STATEMENT OF WORK

For

LANDSAT DATA CONTINUITY MISSION FLIGHT OPERATIONS TEAM SERVICES

In regard to

Launch Readiness, Launch & Early Orbit, and Mission Operations Support

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U.S. Geological Survey
EROS Data Center

ORDER NO. XXXXXXXXXX

LANDSAT Data Continuity Mission

LDCM

Signature Page

Approved by:	Date	Approved by: Mike Headley LDCM Project Manager USGS	Date

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List of TBDs/TBRs

Item No.	Location	Summary
1	1.4 Backup Mission Operations Center (bMOC)	The bMOC location is (TBD).
2	1.7.1.1 Routine 7.16 Collision Avoidance Support	The organizational interface for collision avoidance data is (TBD).
~~3~~	~~5.2 Instrument Vendor Support~~	There will be an instance of the MOE at the main instrument vendor's facility.
4	6.1 Observatory Operations	Launch MOC location and other details are (TBD).
~~5~~	~~13 USGS IT Security Requirements Summary~~	Summary list of security requirements has been provided.
6	2.2 Reference Documentation	Various documents are (TBD).
7	1.2 Scope	Period of performance is (TBD).
8	5 Pre-Launch Requirements	Responsibility for the Launch MOC is (TBD).
9	7.8 Mission Planning	Need correct term for "complex data collection requests" (TBD).

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1 Introduction

The Landsat Data Continuity Mission (LDCM) is the successor mission to Landsat 7. Landsat satellites have continuously acquired multi-spectral images of the global land surface since the launch of Landsat 1 in 1972. The Landsat data archive constitutes the longest record of the land surface as viewed from space. The LDCM mission objective is to extend the ability to detect and quantitatively characterize changes on the global land surface at a scale where natural and man-made causes of change can be detected and differentiated.

1.1 *Purpose*

This Statement of Work (SOW) describes Flight Operations Team (FOT) contractor support to the U.S. Geological Survey for LDCM Observatory acquisition activities, launch readiness, launch and early orbit, and on-orbit mission operations.

1.2 *Scope*

The LDCM Data Continuity Mission (LDCM) consists of the Launch Segment, Space Segment, Data Processing and Archive Segment (DPAS), and the Flight Operations Segment (FOS). This document defines the contractor required Flight Operations Team (FOT) support within the FOS to participate, manage, develop, integrate, and lead in the launch and operation of the LDCM spacecraft. The period of performance for this effort is five (5) years with five (5) one year options (TBD).

1.3 *Primary Mission Operations Center*

The Primary Mission Operations Center will be located at the EROS Data Center in Sioux Falls, SD where the FOT will be resident and operate the LDCM Observatory. The facility will have adequate space and physical security for the requisite GFE equipment, Contractor equipment, office space and storage. The facility will have appropriate network, power and environmental capacity to support the mission operations activity. Figure 1 Mission Operations Center (MOC) illustrates the basic systems and data flows for the Mission Operations Center.

The Collection Activity Planning Element (CAPE) provides image acquisition management and scheduling and produces an imaging plan that will be passed to the mission planning component of the MOE. The CAPE also provides acquisition data and the daily schedule to International Cooperators.

The Missions Operations Element (MOE) provides spacecraft scheduling, command and control, automation and operator interfaces.

The Mission Planning component of the MOE generates the detailed schedule for the Observatory.

The Flight Dynamics component of the MOE provides orbit analysis, acquisition data and other products to mission planning, the CAPE, ground stations, and orbit maintenance/collision avoidance. The primary function of Flight Dynamics is World Reference System (WRS) maintenance and Mean Local Time (MLT) maintenance.

The Trending and Plotting component of the MOE provides the capability for short and long-term trending, analysis and plotting of Observatory housekeeping data.

