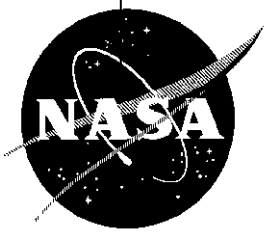
Earth Science Data and Information System Project

Earth Observing System Data and Information System (EOSDIS) Evolution and Development 2 (EED2) Statement of Work For Providing Science Data Processing System Sustaining Engineering and Continuous Evolution

NNG15HZ39C

July 25, 2019



National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

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Earth Observing System Data and Information System (EOSDIS)
Evolution and Development 2
(EED2)
Statement of Work
For Providing
Science Data Processing System
Sustaining Engineering and Continuous Evolution

July 25, 2019

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Approved by:

EED2 COR GSFC - Code 423	Date

Goddard Space Flight Center
Greenbelt, Maryland

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Change Record Page

ISSUE	RELEASE DATE	PAGES AFFECTED	DESCRIPTION
Original	7/25/2019	All	Baseline

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Section 1. Introduction

1.1 Task Summary

This task provides for the evolutionary development and sustaining engineering of the software and hardware for the following subsystems: EOSDIS Core System (ECS) Science Data Processing System (SDPS), and the ECS Maintenance Environment (EME). Hereafter the composite of these subsystems is referred to as the System. The System is a major component of NASA's premier Earth Observing System Data and Information System (EOSDIS).

This task also provides for program management, system engineering, science support, operations support and studies/prototyping support.

This task specifically includes continuing system evolution and technology upgrades.

All software developed under this task should be open sourced as directed by the task lead.

Section 2 describes the work to be performed under this task.

The period of performance of this task includes is 10/1/2019-8/31/2020 (if the contract is extended the task will be modified to add an additional month to allow for the end of task year 5 reports to be generated, as has been done in all previous contract years).

1.2 Applicable and Reference Documents

1.2.1 Applicable Documents

Applicable documents are those specification, standards, criteria, etc. used to define the requirements of this Statement of Work (SOW). In the event of a conflict between an applicable document and this SOW this SOW takes precedence. Should a conflict occur among applicable documents, the contractor shall request resolution from the Contracting Officer.

- 423-46-01, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System Science Data Processing System
- 423-CDRD-EED2 CH 03 Contract Data Requirements Document for EED2
- NPR 2210.1C, Release of NASA Software – Revalidated w/change 1
- NPR 2810.1A Security of Information Technology
- NPR 7150.2B NASA Software Engineering Requirements
- NASA-STD-8719.13C, NASA Software Safety Standard
- NASA-STD-8739.8, Software Assurance Standard
- IEEE Standard 730, Software Quality Assurance Plans
- The contractor is required to comply with all standards and guidelines as addressed by the US Access Board issued under Section 508 of the Rehabilitation Act and Section 255 of the Communications Act. Please see https://www.access-board.gov/guidelines-and-standards/communications-and-it . The contractor should be aware of the planned refresh of the ICT rules and guidelines as specified in https://www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-ict-refresh/overview-of-the-final-rule

1.2.2 Reference Documents

Reference documents are those documents included for information purposes; they provide insight into the operation, characteristics, and interfaces, as well as relevant background information. The contractor is bound by these documents to the extent specified in this specification or in its applicable documents.

1.2.2.1 General Reference Documents

- NPR 4200.1H, NASA Equipment Management Procedural Requirements
- NPR 7120.5E, NASA Space Flight Program and Project Management Requirements

1.2.2.2 Reference Documents

The EED2 contractor shall maintain these system documents per Section 2.2.1.

- PV-SCM-423-EDF - Project Acceptance and Implementation Variances
- CP-SCM-423-EDF - Contingency Plan for the EOSDIS Development Facility
- RA-SCM-423-EDF - Risk Assessment Report for the EOSDIS Development Facility (EDF)
- PIA-SCM-423-EDF - Privacy Impact Assessment
- EED2-SSDP-24 – EED2 Software System Documentation Package:
  - System Requirements
  - Software Design Information
  - User Guides (including the SDP toolkit User's Guide)
  - API Specifications
  - Release Notes
  - Operations Processes, Policies and Procedures
  - COTS Software/Hardware Configuration Baseline
  - Workload Specification

The EED2 contractor shall retain historical versions of these system documents

- DID 305 Segment Design Specification
- DID 311 Database Design and Database
- DID 333 SDP Toolkit User's Guide
- DID 609 Operation Tool Manual
- DID 611 Mission Operations Procedures
- DID 625 Training Material

1.2.2.3 ECS Documentation

The following ICDs and other documents were generated during the development of the ECS and are under the control of the ESDIS CCB. The EED2 contractor shall support the maintenance of these Documents by submitting and reviewing Configuration Change requests.

