Earth Science Data and Information System Project

Earth Observing System Data and Information System (EOSDIS) Evolution and Development 2 (EED2) Statement of Work For Common Metadata Repository (CMR)

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Section 1. Introduction

1.1 Task Summary

This task provides for the development, continuous evolution and sustaining engineering of the software for the following major components of NASA's premier Earth Observing System Data and Information System (EOSDIS) subsystems: Earthdata Search Client (EDSC), Common Metadata Repository (CMR), Metadata Quality (e.g. the Unified Metadata Model (UMM), Global Change Master Directory (GCMD) Keywords), Metadata Tools (e.g. the Metadata Management Tool (MMT), the Curation Dashboard, GCMD tools, the UMM-Variable Generator (UVG)), and international search and discovery tools (e.g. the International Directory Network (IDN), Committee on Earth Observing Satellites (CEOS) Working Group on Information Systems and Services (WGISS) Integrated Catalog (CWIC)). It includes usability improvements, driven by both users and stakeholders, and integration with data transformation services such as subsetting, reformatting, regridding, reprojection etc. This task also provides for program management, system engineering, operations support and studies/prototyping support.

EDSC is the primary tool in the Earth Observing System Data and Information System (EOSDIS) through which search is offered across all of the Distributed Active Archive Centers (DAACs) and is used by some DAACs and science projects in a tailored-portal form for their own search needs. CMR is the metadata repository and API that enables users to ingest and search for data. MMT and UMM and other metadata tools are critical components of the CMR that allow for metadata management and maintenance. GCMD Keywords are an internationally used ontology of controlled scientific vocabulary.

CWIC is a multi-national effort seeking to make individual member country data holdings searchable and accessible by other CEOS partners. NASA supports this effort and helps provide coordination support to organize overall requirements and some degree of implementation by providing for the maintenance of CWIC through sustainment engineering and additional work necessary to evolve current capabilities with new features. Clients/Portals connecting to CWIC, use the IDN to provide directory/collection search of CEOS agencies who have registered their collections in CMR, providing the world's satellite Earth observation data providers with a way to make their data collections searchable using common standards.

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

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-CDRD-EED2 Contract Data Requirements Document for EED2
- NPR 2210.1, External Release of NASA Software
- NPD 2820.1, NASA Software Policies

- NPR 2810.1A Security of Information Technology
- NPR 7150.2 NASA Software Engineering Requirements
- NASA-STD-8719.13B, NASA Software Safety Standard
- NASA-STD-8739.8, Software Assurance Standard
- IEEE Standard 730, Software Quality Assurance Plans
- Section 508 Standards – see http://www.section508.gov/index.cfm?FuseAction=Content&ID=12, particularly Subpart B – Technical Standards 1194.22 Web-based intranet and internet information and applications.

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 4200.1F, NASA Equipment Management Procedural Requirements
- NPR 7120.5D, NASA Space Flight Program and Project Management Requirements

1.2.2.2 Reference Documents

The EED2 contractor shall modify system documentation as required to reflect the new cloud-based implementation in addition to maintaining these system documents per Section 2.2.1.

- CMR Developers Guide
- CMR Clients Guide
- CMR Operations Manual
- Portal Creation Guide
- Earthdata Search Developer's Guide

1.3 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, other NASA actors (such as the Improved Performance from Combined Technology (IMPACT) team), and other EOS contractors. This includes conducting an evolutionary development program to improve the reliability, availability, functionality, operability, and performance of the CMR and EDSC systems within the EOSDIS while reducing operational and maintenance costs.

The contractor shall:

- Maintain a 5-year cost projection of the cost of operating the CMR in the NGAP environment.
- Maintain a full-up CMR Workload configuration, which can be used to run tests mirroring operations.

- Maintain and re-deliver key task documentation as detailed in the Task Plan Request (TPR).
- Perform the following system activities:
    - Provide corrective maintenance engineering of the custom and COTS software in a timely manner.
    - Make SW and tools open-source unless specifically excepted.
    - Provide preventive and corrective maintenance engineering of EOSDIS cloud deployment and hardware components consistent with the operational availability.
    - 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.

1.4 Period of Performance

The period of performance of this task is 10/1/2019 through 8/31/2020.

1.5 Place of Performance

The place of performance is the GSFC, Greenbelt, MD and the contractor's facility in Riverdale Maryland.

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.

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 contractor shall also provide architectural oversight to identify overlaps and opportunities related to intersections with other EOSDIS elements and recommend architectural modifications or development activities to mitigate or leverage them.