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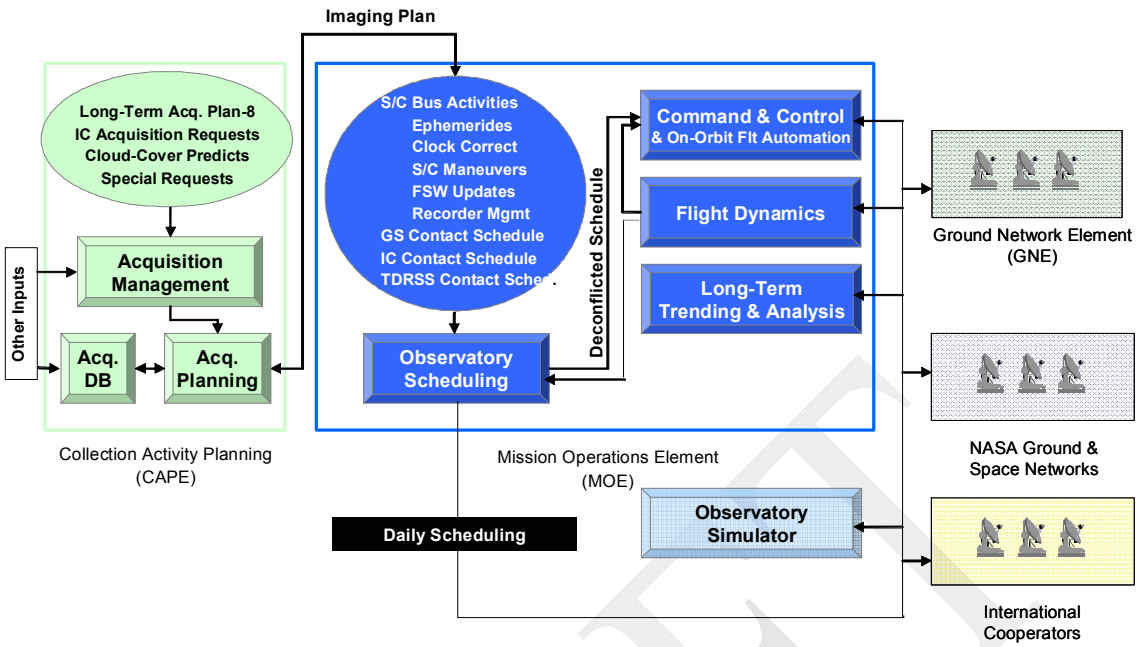

Figure 1 Mission Operations Center (MOC)

The Primary MOC communicates with the USGS Ground Network Element (GNE) for commanding and downloading from the Observatory. In emergency situations when the GNE is not available, the Primary MOC has the capability to communicate with the Observatory through the NASA Ground and Space networks.

The LDCM Observatory Simulator can be used for training, validation, product generation, ground system test and other activities.

The government will provide the systems, interface, networks, communications, building(s), environmental control, security, backup power, for the Primary MOC.

1.4 *Backup Mission Operations Center (bMOC)*

In the event of an emergency, operations simulation, or other mission related activity the FOT will temporarily relocate necessary FOT staff to a GFE backup control center (bMOC). The government will provide the building(s), environmental control, security, backup power, network interfaces, and MOE equipment for an Operational Backup Mission Operations Center (bMOC) to support Flight Operations activities. Functionally, the BMOC is to be a complete instantiation of the Primary MOC capable of sustaining operations for 1 mission planning cycle (approximately 30 days).

The primary purpose of the BMOC is to maintain mission functionality if the Primary MOC is rendered partially or wholly non-functional. However, the FOT may also use the BMOC to fulfill other mission requirements (e.g., training).

The BMOC location is (TBD).

1.5 *Launch Mission Operations Center*

The Missions Operations Center for launch and OIV will be located at (TBD). The launch

MOC will be a duplicate of the Primary MOC and will be used for command and control of the Observatory until the completion of Commissioning. During the early part of the Operational phase, the Launch MOC will serve as the backup to the Primary MOC. When the BMOC is commissioned it will assume the backup responsibilities and the Launch MOC will be decommissioned.

1.6 *Mission Phases*

This document describes the FOT requirements throughout the various phases of the LDCM program. The LDCM phases are described in detail in ref (b). A high level description is provided here.

1.6.1 Pre-launch

The Pre-Launch phase encompasses flight and ground systems development, integration and test of the Observatory and the ground-based systems up until launch. During this phase, NASA has overall government responsibility for the LDCM system system including operations preparation, product development, and readiness testing. FOT responsibilities during this phase will focus on understanding spacecraft, flight software and instrument operation, supporting integration and test activities (including interface testing, ground readiness tests, mission readiness tests and mission simulations), operations product development, and building the expertise, knowledge, products and procedures needed for successful mission operation. The FOT will also participate in mission planning and scheduling for launch and early orbit. Training of the FOT will be initiated for observatory and MOE operations, and day-in-the life exercises will be conducted using nominal and contingency operations procedures.

1.6.2 Launch and Early Orbit

The Launch and Early Orbit (L&EO) phase begins with the initiation of launch activities through the completion of the early orbit checkout of the LDCM observatory. During this phase, NASA has overall responsibility for the LDCM system, including operations. FOT support during this phase will focus around final preparations for launch, launch site support, launch, orbit insertion, spacecraft activation and mechanisms deployment, and spacecraft and instrument checkout. The FOT will assume normal operations in the Launch MOC in support of all elements of this phase and in preparation for the spacecraft system and instruments commissioning phase.

1.6.3 Commissioning

The Commissioning phase begins following the L&EO and is focused on completing the total LDCM system deployment and assessing system performance. During this phase, NASA has overall government responsibility for the LDCM system, including operations. Upon the successful completion of the commissioning phase, NASA will formally accept the LDCM observatory and the overall government responsibility for the LDCM system will transfer from NASA to USGS. Support during this phase will be centered on demonstrating that the spacecraft and instrument meet defined performance requirements. Using the Launch MOC, the FOT will perform command and control and state of health operations, mission planning and scheduling, prepare for transition to operations phase and support commissioning activities.