Any new documents, not already CM managed in COMET but intended to be managed in COMET should adhere to document formatting requirements outlined in the ESDIS Master Document Template, 423-FORM-002 when exporting from Jama - if so directed by the task manager. Nominally these documents would be documents with external interfaces which could be impacted by changes made by Raytheon or high-level (L3 equivalent) system requirements documents. Such documents will be identified by NASA via discussion with Raytheon.

Doc #	Short Name	Version
423-10-69	Requirements for Archiving, Distribution and User Services (ADURD)	Rev B
423-41-45	ICD between ECS and NSIDC DAAC	Rev C
423-41-57	ICD between ECS and SIPS, Volume 0	Rev J, CH01
423-41-57-10	ICD between ECS and SIPS, Volume 10, TES Data Flows	Rev D
423-41-57-16	ICD between ECS and SIPS, Volume 11 ISS SAGE III SCF Data Flows	Original
423-41-57-17	ICD between ECS and SIPS, Volume 11 AMSR	Original
423-41-57-2	ICD between ECS and SIPS, Volume 02 SAGE III SCF Data Flows	Rev B
423-41-57-5	ICD between ECS and SIPS, Volume 05 MOPITT Data Flows	Rev C
423-41-57-6	ICD between ECS and SIPS, Volume 06 MODIS (MODAPS)	Rev C
423-41-58	ICD between ECS and LP DAAC	Rev C
423-41-60	DFCD for EMOS ICC Planning and Scheduling	Rev A, CH02
423-41-63	ICD between EMOS and SDPS	Rev E
423-44-01	ICD between GES DISC S4PA and SSE Interface Mechanisms	Rev A, CH01
423-45-02	ICD between ECS and ECHO for Metadata Inventory and Ordering	Rev D
423-45-03	ICD for EWOC and External Processing Co-located at the DAACs	Rev A
423-46-01	EMD F&PRS	Rev D
423-47-01	ICD between EMS and the Data Providers	Rev A; CCR #142 open
423-ICD-001	ICD between LP DAAC and the ASTER GDS	Rev B
423-ICD-002	ICD between EOS Networks and EOSDIS Elements (Core)	Rev G
423-ICD-002-A	ICD between EOS Networks and EOSDIS Elements EDOS	Rev C
423-ICD-002-AA	ICD between EOS Networks and EOSDIS Elements NSG	Rev F
423-ICD-002-F	ICD between EOS Networks and EOSDIS Elements MISR	Rev C
423-ICD-002-G	ICD between EOS Networks and EOSDIS Elements MOPITT	Rev D
423-ICD-002-H	ICD between EOS Networks and EOSDIS Elements MODIS	Rev B
423-ICD-002-J	ICD between EOS Networks and EOSDIS Elements ASTER	Rev E
423-ICD-002-O	ICD between EOS Networks and EOSDIS Elements TES	Rev B
423-ICD-002-P	ICD between EOS Networks and EOSDIS Elements ICESat	Rev B
423-ICD-002-Q	ICD between EOS Networks and EOSDIS Elements EMS	Rev B;CCR #139 open
423-ICD-002-R	ICD between EOS Networks and EOSDIS Elements ECHO	Rev B
423-ICD-002-S	ICD between EOS Networks and EOSDIS Elements SDS	Rev G
423-ICD-002-U	ICD between EOS Networks and EOSDIS Elements SMAP	Rev C
423-ICD-002-V	ICD between EOS Networks and EOSDIS Elements ICESat-2	Rev E
423-ICD-002-W	ICD between EOS Networks and EOSDIS Elements GIBS	Rev D
423-ICD-002-Z	ICD between EOS Networks and EOSDIS Elements ECOSTRESS	Rev E
423-ICD-005	SMAP - DAAC ICD	Rev A; CCR #138 open
423-ICD-007	ICD Between ICESat-2 SIPS and NSIDC DAAC	Rev A
423-ICD-009	GIBS - Imagery Provider ICD	Rev A
423-ICD-011	NSG and DAAC ICD	Original
423-ICD-012	ICD between ECOSTRESS and LPDAAC	Original
423-ICD-013	ICD between SNPP SDS Elements (core)	Original
423-ICD-013-A	ICD between SNPP SDS Elements Appendix A. VIIRS	Original
423-ICD-014	ICD between NSG and DAAC's	Original
423-OA-001	OA Between SMAP SDS at JPL and NSIDC DAAC	Original; CCR #138 ope
423-OA-002	OA Betweeen SMAP GMAO and NSIDC	Original
423-OA-EDOS/DAAC	OA between EDOS-DAAC	Rev 3
423-OPS-003	NSG Prototype Phase I OpsCon	Original
423-PLAN-001	IceBridge DMP	Original
423-PLAN-002	ARISE-DMP	Original
423-RQMT-001	NSG F&PRS	Original
423-RQMT-002	LANCE Requirements (core)	Rev C;CCR #141 open
423-RQMT-002-F	LANCE MISR Requirements	Rev B
423-RQMT-003	Metadata Requirements Base Reference Document	Original
423-RQMT-005	ECHO / Reverb Requirements	Original
423-RQMT-007	NSG Prototype Requirements	Original
423-RQMT-012	NSG System Requirements Specification	Original
423-SPEC-001	NASA ESD Preservation Spec	Original, Change 01
423-TMPL-001	ESDIS Document Template	Rev A
428-ICD-012	ICD Between EDOS and the ICESat-2 Ground System	Original
428-ICD-EDOS/EGS	ICD between EDOS and EGS	Rev 6
552-FDD-96	ICD between ECS and AM-1 FDS	Rev 11

