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EArth Observing System Data and Information System (EOSDIS) Evolution and Development (EED)

Statement of Work

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NNG10HP02C

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Section 1 – Introduction

This contract provides for development and sustaining engineering of software and hardware systems that provide science data management for the ESDIS Project. A major activity under this contract will be for evolution and development engineering of the EOSDIS Core System (ECS), Earth Observing System Clearing House (ECHO), and other EOSDIS elements that provide the common capabilities and infrastructure of EOSDIS.

1.1 Background

NASA's Science Missions Directorate (SMD) seeks to develop a scientific understanding of the Earth system and its response to natural and human-induced changes to enable improved prediction of climate, weather, and natural hazards for present and future generations. The SMD has established three goals to pursue in carrying out this mission:

- **Science:** Observe, understand, and model the Earth system to learn how it is changing, and the consequences for life on Earth;
- **Applications:** Expand and accelerate the realization of economic and societal benefits from Earth science, information, and technology;
- **Technology:** Develop and adopt advanced technologies to enable mission success and serve national priorities.

The vantage point of space provided by NASA led researchers to view the Earth as a dynamic system of land, atmosphere, oceans, ice and life, gave birth to the interdisciplinary field of Earth System Science. This concept of the Earth as a system shaped the fundamental science questions the SMD seeks to answer:

How is the Earth changing, and what are the consequences for life on Earth?

- *How is the global Earth system changing?*
- *What are the primary causes of change in the Earth system?*
- *How does the Earth system respond to natural and human-induced changes?*
- *What are the consequences of change in the Earth system for human civilization?*
- *How well can we predict future changes in the Earth system?*

Earth science is science in the national interest, driving advances in weather forecasting, management of land and water resources, and agricultural productivity. Accordingly, the SMD includes an applications research and demonstration program in parallel with its science program. Its areas of emphasis are:

- *Resource Management*, including forestry and agriculture;
- *Disaster Management*, including natural hazards;

- *Community Growth*, including urban and transportation infrastructure; and
- *Environmental Quality*, including land cover change.

The SMD conducts its research in collaboration with a broad range of national and international science agencies. Nationally, these include individual US government agencies, a partnership of 11 federal agencies composing the US Global Change Research Program, and several focused interagency collaborations such as the U.S. Weather Research Program. Internationally, these include the World Climate Research Program and the International Geosphere/Biosphere Program sponsored by such entities as the United Nations Environment Program and the World Meteorological Organization.

To answer the call for global scale observations sufficient to detect variability, trends, and causes of change in the Earth system, the SMD has deployed the Earth Observing System (EOS) satellites. Complementing EOS are a series of small exploratory missions to measure Earth system forcings and responses as well as a variety of suborbital platforms (e.g., aircraft and balloons) for *in situ* and remote sensing.

Data and information management system services are as essential as satellite observations to the success of the SMD. Observing systems generate enormous quantities of data (over 2.5 terabyte per day) which must be acquired, processed, archived and distributed. Data acquired from satellites must be processed into globally consistent, calibrated, long-term data records. Diverse data sets must be combined to produce meaningful information on Earth system interactions. Data must be assimilated into Earth system models. These large volumes of data must be moved around and exchanged among researchers at geographically diverse institutions. Finally, data must be broadly available—stored in ways that are not only accessible, but also understandable to users from a variety of science and applications disciplines.

To perform these functions in the EOS era, the SMD has developed the EOS Data and Information System (EOSDIS). EOSDIS is a comprehensive data and information system designed to perform a wide variety of functions in support of a heterogeneous national and international user community. To this end, EOSDIS provides a spectrum of services including:

- Data capture and telemetry processing
- Science data product generation
- Data archive management
- Search and order of science data
- Data distribution to a broad spectrum of users
- User support

EOSDIS is comprised of a variety of heterogeneous component systems that collectively perform the EOSDIS services in an integrated fashion. Central among these is the

EOSDIS Core System (ECS) that provides common capabilities and infrastructure of EOSDIS.

The Earth Science Data and Information System (ESDIS) Project, Code 423, at the Goddard Space Flight Center (GSFC) manages the EOSDIS on behalf of the SMD.

1.2 Scope

In the performance of this contract, the EED contractor is required to coordinate and integrate task related activities with the ESDIS Project, the Distributed Active Archive Centers (DAACs), other Earth science data centers, the science investigator teams, the user community, as well as other EOS contractors. The contractor's overall goal shall be to continuously improve the reliability, availability, functionality, operability, and performance of hardware and software systems within the EOSDIS while reducing operational and maintenance costs.

The contractor may be tasked to:

- Provide new systems and/or major upgrades to existing systems
- Conduct engineering studies directed by the Government.
- Provide corrective engineering of custom and COTS software in a timely manner.
- Provide preventive and corrective engineering of hardware components consistent with the operational availability needs of the DAACs and science users.
- Provide hardware and software adaptive engineering to sustain Earth science systems
- Provide hardware and software perfective enhancements to implement new requirements.
- Provide corrective, adaptive, and perfective engineering to lower the overall cost of maintenance and operations
- Provide system operations support at the ECS DAACs
- Provide user support
- Perform operations for the ECHO system

See Section 2.0 for definitions of preventive, corrective, adaptive, and perfective maintenance.