1.6.4 Operations

The Operations phase represents the period following Observatory commissioning and handover of operational responsibility from NASA to USGS. The handover will include a switch-over from the Launch MOC to the Primary MOC. This switch-over will be

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accomplished by the FOT. This period encompasses the mission operations lifecycle until spacecraft decommissioning. The FOT will have responsibility in this phase for all operations of the LDCM system, including command and control, state of health, anomaly resolution, mission planning, etc.

1.6.5 Decommissioning

At the end of the mission, the LDCM will undergo decommissioning to take it safely out of service. Preparations for this phase will be performed during the operations phase in a manner that will maximize the life of the LDCM. In this phase, the FOT will be responsible for executing the decommissioning plan and taking the LDCM Observatory safely out of service.

1.7 *External Organizational Interfaces*

There are several external organizations that the FOT will interface with to fulfill mission requirements. The FOT's responsibilities for these interfaces will generally include participation in working groups with occasional travel. More specific responsibilities are outlined below.

1.7.1.1 Routine

Routine operations of the LDCM Observatory will require the FOT to interface with several external organizations. The FOT will interface with NASA's Ground and Space Networks as needed to support T&C activities. The FOT will interface with (TBD) for collision avoidance and orbit maintenance tasks. The FOT will interface with the spacecraft vendor for flight software maintenance. Finally, the FOT will also interface with both the spacecraft vendor and the instrument vendor as necessary during anomaly identification and resolution.

1.7.1.2 Cooperative Mission Activities

The FOT will interface as directed by the government with other civilian and military space programs in support of cooperative multi-system activities.

1.7.1.3 International

The FOT will interface with International Cooperators and provide support and participate in the Landsat Technical Working Group (TWG) meetings and the Landsat Ground Station Operators Working Group (GSOWG) meetings. As directed by the government, the FOT will provide guidance and technical assistance to International Cooperators in establishing and operating ground stations and resolving anomalies. The FOT will not be required to provide technical insight into IC ground reception anomalies but only to provide spacecraft operational insight into potential reception discrepancies.

International travel may be required in support of these tasks.

1.7.1.4 Mission Management Office (MMO)

The Mission Management Office (MMO) is the governing body for the USGS Flight Operations Segment (FOS). The MMO oversees and directs all of the functional elements within the FOS such as CAPE, Primary MOC, and the GNE. The MMO board consists of the government management body of the FOS. The contractor will support the MMO as directed by the government.

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1.7.1.5 Pre-Launch Support Interactions

Prior to Observatory commissioning, the Contractor will work with NASA, the spacecraft contractor, the instrument contractor, the MOE contractor and other contractors as necessary to support the development of the LDCM system and transition it to full operational capability.

1.7.1.6 Bus and Instrument Vendors

During the operations phase, the USGS will maintain a task-based support contract with the spacecraft vendor and the instrument vendor. During special events, and as needed to supplement FOT expertise, the Contractor will team with these vendors to fulfill the LDCM mission requirements. The spacecraft vendor will also provide flight software maintenance.

2 References/Definitions

2.1 Applicable Documentation

The following documents are referenced within this SOW as additional requirements.

a. ANSI/EIA-748-A: EIA Standard for Earned Value Management Systems, 28 Aug 2002.
b. Office of Management and Budget (OMB) Circular A-11, Part 7 (Government-wide guidance on EVM) http://www.whitehouse.gov/omb/circulars.
c. NASA Procedural Requirement NPR 2810.1A, Security of Information Technology, May 6, 2006.
d. Federal Information Processing Standards (FIPS) and Special Publication (SP) 800 series documents, National Institute of Standards and Technology (NIST) (http://csrc.nist.gov/publications/fips/index.html)
e. Shana Dale memo, Meeting NASA Information Technology Security Requirements, dated July 26, 2006.
f. Scott Santiago memo, Agency Selection and Tailoring of IT Security Controls, dated Oct 12, 2006.

2.2 Reference Documentation

The following documents provide context and background information on the LDCM system

a. Landsat Data Continuity Mission (LDCM) Operations Concept Document, 427-02-02 (or latest version)
b. LDCM Mission Operations Element Requirements Document, 427-09-03.
c. LDCM MOE Contract Data Requirements List: Document Number 427-09-02.
d. LDCM Mission Operations Element Statement of Work, 427-XX-XX. (TBD)
e. Mission Operations Center (MOC) Operational Concept, (latest date)
f. OLI Statement of Work, (latest date).
g. Other Instrument Statements of Work, as appropriate (latest date)
h. LDCM Integration & Test Plan (?)
i. Ground System Integration and Test Plan (?)
j. LDCM Acronym List and Lexicon: Document Number 427-02-06.
k. Collection Activity Planning Element (CAPE) Operations Concept Document (OCD).
l. 450-SNUG, NASA Space Network (SN) Users' Guide, Revision 8, June 2002.
m. 453-GNUG, NASA Ground Network (GN) User's Guide, Revision 1, February 2005.
n. 452-ICD-SN/CSM Interface Control Document Between the Space Network and Customers for Service Management May 2004.