For informational purpose only, the above documents and ECS specific design documentation are available from a combination of the following Web sites including:

a) ESDIS Project Home Page
b) ECS Data Handling System
c) ESDIS Library
d) GSFC Directives Management System

1.3 Definitions

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

Corrective Engineering – Changes necessitated by actual errors (i.e. 'bugs'), or design deficiencies. Corrective maintenance consists of activities normally considered to be error correction required to keep the system operational. By its nature, corrective maintenance is usually a reactive process. Corrective maintenance is related to the system not performing as originally intended. The four main causes of corrective maintenance are (1) design errors, (2) logic errors, (3) coding errors, and (4) hardware failures.

Adaptive Engineering – Changes initiated as a result of 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, utilities, etc.

Perfective Engineering – (Also known 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.

1.4 Scope

In the performance of this task, the EED2 contractor is required to coordinate and integrate task related activities with the ESDIS Project, the Distributed Active Archive Centers (DAACs), the science investigator teams, the user community, end users, and other EOS contractors. The

contractor shall conduct an evolutionary development program to improve the reliability, availability, functionality, operability, and performance of the System within the EOSDIS while reducing operational and maintenance costs. The contractor shall:

- Provide corrective maintenance engineering of the custom and COTS software in a timely manner.
- Provide preventive and corrective maintenance engineering of EOSDIS hardware components consistent with the operational availability
- Provide hardware and software adaptive maintenance engineering
- Provide hardware and software perfective engineering to implement new requirements.
- Provide corrective, adaptive, and perfective maintenance to lower the overall cost of maintenance and operations of EOSDIS and/or to support evolving system requirements
- Conduct a continuous evolution program to assess new technologies and user requirements.

Under this task, the contractor shall perform functions required to sustain the Contract, including overall Program Management, Program Controls, Supply Chain Management, Procurement Management, Configuration Management/Data Management, Quality Management, Property Management, Security, software and hardware development and maintenance planning, software assurance, and proposal preparation. There may be task-specific activity in each of the above areas when required for each task, but when performed for the Contract these activities shall be performed within this task.

1.5 Period of Performance

The period of performance of this task is 10/1/2019 through 8/31/2020. (if the contract is extended the task will be modified to add a month to allow for the end of task year 5 reports to be generated, as has been done in all previous contract years).

1.6 Place of Performance

The place of performance is the GSFC, Greenbelt, MD and the contractor's facility in Riverdale Maryland. Limited contractor staff will also be dedicated to provide on-site support at the National Snow and Ice Data Center (NSIDC) in Boulder, Colorado.

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Section 2. Work to be Performed

2.1 Program Management

The contractor shall direct and integrate the program management activities necessary to ensure the successful performance of this task. The contractor shall maintain the EED2 Program Management Plan.

2.1.1 Program Control

The contractor shall provide a management organization with the necessary capability and authority to ensure that task, technical, schedule, and cost requirements are met. The prime contractor shall be fully responsible for the management and performance of its subcontractors and vendors.

The contractor's primary government interface is with the Goddard Space Flight Center's ESDIS Project. Contract/task direction and modification can be provided only by the government Contracting Officer (CO).

The contractor shall supply all the necessary resources, materials, facilities, and support tools needed in addition to the government furnished property to manage this task.

The contractor shall implement a formal configuration management system for controlling all aspects of this task including but not limited to hardware, software, systems, procedures, standards, and documentation. The contractor shall maintain the Configuration Management Plan (DID EED2-CMP-19).

The contractor shall establish a Continuous Risk Management System (CRMS) that provides for the identification, analysis, tracking, mitigation, and resolution of risks. The CRMS shall be implemented in accordance with the guidelines set forth by NPR 7120.5, NASA Program and Project Management Processes and Requirements. The contractor shall document their risk management program in a Risk Management Plan (DID EED2-RMP-6). Risks shall be reviewed regularly with the ESDIS Project.

2.1.2 Program Planning, Reporting, and Reviews

Planning

The contractor shall be responsible for all planning necessary to accomplish the work defined by this task.

The contractor shall identify, document, and deliver all management plans to the government (including DID EED2-PMP-8) for comment and where applicable, approval.

Reporting

The contractor shall formally report technical, schedule, and financial performance on a monthly basis. The contractor shall report to the ESDIS Project whenever the contractor's performance warrants communication of current status more often than monthly. The contractor shall submit written reports and orally present status at monthly and other progress reviews. Written reports shall include Monthly Progress Reports (EED2-PMR-10).

