering

The Contractor shall conduct the necessary engineering design and analysis effort to determine an initial physical accommodation of the IRIS observatory onto the Launch Vehicle (LV). The following list of accommodations shall be addressed and provided in the IRIS observatory (or payload) to LV Interface Requirements Document (IRD). This list is not all-

inclusive and will expand in the course of the working dialogue between the Contractor, the Explorers Project, and the KSC engineering teams.

- Mounting approach
- Center of gravity
- First mode estimates and finite element modeling requirements.
- Electrical interface requirements
- T-0 electrical and purge connectors
- Contamination requirements
- Thermal requirements during launch processing
- Orbit and Separation Parameters
- Other constraints

The inputs to the IRD are due on 10/28/2009.

The Contractor shall develop and deliver a simplified finite element model in order to support the coupled loads analysis.

Also, in order to facilitate this effort the Contractor shall produce simplified 3D CAD (computer aided design) layouts of the IRIS observatory which readily define overall physical layout, envelope and mechanical mounting. The CAD model shall be delivered to the KSC LV Project for use in its design process.

3.5.2 Mass and Power Budget Updates

The Contractor shall update and document in the monthly presentations, SRR and PDR the mass and power estimates.

3.5.3 Manufacturing, Integration, Test and Calibration

The Contractor shall present in the PDR its approach to the manufacturing, integration, test and calibration of the IRIS instrument and spacecraft. This includes installation, integration and testing at the observatory level, and during pre-launch processing at the launch site.

3.5.4 Technology Demonstration Hardware

The Contractor shall define the specific requirements and plans for the manufacture and test of technology demonstration hardware. This includes bread boards and brassboards, engineering model or engineering test hardware, proto-type or proto-flight hardware, life test units and appropriate Technology Readiness demonstration hardware required to achieve a Technology Readiness Level of six (6) by PDR. A summary of the plans and approach for demonstration hardware shall be included in the monthly presentations as agreed to with the COTR.

3.5.5 Critical Long Lead Materials

The Contractor shall identify and procure critical procurements of long lead materials that must be procured in order to support the IRIS master schedule. The Contractor shall provide a list of critical items and submit it to the CO/COTR for approval. The Contractor shall be provided with a response within 10 days of receipt.

3.6 Software Development

The Contractor shall begin the software development effort and shall initially focus on finalizing the software development approach and refine the conceptual software architecture. Some coding and testing efforts shall commence.

The Contractor shall define and present at the SRR the software requirements and the functional description.

At the PDR, the Contractor shall define and present the development approach including provisions for software change control, and the verification and validation plan/process.

3.7 Mission Operations Concept

The Contractor shall refine the IRIS mission operations concept and associated flight operations architecture.

Specific aspects that shall be addressed include, but are not limited to the layout and interconnect of the mission operations components and operational facilities, apportionment of the mission operations engineering tasks between the Contractor and COTR, manning strategy, data buffering and archival strategies, observation planning and science data distribution.

The Contractor shall clarify and refine baseline observation scenarios including routine (hands-off) operations, initial commissioning and approach to on-orbit checkout, and any unique maintenance, target of opportunity and on-orbit calibration operations.

The Contractor shall present the mission operations requirements at the SRR.

The Contractor shall update, document, and present the refined IRIS mission operations concept at the PDR.

3.8 Education and Public Outreach Program

The Contractor shall refine and document the Contractor's approach and plans (including content) for an Education and Public Outreach program. The Contractor shall work with the COTR to review and clarify the E/PO program.

3.9 Preliminary Design Review (PDR)

The Contractor shall complete the necessary preliminary design and associated design

analyses efforts required to translate the design concepts into the preliminary designs of the instrument, spacecraft, mission operations center (MOC), and the science operations center (SOC).

This preliminary design effort shall include the final development of all applicable performance and functional specifications; the development of the initial hardware designs for the instrument and spacecraft flight parts, components, subsystems and system; development and the definition of the initial plans for integration, test and operation of the resulting flight observatory.

The Contractor shall develop the requirements, the concept of operations, and preliminary designs of the MOC and SOC for the conduct of flight operations and science data processing. This effort shall include the preliminary design of the embedded flight and operational software, and the interfaces with the IRIS ground system.

The key result of the preliminary design phase is the demonstration that the requirements can be feasibly and affordably implemented in the required hardware and electronic designs.

3.9.1 Development Test Units

The level and scope of the developmental test unit program shall be defined by the Contractor. Developmental test units shall be constructed as needed, and under the guise of a limited budget SMEX program. If so initiated, initial performance and test results shall be presented at the mission PDR, if available.