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2.3 *Definitions*

The following definitions apply to this document:
Shall – Compliance by the Contractor is mandatory. Any deviation from these contractually imposed mandatory requirements requires the approval of the contracting officer.
May – At the discretion of the Contractor or Government
Will – Designates the intent of the Government. Unless required by other contract provisions, noncompliance with the *will* requirements does not require approval of the contracting officer and does not require documented technical substantiation.
Support – The use of "support" indicates an activity where the FOT will work cooperatively with the government, other contractor, or outside agency but will not have leadership or responsibility.

3 Management Support

This section describes the Contractor's management duties throughout all mission phases.

3.1 *Project Management*

[FOT001] The Contractor shall create and maintain a Project Management Plan (CDRL MP001) that documents the manner in which the Contractor will manage the mission operations and the work described throughout this SOW.

[FOT002] Under guidance of the government, the Contractor shall direct the overall performance of the LDCM Flight Operations Team (FOT).

[FOT003] The Contractor shall define and implement a contract Work Breakdown Structure (WBS) (CDRL MP002) categorizing the tasks to be performed.

[FOT004] The Contractor shall provide a full time manager for this project at the Mission Operations Center.

3.2 *Financial Management*

[FOT005] The Contractor shall create and maintain a Project Budget Plan (CDRL MP013) that documents the contract budget.

[FOT006] The Contractor shall manage staffing and other expenditures to conform to the Project Budget Plan (CDRL MP013).

[FOT007] The Contractor shall provide a financial budgeting and accounting system for allocating all financial resources and monitoring their expenditures, including the financial management of subcontracts.

[FOT008] The contractor shall provide a monthly Financial Report (CDRL MR005).

3.3 *Management Reporting*

[FOT009] The Contractor shall provide a Monthly Activity Report and Review (CDRL MR001).

[FOT010] Key FOT personnel shall be available to meet with the government once per week during the Operations phase and more frequently during the pre-Operations phases to update the

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government on the status of the mission operations of the past week and any upcoming events.

[FOT011] The Contractor shall support other status and management meetings as directed by the government.

[FOT012] The Contractor shall provide Special Event Activity Reports (CDRL MR002) within 30 days of a special event. Special events are unusual or unique operational situations such as extended eclipse events, leap second events, etc.

[FOT013] The Contractor shall provide Ad Hoc Reports (CDRL MR003) as directed by the government.

[FOT014] The Contractor shall measure program metrics and report these in Metrics Reports (MR004). The metrics will be defined by the government.

3.4 *Integrated Baseline Review*

The Integrated Baseline Review (IBR) Package (CDRL O009) is a joint FOT Contractor and Government assessment of the Project Management Plan (CDRL MP001) and the Project Budget Plan (CDRL MP013). The objective of the IBR is for the Contractor and Government to jointly assess technical areas, such as the Contractor's planning, to ensure: a) complete coverage of the statement of work; b) logical scheduling of work activities; c) adequate resources; and d) appropriate methodologies for calculating earned value on a continuous basis.

[FOT015] The Contractor shall conduct an Integrated Baseline Review (IBR) 90 calendar days after contract award.

3.5 *Staff Allocation and Expertise*

[FOT016] The Contractor shall ensure availability and competence of the contract work force to execute the management and technical activities specified in this document.

[FOT017] The Contractor shall manage staff allocation to the required tasks. This shall be documented through a Staffing Plan (CDRL MP003).

3.6 *Training and Certification of Personnel*

[FOT018] The Contractor shall develop, maintain and execute a formal Training and Certification Plan (CDRL MP004).

[FOT019] The Training and Certification Plan (CDRL MP004) shall ensure that the Flight Operations Team has the expertise and knowledge to conduct the LDCM mission and meet operational requirements.

[FOT020] The Contractor shall develop and maintain the FOT Training Materials (CDRL O008) required by the Training and Certification Plan (CDRL MP004).

[FOT021] The training program shall include formal classroom training, simulated operations training and supervised hands-on operations.

[FOT022] The Contractor shall ensure that all FOT personnel have the required training and

certifications prior to assuming operational responsibilities.

[FOT023] The Contractor shall make all training resources available to government personnel on a non-interference basis.

[FOT024] The Contractor shall provide five working days per year of training specifically for government personnel.

[FOT025] The Contractor shall report metrics on training and certification on a monthly basis in the Metrics Report (CDRL MR004).

3.7 *Security Requirements*

[FOT026] As part of the Project Management Plan (CDRL MP001), the Contractor shall provide an IT Security Requirements and Compliance Plan as well as all documents and other evidence required to show compliance.

[FOT027] The Contractor shall be compliant with the DOI and USGS IT security requirements. 13 USGS IT Security Requirements Summary identifies the key requirements.