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 cloud configuration, hardware, software, systems, procedures, standards, and documentation.

The contractor shall implement, maintain, and manage a 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 use a Continuous Risk Management System (CRMS) that provides for the identification, analysis, tracking, mitigation, and resolution of risks related to this task. The CRMS shall be implemented in accordance with the guidelines set forth by NPR 7120.5, NASA Program and Project Management Processes and Requirements. 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 lead the Unified Technical Committee in order to receive technical guidance from the community and to discuss operational issues at the request of data/client providers and in concurrence with ESDIS.

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 and Monthly Manpower Reports (DIDs EED2-MPR-10 & EED MCMR-12).

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).

The contractor shall track and report separately on the following costs:

- CMR maintenance, operations, and development,
- Metadata Tools (Dashboard, MMT, GCMD, UVG),
- Metadata Quality (UMM, GCMD Keywords),
- IDN maintenance and operations,
- CWIC maintenance and operations, and
- EDSC maintenance, operations, and development.

Technical Reviews

The contractor will provide technical reviews at the request of the task monitor or COR. The contractor shall conduct a periodic evolution planning review to establish the evolutionary direction of the task components. Reviews shall address emerging technologies and application to the task components and user requirements. The reviews shall include trades that address technical and cost parameters if required.

The contractor shall provide annual User Workshops, to address ongoing efforts in application or metadata development and to solicit feedback from the user community. Whether or when this feedback becomes actionable work to address will be negotiated with the task monitor.

2.1.3 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 Partner 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.

2.1.4 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.

2.2 System Evolution Engineering

2.2.1 General

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 task components. 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. 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 shall support the management of task 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 create and maintain all other documentation required to ensure task documentation is kept current throughout the contract. This includes but is not limited to the Portal Creation Guide and Earthdata Search Developers' Guide, as well as design documentation, operations procedures, interfaces, and user's guides. Maintain application-specific guides and other documentation in the relevant application repositories (e.g. github). Documentation and descriptive web and wiki pages shall be periodically revisited to archive or remove obsolete information as well as add and update information to reflect the implementation of the current operational releases and patches.

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

The contractor shall develop and maintain the task components in compliance with Section 508 Standards, particularly standard 1194.22 Web-based intranet and internet information and applications, including a compliant capability to search and access EOSDIS data across all of the Distributed Active Archive Centers (DAACs).

The contractor shall investigate ways to represent dataset relationships, dataset recommendations, and dataset maturity metrics. The contractor shall ensure the compatibility of interfaces between the task components and other system components.

All new functionality shall be thoroughly tested prior to its release. The acceptance criteria for new functionality shall be approved by the COR. 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 shall be executed for each major software release. 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 operational systems. The tests shall ensure the current system performance is maintained. 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

2.2.1.1 CWIC

The CWIC Prototype Client will serve as a web-based client to access cross-discipline data from all CWIC data providers. The client also serves as a test for all functionality of the CWIC Server and IDN. The contractor shall:

- Perform sustaining engineering and requested enhancements as needed including usability and workload testing of the CWIC Prototype GUI (CWICSmart) and CwicSmart OpenSearch Validation Tool.
- Support evolution and implementation of a CEOS OpenSearch format and advocate for the adoption of the CEOS OpenSearch Best Practice.
- Provide compatibility for CWIC Prototype GUI (CWIC Smart) with other OpenSearch implementations.
- Support the development of CWIC based searching in the EDSC.
- Support development and evolution of CEOS OpenSearch Developer Guides and Best Practices.

2.2.1.2 EDSC

The contractor shall provide user interface/experience enhancements to the EDSC, based on feedback from end users, DAACs and their User Working Groups, surveys, usability studies, and ESDIS and HQ stakeholders. Potential enhancements may include:

- Improve cross-EOSDIS user experience by further promulgating use of EUI and/or 18f reusable snippets.
- Improve layouts for understandability and navigability.
- Allow users to select a geophysical event instead of a space/time box
- Provide metadata-related user interface/experience enhancements to implementation of Humanizers and relevancy improvements.

The contractor shall expand the access provided by EDSC to data services at the DAACs. The contractor shall provide training to certain communities as prioritized by ESDIS and consulting support to NASA Earth science organizations that wish to configure and maintain an EDSC portal for their communities.

The contractor shall provide and maintain a user-accessible experimental version of the EDSC for testing experimental features with end users and DAACs.