In addition to formal presentations, the contractor shall meet with ESDIS Project technical monitors on a weekly (or other mutually agreed to) basis to communicate status and priorities. The contractor shall meet with the users on a mutually agreed to schedule (nominally weekly) to discuss status and priorities.

The contractor shall provide 533M, 533Q, accrual, and variance reports (DID EED2-533-11).

Technical Reviews

The contractor shall conduct a periodic evolution planning review to establish the evolutionary direction of the System. Reviews shall address emerging technologies and application to the System and User requirements. The reviews shall include trades that address technical and cost parameters.

At a minimum, the contractor shall conduct a Pre-Ship Review (PSR) or convene a DAAC working group as appropriate, to be performed for all deliveries, including patches resulting from sustaining engineering activities and releases resulting from perfective engineering activities. The PSR shall be conducted for any software release or patch, including patches and upgrades to COTS software. The review shall include:

- A complete description of the new functionality,
- Functional, regression, and installation test results conducted for the release or patch and an assessment of potential impacts based on any hardware and/or software difference between the development facility and the planned target site,
- Installation/transition plan and a detailed walkthrough of the installation instructions for the release or patch
- A description of and operations impact assessment of any liens against the release.

  The primary audience for the review shall be the operations staff.
- DID EED2 PSR-14

In addition, for technical modifications that introduce changes in system behavior, the contractor shall conduct Requirements Reviews, which will cover the following items:

- Summary operations concept for each modified capability in the upcoming release,
- Description of all functional and performance requirements to be supported, including derived subsystem requirements for each capability in the upcoming release,
- Functional, performance and error handling verification criteria for each capability in the upcoming release,
- Discussion of operations, including installation/transition and training, impact for each capability in the upcoming release.

2.1.3 Procurement Management

The contractor shall maintain the Procurement Management Plan (DID EED2-PM-17), which documents procedures to be used for the competitive selection and procurement of required products and services, as well as the management of vendors and subcontractors.

2.1.4 Performance Based Metrics

The contractor shall identify, implement, track, and analyze metrics over the period of the task. Metrics shall address significant performance aspects of this task including responsiveness to ESDIS and DAAC priorities.

Task and system performance metrics shall be selected such that accomplishments, as measured by the metric, shall be completely within the control of the EED2 contractor.

As appropriate, metrics shall be developed jointly with other contractors (e.g., DAAC operations contractors) and organizations (e.g., instrument teams) to measure performance areas of shared or overlapping responsibilities.

Metrics will be used to monitor the contractor's progress and may be used for award fee purposes.

2.1.5 Internal Work Priorities

The contractor's internal work priorities shall reflect the overall goals and priorities of the ESDIS Project, as set during the ongoing agile development process. The priorities and goals of ESDIS are aligned with those of the Science Missions Directorate (SMD) and consider the net benefit to the EOSDIS and user community.

The contractor shall prepare and deliver custom code and COTS software and hardware patches and changes as required and prioritized by security and agile development process. The contractor shall interface with DAACs to describe upcoming emergency patches. Pre-Ship Reviews (PSRs) shall be conducted for hardware and software changes and patch deliveries. PSRs shall be presented at weekly technical interchange meetings with government representatives.

2.1.6 Quality Management System

The Contractor shall maintain a Quality Management System (QMS) that addresses their documented processes and procedures, approach to nonconformance reporting and corrective and preventive actions, and plans for continuous improvement. The Contractor QMS shall be compliant at least to the minimum requirements of ANSI/ISO/ASQ 9001:2000 or equivalent.

2.2 System Evolution Engineering

2.2.1 General

The contractor's overall evolution and sustaining engineering program shall include a prioritized balance of corrective engineering actions, requests for routine minor enhancements (perfective), and technology refreshment. The contractor shall proactively coordinate with the user community and the ESDIS Project to establish consensus priorities while ensuring the operational availability and performance of the System. The contractor shall submit technology refresh technical and cost proposals to the government for authorization and commitment of

funds prior to implementation. These efforts will then be planned and funded either as separate tasks or as future modifications to this task.

The contractor shall replace, delete and/or upgrade custom software, COTS software, COTS hardware, and system media (e.g. archive media) based on favorable cost trades against the overall ESDIS maintenance and operations costs, or to improve system performance, scalability, maintainability, and/or reliability. Trade studies shall generally look forward 3 to 5 years even if this time period is beyond the period of performance of this task.

The contractor is responsible for the total hardware and software maintenance process 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.

The contractor shall plan, document, implement, and maintain the hardware and software maintenance process to be used throughout the life of the System maintenance engineering program. The contractor shall provide configuration control of System hardware, software, and documentation.

The contractor shall ensure that hardware/software maintenance activities do not degrade, impair, delete, or otherwise reduce the functionality or performance of the current operational system.