[FOT028] The Contractor shall follow all DOI regulations for certification and accreditation (C&A) of all systems.

[FOT029] All Contractor employees shall complete USGS IT security training before being allowed access to USGS IT systems.

[FOT030] In the event of a security incident, the contractor shall report the incident to the government or government designated point of contact and follow all appropriate response procedures.

[FOT031] The Contractor shall be compliant with NASA security requirements as defined in NASA Procedural Requirement NPR 2810.1A. NPR 2810.1A requires that National Institute of Standards and Technology (NIST) publications including the Federal Information Processing Standards (FIPS) and Special Publication (SP) 800 series documents be implemented to meet the Federal Information Security Management Act (FISMA) requirement. The Contractor shall be compliant with the security requirements outlined in the NIST publications and all other publications reference in NPR 2810.1A.

[FOT208] The Contractor shall be compliant with all interim NASA security requirements as defined in NASA memos, including: Shana Dale memo, Meeting NASA Information Technology Security Requirements, dated July 26, 2006, and Scott Santiago memo, Agency Selection and Tailoring of IT Security Controls, dated Oct 12, 2006.

[FOT209] The Contractor shall support a Certification and Authentication Review of the LDCM ground system pre-launch, and every three years or as required thereafter.

[FOT032] The Contractor shall obtain all required access authorizations and submit any paperwork required for the Contractor to access Government controlled facilities (such as Goddard Space Flight Center) or other contractor's facilities (such as the spacecraft vendor's I&T facility).

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3.8 *Phase-Out Transition*

[FOT033] The Contractor shall support a smooth and orderly transition to a successor organization, with no reduction or break in contractor provided services, upon expiration of this contract or in the event that the government terminates this contract for any reason in accordance with FAR Clause 52.237-3 Continuity of Services.

[FOT034] The Contractor shall produce a Phase-out Transition and Training Plan (CDRL MP005).

[FOT035] The Contractor shall produce the Phase-Out Training Materials (CDRL O007).

[FOT036] The Contractor shall provide phase-out training at the Primary MOC or at a location in its vicinity as designated by the Government.

[FOT037] The Contractor shall permit the Government to videotape or otherwise record the phase-out training.

[FOT038] The Government shall have full intellectual property rights to any phase-out training materials and recordings.

3.9 *Quality Assurance and Improvement*

[FOT039] As part of the Project Management Plan (CDRL MP001), the Contractor shall create and implement a quality assurance plan that ensures continued compliance with operational requirements.

[FOT040] As part of the Project Management Plan (CDRL MP001), the Contractor shall create and implement a plan for continuous improvement of the FOT's performance and cost.

3.10 *Configuration Management*

[FOT041] The Contractor shall be responsible for developing and instituting a Configuration Management (CM) program for LDCM flight operations.

[FOT042] The Contactor shall submit a Configuration Management Plan (CDRL MP006) to the government which describes this activity.

[FOT043] The Contractor shall accept Configuration Change Requests (CCR) as directed by the government.

[FOT044] The Contractor shall maintain configuration management for all MOC and bMOC hardware and software, including all CDRLS, Flight Software, data bases, ad-hoc operations tools and other ancillary information.

[FOT045] The Contractor shall use government-furnished CM tools. (See 10.8 CM Tools .)

[FOT046] The Contractor shall conduct CM meetings weekly or as designated by the government.

[FOT047] The Contractor shall direct the CM meetings and the government shall board the meetings and status all CM actions.

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[FOT048] The Contractor shall attend the USGS Project level CM meetings and represent the program and mission responsibilities accordingly.

3.11 *Flight Operations*

The LDCM Flight Operations Plan (CDRL MP007) explains how the Flight Operations Team (FOT) does their job. It details the specifics of spacecraft and ground responsibilities by providing an outline of mission operations including plans, timelines, configurations, and interfaces necessary to coordinate flight and ground resources.

[FOT049] The Contractor shall provide a Flight Operations Plan (CDRL MP007).

3.12 *Earned Value Management*

[FOT050] The Contractor shall apply the principles and processes of Earned Value Management to provide effective and objective technical, schedule, and cost performance measurement.

[FOT051] The Contractor shall meet all EVM requirements as defined in Sections C and L of the RFP.

[FOT052] The Contractor shall document the planned approach to EVM in the Project Management Plan (CDRL MP001).

[FOT056] The Contractor shall provide monthly Contract Performance Reports (CPR) (CDRL MR006).

4 Administrative Duties

This section describes the administrative duties throughout all mission phases.

4.1 *Personnel*

[FOT057] The contractor shall provide human resources to maintain a trained staff sufficient to perform all the functions described in this SOW at the required levels.

4.2 *Library*

[FOT058] The contractor shall provide for the operation and maintenance of a FOT library which shall contain all reference documentation, including written materials and CDRLs produced in conduct of this contract. USGS will provide appropriate space at the Primary MOC to house the library.