See the ESDIS Project web site for additional information about the Project and the EOSDIS system and components: http://www.esdis.eosdis.nasa.gov/index.html

See the EOSDIS Evolution and Development website for information related to the Request for Proposal: http://esdis.eosdis.nasa.gov/emd2rfp/index.html

1.3 Place of Performance

The contractor is responsible for selecting the location(s) to perform the activities required by this statement of work. Generally, the contractor shall be able to support task related meetings at the GSFC within 2 hours of notification.

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The contractor shall host government and government support personnel attending required monthly reviews.

The contractor shall make a minimum of 2 full time offices (no less than 160 square feet total) available for visiting government support personnel, and government assurance representatives upon request.

Section 2.0 Definitions

Corrective Engineering – Changes necessitated by actual design errors and/or design deficiencies. Corrective engineering consists of activities normally considered to be error correction required to keep the system operational. By its nature, corrective engineerng is usually a reactive process. Corrective engineering is related to the system not performing as originally intended. The three main causes of corrective engineering are (1) design errors, (2) logic errors, and (3) coding errors.

Adaptive Engineering – Changes initiated as a result of technology upgrades and changes in the environment in which a system must operate. These environmental changes are normally beyond the control of the maintainer and consist primarily of changes to the: (1) rule, laws, and regulations that affect the system: (2) hardware configuration, e.g., new terminals, local printers, etc.: (3) data formats, file structures: and (4) system software, e.g., operating systems, compilers, and utilities.

Perfective Engineering – (Also commonly referred to as enhancements and upgrades) All changes, insertions, deletions, modifications, extensions, and enhancements made to a system to meet the evolving and/or expanding needs of the user. It is generally performed as a result of new or changing requirements, or in an attempt to augment or fine-tune the existing software/ hardware operations/performance. Activities designed to make the code easier to understand and to work with, such as restructuring or documentation updates and optimization of code to make it run faster or use storage more efficiently are also included in the Perfective category.

Preventive Maintenance – As used in this statement of work Preventive Maintenance refers to hardware preemptive activities, such as cleaning filters and installing recommended engineering changes, to avoid future failures. Preventive maintenance activities are expected to be included with a corrective maintenance task.

Section 3.0 Requirements

Within the scope of this contract the contractor shall provide all the necessary capabilities including, but not limited to, trained personnel, tools, materials, documentation, procurement, software and hardware environments, and facilities (except as contractually provided by the government as Government Furnished Property) to perform the following:

3.1 Program Management (WBS 1)

The EED contractor shall plan, develop, integrate, and execute the program management activities necessary to successfully execute the requirements of this contract. The contractor shall provide the necessary skills and staffing levels to ensure successful performance on this contract. These activities shall include, but are not limited to, program planning, detailed technical planning; conduct of technical and program reviews; financial and technical progress reporting; financial management; purchasing and procurement of required products, services and resources; subcontract management; configuration management; safety management; security and property management; quality management; risk management; and performance assurance.

3.2 Transition of Engineering Responsibilities (WBS 2)

The EED contractor shall plan for and execute the transfer of hardware and software system responsibilities from the current EEB contractor (NNG09HP00C). The EED contractor shall also plan and execute the transfer of hardware and software system responsibilities and provide training and consultation services to the responsible contractor in the post-EED timeframe. These activities shall include but are not limited to facility planning; transition planning to meet the operational requirements of this contract; goal setting and development of schedules and milestones; coordination of activities; property management; training of personnel necessary for the acceptance, maintenance, development and operation of the software systems under this contract; installation and testing of both hardware and software; and conduct of a Capability Demonstration Test.

3.3 Development Engineering (WBS 3)

The EED contractor shall perform design, development, test and implementation activities for Earth science data systems. Development activities shall include, but not be limited to, hardware and/or software requirements analysis, test plan development, test activity planning and coordination, design, interface definition and /or compliance with standards cited within this contract, test and integration, training, quality assurance and documentation development and maintenance.

3.4 Maintenance Engineering (WBS 4)

The EED contractor shall perform hardware and software engineering maintenance of Earth science data systems in accordance with authorized tasks. Engineering maintenance shall consist of a large spectrum of activities including, but not limited to, replace, remove and/or upgrade custom software, COTS software, COTS hardware and system media; design; implementation; modification; configuration management; computer resource analysis and utilization planning; training of personnel as necessary; integration; installation; user liaison; help desk; and testing. The contractor shall also plan, document, implement, and maintain the hardware and software maintenance and development processes to be used throughout the life of the EED contract, including detailed patch and release documentation.