In addition to responding to corrective, adaptive, and perfective modification requests, the contractor shall continuously analyze the System hardware and software system to identify implementation and architecture changes that may reduce the overall maintenance and operational cost to the ESDIS Project.

The contractor shall support the management of the System requirements by recommending changes, and reviewing, analyzing, and impacting change requests. The requirements are configuration controlled at the ESDIS Configuration Control Board (CCB). The contractor shall participate in the government configuration control process. The contractor shall control lower level requirements at the contractor's configuration control board.

The contractor shall be responsible for the maintenance of the System documentation, including but not limited to design documentation, operations procedures, interfaces, and user's guides. Documentation shall reflect the implementation of the current operational releases and patches. In addition the contractor shall create and maintain all other documentation required to ensure System documentation is kept current throughout the contract. A Documentation Package (SSDP-24) shall be delivered for SDPS as per the CDRD. The Level 4 requirements of the ECS are baselined in the Earthdata Requirements Management System (RMS). The contractor shall maintain the ECS Level 4 Requirements Baseline, coordinate the requirements with Jira tickets, and create requirements documentation for COMET.

The contractor shall ensure the compatibility of interfaces between the System and other system components.

The contractor shall implement, maintain, and manage a software and hardware problem reporting system and shall report on the status of open/closed items within this system at regular weekly/monthly and technical interchange meetings with the ESDIS Project.

The contractor shall be readily accessible to the operational DAACs on a 5-day per week, 8-hour per day basis to answer routine questions, provide status of corrective changes, support new patches and releases, and coordinate future deliveries.

The contractor shall develop and document, or maintain where they already exist, detailed working agreements with the DAACs, Instrument Teams (IT), and other organizations that currently interact with the EED2 organization. The contractor shall clearly document and communicate maintenance interfaces and processes to the DAACs and ESDIS Project, and coordinate maintenance schedules with the DAACs.

The contractor shall provide the necessary hardware and software environment to perform evolutionary development and maintenance engineering functions required by this statement of work. The environment may consist of the GFE environment and/or new components and tools. The environment shall be maintained throughout the task period of performance.

The contractor shall perform database administration for the System, including but not limited to monitoring, maintenance, backups, and performance tuning.

The contractor shall develop and maintain the System in compliance with Section 508 Standards, particularly, standard 1194.22 Web-based intranet and internet information and applications.

The contractor shall provide online access to all current and legacy ECS/EED2 documentation.

All new functionality shall be thoroughly tested prior to its release. The acceptance criteria for new functionality shall be approved through the established agile development process. For each new release, the contractor shall address any deltas between the test environment and the target system and assess the impacts of those differences with the ESDIS Project.

End-to-end performance tests with loads equivalent to 24 hours of operations shall be executed for each major software release or at least yearly (if no releases have occurred in the 12 months prior to the test). These tests shall approximate the maximum loads projected to occur during the year following the test dates. The exact workloads to be used for each test shall be defined by the EED2 contractor and approved by the COR. These tests shall be executed in the contractor's development facility and should take into account any differences between the test environment and the target systems.

Regression testing consisting of a controlled set of functionality tests shall be executed as part of the testing for each major release or patch prior to its release to the System operational systems. The tests shall ensure the current system performance is maintained.

Installation testing consisting of full trial installations and installation ‘back-outs’ from a simulated operational environment shall be executed prior to the shipment of each major release or patch. Installation tests shall also include execution of regression tests once the installation is complete to verify that the installation functions properly. The installation test should demonstrate that the installation and transition to operations for the release or patch could be completed in less than 24 hours.

The contractor shall make the test plans (e.g. regression and installation) and results available to the COR upon request.

A member of the ESDIS project or their appointed representative may witness the execution of all acceptance, regression, installation and performance tests.

Although the ESDIS project is responsible for overall integration of the EOSDIS, the contractor shall support these integration activities as follows:

- By conducting pre-release interface tests at the development facility,
- By reviewing and submitting technical comments for EOSDIS integration test plans and specifications, and
- By providing problem analysis and recommendation of solutions

2.2.2 Software

The contractor shall be fully responsible for the software evolutionary development and maintenance engineering of the System. This responsibility includes, but is not limited to, System custom code and scripts, COTS software products, Earth Science Data Types (ESDTs), databases, configuration control, overall configuration management, documentation, testing, reviews, and support services.

The contractor shall maintain the Software Maintenance and Development Plan (DID EED2-SMDP-2) by a formal change control process. The SMDP shall address methodologies for corrective, adaptive, and perfective changes. The SMDP shall include, but not be limited to:

- Contractor's maintenance and development concept (including use of vendors)
- Organization and maintenance activities
- Resources
- Processes
- Testing and verification
- Training requirements
- Maintenance/development records and reports
- Configuration management plans

The contractor's interface to the DAACs shall include a Patch Integrated Product Team (IPT) to convey and prioritize DAAC problems and for describing upcoming emergency patches. Pre-Ship Reviews (PSRs) shall be conducted for COTS changes (hardware and software) and patch deliveries.