4.3 *Inventory Database*

[FOT059] The Contractor shall provide and maintain an Inventory Database (CDRL O001) that contains an accurate record of the Primary MOC and bMOC equipment (both hardware and software).

[FOT060] The Contactor shall affix government provided tags on all Primary MOC and bMOC equipment as directed by the government.

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4.4 *Documentation*

[FOT061] All documentation and CDRLs required by this SOW shall be delivered both electronically and in three (3) hard copies to the government, unless directed otherwise by the government.

4.5 *Secretarial, Clerical, and Administrative Support*

[FOT062] The Contractor shall provide any secretarial, clerical, and administrative resources required for the execution of the contract.

4.6 *Routine Purchases*

[FOT063] Routine purchases of equipment and supplies necessary to execute this SOW and not provided as government furnished equipment (GFE) shall be done through the USGS EROS purchasing process.

[FOT221] Micro-purchases and Other Direct Charges (ODC) of up to $500 in support of this contract are permitted with approval by the government.

4.7 *Emergency Purchases*

[FOT064] On an emergency basis and as approved by the government, the Contractor may purchase equipment and supplies directly.

5 Pre-Launch Requirements

This section describes the Contractor requirements in the pre-launch phase as described in the LDCM Operations Concept Document (Section 2.2 a). In this phase, NASA will have primary responsibility for the development, integration, and test of the Launch MOC (TBD), the LDCM spacecraft and observatory instruments. USGS will have primary responsibility for development, integration and test of the LDCM Primary MOC, bMOC and ground systems.

During the pre-launch phase the government will provide a formal training program for the Flight Operations Team contractor. This program will feature an appropriate mix of classroom, hands-on, and on-the-job training sessions which will be individually planned for each staff position.

5.1 *Spacecraft Vendor Support*

This section describes FOT technical requirements during the development and acquisition of the LDCM spacecraft. It is envisioned that engineering personnel from the FOT will work closely with the spacecraft vendor throughout the spacecraft development and acquisition to ensure overall system compatibility and to gain detailed knowledge of the spacecraft for use within the FOT. This may require daily interactions with the spacecraft vendor over extended periods of time throughout the spacecraft development and acquisition.

[FOT065] The FOT Contractor shall provide appropriate engineering support for all spacecraft project milestones (e.g., PDR, CDR).

[FOT066] The Contractor shall support spacecraft I&T including participation in I&T working groups, support of I&T procedures, interface testing, mission readiness test (MRT), operational readiness review (ORR), and mission rehearsals.

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[FOT225] The Contractor shall be resident at the spacecraft vendor as appropriate to meet the requirements of this SOW.

[FOT226] The Contractor shall limit FOT participation in spacecraft vendor activities to those that support the requirements in this SOW.

[FOT227] The Contractor shall coordinate all spacecraft vendor visits with the government.

[FOT067] The Contractor shall configure and maintain an instance of the MOE in the spacecraft vendor's I&T facility.

[FOT068] The Contractor shall use the spacecraft vendor's facility MOE for prototyping and risk reduction of the MOE-spacecraft interface and the spacecraft portion (e.g., command and telemetry definitions, telemetry limit definitions, etc.) of the Combined Project Database (Section 5.9).

[FOT069] The Contractor shall support the spacecraft vendor's efforts to integrate the MOE and the spacecraft.

[FOT070] The Contractor shall work with the spacecraft vendor to capture the spacecraft expertise and knowledge necessary to develop spacecraft operations products (e.g., command procedures, command & telemetry definitions, telemetry displays, etc.), FOT training and certification materials, and to ensure overall mission success.

[FOT071] The Contractor shall work with the spacecraft vendor to support the development and test of the LDCM Observatory Simulator.

5.2 *Instrument Vendor Support*

This section describes FOT technical requirements during the development and acquisition of the mission instruments. It is envisioned that engineering personnel from the FOT will work closely with the instrument vendor(s) throughout the spacecraft acquisition to ensure overall system compatibility and to gain detailed knowledge of the instruments for use within the FOT. This may require daily interactions with the instrument vendor(s) over extended periods of time throughout the instrument(s) development and acquisition.

[FOT072] The Contractor shall provide appropriate engineering support for all instrument acquisition project milestones (e.g., CDR, PDR).

[FOT073] The Contractor shall participate in developing instrument I&T procedures.

[FOT074] The Contractor shall support instrument I&T activities.

[FOT228] The Contractor shall be resident at the instrument vendor(s) as appropriate to meet the requirements of this SOW.

[FOT229] The Contractor shall limit FOT participation in instrument vendor activities to those that support the requirements in this SOW.

[FOT230] The Contractor shall coordinate all instrument vendor visits with the government.

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[FOT075] The Contractor shall configure and maintain an instance of the MOE in the main instrument vendor's I&T facility.

[FOT076] The Contractor shall use the main instrument vendor's facility MOE for prototyping and risk reduction of the instrument portion of the Combined Project Database (Section 5.9).