The contractor shall maintain the EDSC compliance with NASA website requirements. The contractor shall perform usability testing and develop new content and layouts as needed to meet EDSC goals.

The contractor shall develop and deliver Use Cases for new EDSC versions and version independent development based on the requirements established at the Requirements Review.

2.2.1.3 CMR

The contractor shall provide and maintain an accessible version of the CMR system for client partner testing (including ingest and ordering) that is independent from the operational CMR system. The contractor shall maintain the CMR tools ensuring the tools are updated for each new version of CMR and is in compliance with all NASA website requirements. The contractor shall perform usability testing and develop new content and layouts as needed to meet CMR website goals.

The contractor shall develop and deliver Use Cases for new CMR versions and version independent development based on the requirements established at the Requirements Review. The contractor shall develop a design based on the Use Cases that is scalable to allow for additional datasets, providers, and queries while still meeting the CMR system performance requirements. The Use Case and design materials shall include any data model, Application Program Language (APL), and interface changes, and will be reviewed by the CMR Leadership Team at a design review with materials updated based on feedback.

The contractor shall provide CMR metadata population and reconciliation support during this period of performance. The contractor will also assist data centers in adding metadata that currently is not available in CMR-supported formats. The contractor shall perform outreach activities to increase CMR client participation.

For CMR and related releases, a Software System Documentation Package (DID EED2-SSDP-24) shall be delivered.

2.2.1.4 Metadata Tools

The contractor shall manage quality assessment and curation of metadata in CMR. This will include the integration of CMR QA activities and tools intended to semi-automatically assess and improve quality of CMR metadata. The contractor shall continue to manage its continued development and sustainment of the Curation Dashboard (to include expanding roles to adapt to DAAC workflows and updating the open-source version as the dashboard evolves).

The contractor shall investigate MMT improvements and manage initiatives, to include but not be limited to granule bulk-updates, Services refactoring adaptation, Launchpad rollout, and ways to make MMT usage loss-less.

The contractor shall investigate CMR improvements and manage initiatives, to include but not be limited to Launchpad rollout, CMR refactoring for the cloud environment, legacy service updates and consolidation,

2.2.1.5 Metadata Quality

The contractor shall implement, maintain and evolve the current set of metadata concepts developed and integrated into the CMR which include Collections (UMM-C), Granules (UMM-G), Services (UMM-S), Variables (UMM-Var), and Common (UMM-Common) and investigate the possibility of new metadata models such as Visualization (UMM-Vis) to accommodate Worldview or Algorithms (UMM-A) to accommodate the Multi-Mission Algorithm and Analysis Platform (MAAP) initiative.

The contractor shall maintain lists of CMR metadata valids and infrastructure necessary to establish metadata mapping between external partner's metadata formats and the CMR metadata format. UMM documentation shall be periodically updated to reflect evolving metadata field clarifications and explanations and delivered to ESDIS for baseline documentation updates.

Metadata concepts will be developed upon evaluation of stakeholder needs, development of use cases, documenting relationships between the concepts, documenting the fields for each concept including: definitions, constraints, use-cases, uniqueness attributes, linkages to other concepts, maps to existing implementations, and vocabulary requirements. For each concept, interactions with existing CMR subsystems will be identified including for Ingest, Search and Retrieval, Access Control List, and Quality Assurance. Sizing, performance, and availability requirements will be identified for each concept. A maintenance life-cycle will be defined for the concepts.

2.2.1.6 GCMD & IDN

The contractor shall provide sustaining engineering efforts and support the evolution of Global Change Master Directory (GCMD) components as specified in the GCMD Transition Plan; the primary goal of the contractor is to ensure the continuity of services to the International Directory Network (IDN) and ESDIS communities. All attempts will be made to ensure the operational availability of the GCMD/IDN applications used by the community as well the availability of the GCMD staff to continue to provide support to the community; while ensuring continuity, the contractor will also focus on providing ESDIS efficiencies in three key areas:

- Reduction in infrastructure duplication,
- Reduction in tool duplication,
- Streamlined processes to ensure transparency and high return on investments for future development work.

2.2.2 Software

The contractor shall be fully responsible for the software evolutionary development and maintenance engineering in support of this task. This responsibility includes, but is not limited to, custom code and scripts, COTS packages, services and databases, configuration control, overall configuration management, documentation, testing, reviews, and support services.

The contractor is responsible for the 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 will recommend usability metrics and in agreement with ESDIS, collect and maintain a database of these metrics.