Sustaining Engineering:

The contractor shall work with the DAACs to establish priorities for sustaining engineering fixes and corrections to baseline custom code discrepancies. These corrective actions will primarily be initiated by entry of NCRs or Trouble Tickets by either the DAAC or SDPS staff. The contractor shall balance sustaining engineering needs across the three ECS DAACs, also taking into account issues and discrepancies found internally by the SDPS team.

New Development:

The contractor shall provide adaptive and perfective engineering and development to support the ECS DAACs. The contractor shall work with both the DAACs and ESDIS stakeholders to establish priorities of new development work to effectively manage requests for changes and enhancements. New development work may include but not be limited to support to new

missions and data types, changes in data needs and usage by earth data scientists, enhancements to SDPS interfaces, configurations, science data reprojections / subsetting, and parameter management as needed to streamline operations at the DAACs, and to accommodate the ever-changing requirements as the missions of EOSDIS continuously evolve.

Software metrics shall include, but shall not be limited to:

- Software size with emphasis on tracking reductions achieved through evolution
- Software staffing
- Modification Request processing
- Software enhancement scheduling
- Discrepancy report open duration
- Break/fix ratio

2.2.3 Hardware

The Contractor shall provide preventive and corrective engineering of the System computer equipment including, but not limited to, central processing units, workstations and servers, direct access storage devices, robotic tape libraries and tape devices, archive media, laser printers, network and communications devices, and other associated equipment for the System**.** Equipment is located at the 3 ECS DAAC sites and the contractor's development facility.

The contractor shall maintain the hardware in accordance with OEM standards for maintenance, including installation of OEM recommended microcode and engineering changes. The contractor shall maintain the equipment in such a manner that it is certified to be acceptable by the OEM for maintenance.

The contractor shall enhance System hardware, if required, to support software upgrades.

The contractor shall maintain the Hardware Maintenance and Development Plan (DID EED2-HMDP-3) by a formal change control process. The HMDP shall address methodologies for preventive, corrective, adaptive, and perfective changes. The HMDP shall include, but not be limited to:

- Contractor's maintenance and development concept (including use of vendors)
- Maintenance activity
- Resources
- Processes
- Testing and verification
- Training requirements
- Maintenance/development records and reports

The contractor shall perform preventive maintenance as necessary to ensure the System reliability and operational availability requirements are achieved.

The contractor shall ensure that all failed hardware components and system media are restored to service in a time period consistent with the operational availability requirements of the System as specified in the functional and performance specifications and derived lower level derived requirements.

Hardware maintenance shall be provided for equipment transitioned to the contractor, equipment upgrades, enhancements performed by the contractor, capacity upgrades, and for specific equipment provided by the government.

The contractor shall be responsible for the timely repair of all hardware components regardless of the cause of failure (e.g., due to the negligence of the government or the operations staff, or catastrophic event).

The contractor shall maintain records of equipment failures, repair statistics, Engineering Changes (ECs), time to restore, etc. Maintenance records shall be made available to the government upon request.

Hardware maintenance shall include the maintenance of hardware component microcode.

The following approximate square footage will be made available at the DAACs for spare parts and components, test equipment, and repair work:

DAAC	SQ. FT.
LARC	400
EDC	550
NSIDC	250

2.3 Science Support

The contractor shall provide support to the science community as follows:

- Update Earth Science Data Types (ESDTs) and associated services to support evolving science products based on periodic inputs from the Instrument Teams (ITs).
- Define and develop new ESDTs to support new product types.
- Provide ESDT training to ITs and DAACs including instruction on the EOSDIS data model, the ESDT definition process, and the metadata requirements and options.
- Develop and maintain interface documentation between ECS SDPS and each of the supported ITs.
- In coordination with the ITs and their associated Science Teams, evaluate and refine any proposed modifications or extensions to the ECS SDPS in support of the formal Modification Request process.
- Answer science user and instrument team questions and assist in resolving problems related to HDF-EOS, Science Data Processing (SDP) Toolkit, HDF-EOS to GeoTIFF (HEG) conversion utility, and HDF.
- Maintain the ECSinfo web site that provides online information to science users. This web site includes information on the current ESDT baseline, ECS metadata model, and SDP Toolkit.
- The contractor shall provide lifecycle metadata support for SDPS related metadata products across EOSDIS by assisting personnel in defining metadata standards

compliance, usability and interoperability. The contractor shall maintain SDPS related metadata products, including ESDTs.