3.5 System Engineering (WBS 5)

The EED contractor shall perform system engineering on Earth science data system hardware and software systems in accordance with authorized tasks. System Engineering activities shall include, but not be limited to, analyses; trade studies; point papers related to recommending enhancements to the EOSDIS system and/or its components for cost saving and/or cost avoidance; capacity growth; performance, reliability, maintainability and/or operational improvements; technology refresh; design improvements; process improvement; and other similar type upgrades.

3.6 Science Support (WBS 6)

The EED contractor shall provide support to the Earth science community in accordance with authorized tasks. Support shall include but not be limited to training in the use of the EOSDIS or other Earth science systems, including instruction on data models, definition of the Earth Science Data Types, development and maintenance of interfaces and related documentation, identification of system modifications required to support science community needs, and training in the analysis of problems.

3.7 Operations Support (WBS 7)

The EED contractor shall provide operations support in accordance with authorized tasks. These activities include, but are not limited to, on-site system operations, on site system administration, on-site maintenance, training of operations and related skilled personnel on the maintenance and operation, use of operational and diagnostic tools and procedures, development of procedures to accommodate upgrades or enhancements, on-site engineering support at designated sites, on-site metric collection related to the operational performance, problem diagnoses and solution development, system administration and security planning, system tuning, patch and release planning and coordination , system testing, informational bulletin development; special tools use and development, system impact analyses and problem analyses.

3.8 Studies and Prototyping (WBS 8)

The EED contractor shall perform and/or support special studies and prototyping in accordance with authorized tasks.

Appendix A

EED Work Breakdown Structure

The following WBS elements shall be the basis of the offeror's WBS. The offeror shall determine the appropriate lower level WBS elements. The Contracting Officer will approve any changes to the following WBS elements.

WBS 1 — Program Management

Includes all work to develop, integrate and execute the program management activities necessary to successfully execute the requirements of this contract. These activities include, but are not limited to, program planning, reporting, financial management, purchasing, subcontract management, configuration management, safety management, security, property management, quality management, risk management, and performance assurance. Specific Transition related Program Management activities should be allocated in WBS 2.1.

WBS 2 — Transition of Engineering Responsibilities
- WBS 2.1 Transition Specific Program Management
- WBS 2.2 Transition Technical Activities

Includes all work to plan and execute the transfer of hardware and software system responsibilities from the system development contractor(s) to the EED contractor. This WBS also includes all work to plan and execute the transfer of hardware and software system responsibilities and provide training and consultation services to the EED follow-on contractor.

WBS 3 — Development Engineering
- WBS 3.1 ECS Development Engineering
  - WBS 3.1.1 — Development of Custom Code and other non-COTS-related Work
  - WBS 3.1.2 — Perform Engineering and Integration of COTS Software
  - WBS 3.1.3 — Perform Engineering and Integration of COTS Hardware
- WBS 3.2 ECHO Development Engineering
  - WBS 3.2.1 — Development of Custom Code and other non-COTS-related Work
  - WBS 3.2.2 — Perform Engineering and Integration of COTS Software
  - WBS 3.2.3 — Perform Engineering and Integration of COTS Hardware

Includes all design and development activities for new Earth science systems or components/capabilities. Development activities include, but are not limited to, requirements analysis, design, interface definition, development, integration, test, training, and documentation.

WBS 4 — Maintenance Engineering

- WBS 4.1 ECS Maintenance Engineering
  - WBS 4.1.1 — Maintenance of Custom Code and other non-COTS-related Work
  - WBS 4.1.2 — Maintenance of COTS Software
  - WBS 4.1.3 — Maintenance of Hardware
- WBS 4.2 ECHO Maintenance Engineering
  - WBS 4.2.1 — Maintenance of Custom Code and other non-COTS-related Work
  - WBS 4.2.2 — Maintenance of COTS Software
  - WBS 4.2.3 — Maintenance of Hardware

Includes all work to perform hardware and software maintenance of the Earth science data systems and/or its components. Maintenance includes a large spectrum of activities including, but not limited to, management, design, implementation, modification, configuration management, personnel training, operator training for baseline changes, integration, installation, user liaison, help desk, testing, quality assurance, and technical assistance. This WBS also includes all work for the maintenance of system documentation, including, but not limited to, design documentation, operations procedures, and user's guides. It also includes all work to plan, document, implement, and maintain the hardware and software maintenance and development processes to be used throughout the life of the EED contract.

WBS 5 — System Engineering

Includes all work to perform on-going system engineering for the purpose of, but not limited to, recommending enhancements to the Earth science data systems and/or its components for cost saving, capacity growth, technology refresh, design improvements, and other upgrades.

WBS 6 — Science Support

Includes all work to provide support to the science community. This work includes, but is not limited to, assistance in the use of Earth science data systems, development and maintenance of interfaces, identification of system modifications to support science community needs, and assistance in the analysis of problems.

WBS 7 — Operations Support

Includes all work to provide operations support for Earth science data systems including, but not limited to, system operation, training of operations personnel, on-site engineering support, special tools, and problem analysis.

WBS 8 — Studies and Prototyping

Includes all work to perform and/or support special studies and prototyping.