The contractor will recommend metrics for open-source contributions and in agreement with ESDIS, collect and maintain a database of these metrics.

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 task's computer equipment**.** Much of the scope of these hardware requirements will be reduced as elements are transitioned to the cloud architecture.

The contractor shall maintain the hardware in accordance with Original Equipment Manufacturer (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 perform preventive maintenance as necessary to ensure 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 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.

2.3 Operations Support

The contractor shall identify processes, tools, and system enhancements that automate and/or improve the efficiency of system operations and simplify system usage for ESDIS partners. Specifically the contractor shall investigate enhancements that:

- Increase the number of clients and keep up with EOSDIS data growth by reducing cost of entry and improving ease of use.
- Reduce operations costs.
- Increase the scope of clients that can be supported.

The contractor shall provide operator training for all new product versions.

The contractor shall support 8 hour/5 day attended operations of operational servers, partner test servers, public-facing sites, and web server except as noted.

The contractor shall maintain documentation required to capture and communicate operations processes, policies, and procedures.

The contractor shall implement operational changes approved by the ESDIS CCB.

The contractor shall create and maintain listserves to facilitate communications on operations and general project information and activities.

The contractor shall manage CMR ingest operations, including scheduling and monitoring ingest, update, and deletion of collection metadata, granule metadata, and browse; working with data providers to track, troubleshoot, and correct ingest problems; and supporting periodic metadata and browse reconciliations.

The contractor shall collect and distribute quantitative information on CMR system holdings, availability, performance, and usage. The contractor shall provide operational support for the CMR interface to the EOSDIS Metrics System (EMS).

The contractor shall provide user support to the users of task components and supporting tools. The contractor shall:

- Provide technical assistance and coordination to support the registration and acclimation of new partners, including development and maintenance of Operations Agreements.
- Assist partners in using current and new versions of task components, supporting tools, and related tools in both the operational and partner test system environments.
- Support end-to-end testing with partners.
- Provide user support for ESDIS partners on weekdays between 8am and 7pm. Provide after-hours support to ESDIS partners as needed, on a pre-arranged schedule.
- Maintain regular contact with ESDIS partners to ensure the contractor team has an understanding of each partner's future needs and its supporting tools plans. Maintain records of user interactions that document the type of support provided.
- Provide critical feedback on system issues and priorities.
- Develop and maintain user documentation.

The contractor shall organize and conduct user training and workshops.

2.4 Security

The contractor shall maintain and upgrade the security features of hardware and cloud deployment 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. The contractor shall continue to include software vulnerability checks as a part of the application pipeline process.

2.5 Property Management

The Contractor shall provide property management services in accordance with contract provisions at the facilities hosting task equipment, located at the GSFC and the contractor's development facility.

2.6 Contract Year 5 – COTS Refresh and Capacity

Technology Refresh
The contractor is to provide Requirements Analysis, Design, Integration, Testing, Training, Implementation, Configuration Management, Documentation, and Reviews for any necessary technology refresh of task components.

The contractor shall execute the work as outlined in section 1.4 (Scope).

Appendix A. EED Acronym List

API	Application Programming Interface
CCB	Configuration Control Board
CEOS	Committee on Earth Observing Satellites
CMR	Consolidated Metadata Repository
CO	Contracting Officer
COR	Contracting Officer's Representative
COTS	Commercial Off The Shelf
CRMS	Continuous Risk Management System
CWIC	CEOS WGISS Integrated Catalog
DAAC	Distributed Active Archive Center
DID	Data Item Description
EBnet	EOSDIS Backbone Network
EC	Engineering Change
EED	EOSDIS Evolution and Development
EMS	ESDIS Metrics System
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
ESDIS	Earth Science Data and Information System
GCMD	Global Change Master Directory
GFE	Government Furnished Equipment
GEO	Group on Earth Observation
GSFC	Goddard Space Flight Center
HW	Hardware
IDN	International Directory Network
KMS	Keyword Management Systems
MAAP	Multi-mission Algorithm and Analysis Platform
MMT	Metadata Management Tool
MR	Modification Request
NASA	National Aeronautics and Space Administration
NPR	NASA Procedual Requirements
OEM	Original Equipment Manufacturer

OTS	Off the Shelf
SERF	Service Entry Resource Format
SMD	Science MissionS Directorate
SOW	Statement of Work
SW	Software
TBD	To Be Determined
TPR	Task Plan Request
UMM	Unified Metadata Model
WGISS	Working Group on Information Systems and Services