2.4 Operations Support

2.4.1 General DAAC Technical Support

The contractor shall provide operations support as follows:

- Train operations personnel in how to administer and operate the evolving system. As DAAC operations and support personnel are changed out provide any necessary refresher training to new DAAC operations and support personnel.
- Train operations personnel in the installation of and transition to major system upgrades, including major COTS upgrades.
- Provide on-site support as defined in Section 2.4.2 at the NSIDC DAAC for the installation of and transition to system upgrades. The NSIDC DAAC is located at: National Snow and Ice Data Center (NSIDC), Boulder, Colorado (a University of Colorado facility)
- Provide CM support for externally developed Operational Support Software (OSS) components that interface to the ECS SDPS. OSS components are operational tools developed and maintained externally (e.g., by the DAAC operations staff). Evaluate OSS for adherence to system requirements and system impacts prior to integration into systems.
- Provide tools and new release training to minimize the impact of each new patch or release to on-going operations.
- Provide training to the DAAC operations staff for on-site metric collection, problem diagnosis, including security issues, system administration, and system tuning to ensure system down time is minimized and to ensure mission support is maximized.
- Ensure DAACs are kept informed regularly on any planned upgrades, patches, etc and proposed timelines and ensure their readiness for any new releases, upgrades or corrective actions

2.4.2 On-site DAAC Technical Support

In addition to and in support of the above requirements the contractor shall provide on-site support services at the NSIDC DAAC satisfying the following functional requirements:

- DAAC System Engineering – Analyze and identify ways to accommodate needed improvements, new technologies and concepts and perform activities necessary to assure ECS reliability, maintainability, availability, and performance.
- DAAC Software Maintenance Engineering – Track corrections, modifications, and enhancements to the ECS software (including COTS), record and track problems, support operations installation and integration and test of software, and provide inputs to the DAAC CM administrator as required.
- DAAC System Testing –Support execution of formal and impromptu testing at the DAAC, and report and analyze findings.

- Provide liaison between DAAC Operations Contractor staff, institutional management, and the EED2 maintenance staff.

Staffing levels shall be based on DAAC unique requirements and evolutionary changes.

2.4.2.1 NSIDC DAAC-specific Technical Support

The contractor shall provide on-site operations support at the NSIDC DAAC in the form of software development expertise for NSIDC evolutionary software development activities.

The contractor shall provide sustaining engineering to include (for IceBridge and other ESDIS missions):

- SIPS Metadata Ingest Application Tool (SIPS Metgen) NCR fixes and enhancements as prioritized
- Testing and deployment of SIPS Metgen patches, test executables, and engineering software
- Technical support to the data providers (as approved by ESDIS) using the SIPS metgen application
- On-site operations support at the NSIDC DAAC to address any IceBridge related ingest, hardware, or software issues
- Supporting the integration of data products with the ECS system architecture
- End to end data flow process development and refinement
- On-site support at the NSIDC DAAC in the form of software development process expertise for NSIDC IceBridge team software development activities

2.5 Software Assurance

The Contractor shall plan, document, and implement a software assurance program for all software development and maintenance activities. The software assurance program shall address the disciplines of Software Quality, Software Safety (if applicable), Software Reliability, and Software Verification and Validation (V&V). The contractor shall document their software assurance procedures, processes, tools, techniques, and methods to be used in a Software Assurance Plan (DID EED2-SQAP-4).

2.6 Security

The contractor shall maintain and upgrade the security features of the System hardware and software components to ensure the integrity of the system and the protection of the data holdings. The contractor shall support the on-site Security Managers maintenance of the on-site security plans and programs.

The contractor shall ensure the security of the System and data holdings throughout the period of performance of this task.

2.7 Property Management

The Contractor shall provide property management services for the System in accordance with contract provisions at the facilities hosting the ECS DAACs and the contractor's development and test systems.

The Contractor shall prepare a Property Management Plan (DID EED2-PP-5) in accordance the NASA Procedural Requirements (NPR) 4200.1, NASA Equipment Management Procedural Requirements.

Per contract clause B.1 and G.l3, the contractor shall provide NASA Form (NF) 1018 reporting on the dollar value of government material and equipment in its possession. The contractor shall provide annual transaction reports.

2.8 Contract Year 4 – COTS Refresh and Capacity

The contractor is to provide Requirements Analysis, Design, Integration, Testing, Training, Implementation, Configuration Management, Documentation, and Reviews for technology refresh of SDPS components which are due to reach End-Of-Service-Life in 2020 and were not already addressed in Task 42 Modification 2 or the contract year 4 burndown plan.

The contract year 5 refresh and capacity requirements, in addition to items already purchased under Task 42 modification 2 or the contract year 4 burn down plan , are anticipated to include the following:

Required COTS Upgrade/Replacement/Expansion	Site	Material
Install Unity XT 880 to include 1178TB of expansion	NSIDC	T42M2
Install Unity XT 880 to include 2121TB of expansion	LP DAAC	T42M2
Install Unity XT 680	ASDC	T42M2
Install Unity 600 capacity expansion	PVC	T42M2
Install 200 slot license for the StorNext AEL6000	NSIDC	T42M2
Provide additional storage media	ASDC, NSIDC	T42M2
Install HPE BL460c G10 blade servers with Red Hat (QTY 10)	EDF, PVC, Prototype	T42M2
Install new VM datastore array (QTY 3)	PVC, EDF	T42M2

Purchase HPE BL460c G10 blade servers with VMware and Red Hat virtual data center subscriptions (QTY 10)	All sites	T52
Purchase and install new VM datastore array (QTY 3)	LP DAAC, NSIDC, ASDC	T52
Purchase and install Juniper SRX4100s (QTY 4) and SRX1500 (QTY 2)	NSIDC, EDF, PVC	T52
Purchase and install LTO7 Tape Drives for StorNext AEL6000 (QTY 2)	NSIDC, LP DAAC	T52

2.9 Studies & Papers

- The contractor shall maintain and update the lessons learned document covering all the cloud development and operational activities conducted on any EED-2 task.