[FOT077] The Contractor shall work with the instrument vendor(s) to capture the instrument expertise and knowledge necessary to ensure overall mission success.

5.3 *MOE Vendor Support*

This section describes FOT technical requirements during the development and acquisition of the MOE. It is envisioned that engineering personnel from the FOT will actively participate in the MOE development, test and acquisition process.

[FOT078] The Contractor shall work with the MOE developer and the government to ensure that the MOE will satisfy all mission requirements, to ensure that the MOE will successfully integrate with the MOCs and LDCM ground systems, and to obtain the knowledge and expertise of MOE needed to fulfill all mission requirements.

[FOT079] The Contractor shall support major MOE development milestones (e.g., PDR, CDR).

[FOT080] The Contractor shall provide technical support to the MOE vendor during the development and integration of the MOE.

[FOT081] The Contractor shall provide feedback to the MOE vendor and support all MOE deliveries.

5.4 *CAPE Support*

During the pre-Launch phase, the CAPE developer will provide the Contractor with training and documentation on the operation of the CAPE.

[FOT082] The Contractor shall work with the CAPE developer and the government to ensure that the CAPE will satisfy all mission requirements, to ensure that the CAPE will successfully integrate with the MOCs, and to obtain the knowledge and expertise of CAPE needed to fulfill all mission requirements.

[FOT083] The Contractor will support integration and test of the CAPE.

[FOT084] The Contractor shall support major CAPE development milestones (e.g., PDR, CDR).

[FOT085] The Contractor shall provide technical support to the CAPE developer during the integration of the CAPE into the MOCs.

[FOT086] The Contractor shall provide feedback to the CAPE developer and support all CAPE deliveries.

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5.5 *GNE Support*

[FOT087] The Contractor shall work with the GNE developers and the government to ensure that the GNE will satisfy all mission requirements, to ensure that the GNE will successfully integrate with the MOCs, and to obtain the knowledge and expertise of GNE needed to fulfill all mission requirements.

[FOT088] The Contractor will provide technical support to the GNE developers during integration and test of the GNE.

[FOT089] The Contractor shall support major GNE development milestones (e.g., PDR, CDR).

5.6 *Working Groups*

Throughout the pre-launch phase, the government will convene various ad-hoc and standing working groups to ensure end-to-end system compatibility and mission success. These may be USGS-only or joint USGS-NASA working groups. These working groups may occur at EROS or at Goddard Space Flight Center.

[FOT090] The Contractor shall support LDCM working group meetings as directed by the government.

5.7 *Launch MOC, Primary MOC and bMOC Integration and Test*

The FOT will have primary responsibility for installation, integration and test of the Launch MOC, the Primary MOC and bMOC.

[FOT091] The Contractor shall be responsible for the installation, integration and testing of hardware and software at the Launch MOC, Primary MOC and bMOC.

[FOT092] When new or updated hardware or software is installed at the Launch MOC, Primary MOC or bMOC, the Contractor shall be responsible for regression testing.

[FOT093] The Contractor shall be responsible for installation, integration and testing of the MOE at the Launch MOC, Primary MOC and bMOC.

[FOT094] The Contractor shall be responsible for installation, integration and testing of the LDCM Observatory Simulator at the Launch MOC, Primary MOC and bMOC.

[FOT095] The Contractor shall be responsible for installation, integration and testing of the CAPE at the Launch MOC, Primary MOC and bMOC.

[FOT096] The Contractor shall be responsible for the installation, integration and testing of the USGS Ground Network Element (GNE) at the Launch MOC, Primary MOC and bMOC.

[FOT097] The Contractor shall be responsible for the installation, integration and testing of the NASA Ground Network at the Launch MOC, Primary MOC and bMOC.

[FOT098] The Contractor shall be responsible for the installation, integration and testing of the NASA Space Network at the Launch MOC, Primary MOC and bMOC.

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[FOT099] The Contractor shall be responsible for the integration and testing of the Launch MOC and Primary MOC with the spacecraft vendor's facility as needed to support pre-launch and launch activities.

[FOT100] The Contractor shall be responsible for the integration and testing of the Launch MOC with the launch vendor's facility as needed to support pre-launch and launch activities.

[FOT101] The Contractor shall define and conduct network interface and compatibility tests for all the Launch MOC, Primary MOC and bMOC network interfaces.

[FOT221] The Contractor shall prepare a bMOC Operational Readiness Plan (CDRL MP015).

5.8 *Mission Integration and Test*

The FOT will have the primary responsibility for mission integration and test in the Pre-Launch phase. Major integration and test activities during this period include Ground Readiness Tests (GRTs), Mission Readiness Tests (MRTs), Mission Simulations, Launch Rehearsals, the Mission Operations Review (MOR) and Final Operations Review (FOR). The role of the FOT is described in more detail in the LDCM Integration and Test Plan.

[FOT102] The Contractor shall support the Government in the preparation of the Ground Readiness Test Plan.