- The contractor shall work with ESDIS to maintain the guiding principles document for cloud development and operations planning.

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Appendix A. EED2 Acronym List

ACRIM	Active Cavity Radiometer Irradiance Monitor
ADC	Affiliated Data Center
AMSR-E	Advanced Microwave Scanning Radiometer - EOS
API	Application Programming Interface
ASTER	Advanced Space borne Thermal Emissions and Reflection Radiometer
CCB	Configuration Control Board
CEOS	Committee on Earth Observing Satellites
CMO	Configuration Management Office
CO	Contracting Officer
COR	Contracting Officer's Representative
COTS	Commercial Off The Shelf
CRMS	Continuous Risk Management System
CSR	Consent to Ship Review
CWIC	CEOS WGISS Integrated Catalog
DAAC	Distributed Active Archive Center
DAS	Data Assimilation System
DBMS	Data Base Management System
DCE	Distributed Computing Environment
DCN	Documentation Change Notice
DDTS	Distributed Defect Tracking System
DID	Data Item Description
EBnet	EOSDIS Backbone Network
EC	Engineering Change
ECS	EOSDIS Core System
EDC	EROS Data Center
EDF	ECS Development Facility
EDOS	EOS Data and Operations System
EED2	EOSDIS Evolution and Development 2
EGS	EOS Ground System
EME	ECS Maintenance Environment
EMOS	EOS Mission Operations System
EMS	ESDIS Metrics System

EMSnet	EOS Mission Network
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
EROS	Earth Resources Observation System
ESDIS	Earth Science Data and Information System
ESDT	Earth Science Data Type
SMD	Science Missions Directorate
FDS	Flight Dynamics System
F&PRS	Functional and Performance Requirements Specification
GCMD	Global Change Master Directory
GDS	Ground Data System
GFE	Government Furnished Equipment
GHRSST	Group for High Resolution Sea Surface Temperature
GIA	Government Inspection Agency
GLAS	Geoscience Laser Altimeter System
GOES-R	Geostationary Operational Environmental Satellite – R Series
GSFC	Goddard Space Flight Center
HMDP	Hardware Maintenance and Development Plan
HW	Hardware
HIRDLS	High-Resolution Imaging Spectrometer
IAC	Independent Assurance Contractor
ICD	Interface Control Document
IGS	International Ground Station
IPNOC	Internet Protocol Network Operations Center
IPT	Integrated Product Team
ISO	International Standards Organization
IT	Instrument Team
IV&V	Independent Verification and Validation
JPSS	Joint Polar Satellite System
LaRC	Langley Research Center
LLR	Lessons Learned Review
LP DAAC	Land Processes DAAC
LPDS	Level 1 Product Distribution System
MDT	Mean Down Time

MLS	Microwave Limb Sounder
MODIS	Moderate-Resolution Imaging Spectroradiometer
MOPITT	Measurement of Pollution In The Troposphere
MR	Modification Request
NASA	National Aeronautics and Space Administration
NCR	Non Conformance Report
netCDF	Network Common Data Form
NewDISS	New Data and Information Systems and Services
NOAA	National Oceanic and Atmospheric Administration
NPR	NASA Procedual Requirements
NSI	NASA Science Internet
NSIDC	National Snow and Ice Data Center
OEM	Original Equipment Manufacturer
OMI	Ozone Monitoring Instrument
OSF	Open Software Foundation
OSS	Operations Software Support
OTS	Off the Shelf
PGE	Product Generation Executive
PMP	Procurement Management Plan
PSR	Pre Ship Review
PUMP	Provider User Management Program
PVC	Performance Verification Center
QMS	Quality Management System
RFI	Request For Information
RMA	Reliability, Maintainability, and Availability
SAGE III	Stratospheric Aerosols and Gas Experiment III
SCF	Science Computing Facility
SDPS	Science Data Processing System
SEP	System Enhancement Proposal
SIPS	Science Investigator-led Processing Systems
SMDP	Software Maintenance and Development Plan
SOW	Statement of Work
SW	Software
TES	Tropospheric Emissions Spectrometer

TBD	To Be Determined
THREDDS	Thematic Realtime Environmental Distributed Data Services
WGISS	Working Group on Information Systems and Services
WIST	Warehouse Inventory Search Tool
XMG	XML Management Group
XML	Extensible Markup Language