[FOT103] The Contractor shall conduct the Ground Readiness Tests in cooperation with the Government, the spacecraft vendor, and other vendors in accordance with the Ground Readiness Test Plan.

[FOT104] The Contractor shall support the Government in the preparation of the Mission Readiness Test Plan.

[FOT105] The Contractor shall conduct the Mission Readiness Tests in cooperation with the Government, the spacecraft vendor, and other vendors in accordance with the Mission Readiness Test Plan.

[FOT106] The Contractor shall prepare a Mission Simulation Plan (CDRL MP014).

[FOT107] The Contractor shall conduct a minimum of five (5) Mission Simulations in cooperation with the Government, the spacecraft vendor, and other vendors in accordance with the Mission Simulation Plan.

[FOT108] The Contractor shall support the Government in the preparation of the Launch Rehearsal Plan.

[FOT109] The Contractor shall conduct a minimum of three (3) Launch Rehearsals in cooperation with the Government, the spacecraft vendor, and other vendors in accordance with the Launch Rehearsal Plan.

[FOT110] The Contractor shall prepare a Mission Operations Review (MOR) Package (CDRL O004).

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[FOT111] The Contractor shall conduct a Mission Operations Review (MOR). The purpose of the MOR is to review the status of the system components, including the ground systems and its operational interfaces with the flight systems including summary results of the network compatibility tests. The MOR also presents the initial operations concept and explains how the ground systems and FOT activities will support the concept.

[FOT112] The Contractor shall prepare a Final Operations Review (FOR) Package (CDRL O005).

[FOT113] The Contractor shall conduct a Final Operations Review (FOR). The purpose of the FOR is to certify that the LDCM system is qualified for operations. The FOR shall include a review of any outstanding deficiencies or discrepancies and plans for corrective actions.

5.9 *Combined Project Database Development*

The combined project database contains all the configurable or user-specifiable information for the Launch MOC, Primary MOC and bMOC systems. This includes command & telemetry definitions, derived telemetry definitions, telemetry limit definitions, commanding scripts, ground support equipment (GSE) telemetry definitions and command directives, flight dynamics configuration, user interface configurations (e.g., telemetry page displays) and trending and report information. The government will provide an initial delivery of preliminary command and telemetry definitions from the spacecraft and instrument vendors. During the pre-launch phase, the FOT will be responsible for developing and maintaining the operational version of the combined project database.

[FOT114] The Contractor shall develop and validate a combined project database that shall include all configurable or user-specifiable information required to operate the Launch MOC, Primary MOC and bMOC systems.

[FOT115] The Contractor shall maintain and configuration manage the combined project database.

[FOT116] The Contractor shall electronically document Combined Project Database Deliveries (CDRL O002).

5.10 *Command Procedures Development*

Command procedures are sequences of spacecraft commands implemented on the MOE to accomplish particular tasks, such as uploading new star targets.

[FOT117] The Contractor shall develop all spacecraft command procedures required for operation of the LDCM Observatory in all mission phases.

[FOT118] Before launch, the Contractor shall obtain signed approval from the spacecraft vendor on all spacecraft command procedures.

5.11 *Operating Procedures Development*

Operating procedures define standard FOT operations (e.g., pre-pass setup) or contingency operations (e.g., incorrect command load). Each procedure provides a clear specification of the timing, sequence, and execution of defined steps used by the FOT to accomplish a particular goal, e.g., the process for obtaining, verifying and uploading a new ephemeris. While command

procedures refer only to spacecraft commands, operating procedures cover all the steps and processes to accomplish a task, such as off-line calculations, coordinating with other organizations, seeking government approval, etc. The operating procedures will be developed by the FOT based upon their experience, knowledge, and the information obtained from the spacecraft vendor, instrument vendor(s), MOE vendors, and other pre-launch activities.

[FOT119] The Contractor shall prepare an Operating Procedures Style Guide (CDRL O006) and develop all operating procedures in accordance with the guide.

[FOT120] The Contractor shall develop, test, rehearse and maintain Standard Operating Procedures (CDRL MProc001).

[FOT121] The Contractor shall develop, test, rehearse and maintain Contingency Operating Procedures (CDRL MProc002)

[FOT122] The Contractor shall develop, test, rehearse, and maintain Ground Readiness Test Procedures (CDRL MProc003).

[FOT123] The Contractor shall develop, test, rehearse, and maintain Mission Readiness Test Procedures (CDRL MProc004).

[FOT124] The Contractor shall develop, test, rehearse, and maintain Mission Simulation Procedures (CDRL MProc005).

6 Launch, Early Orbit, and Commissioning Requirements

This section describes the Contractor requirements throughout the Launch, Early Orbit and Commissioning phases as described in the LDCM Operations Concept Document (Section 2.2 a). During these phases, NASA will have primary responsibility for the Launch, orbital insertion, deployments, testing, anomaly resolution and checkout. During these phases, the Observatory will be operated by the FOT from the Launch MOC. The Primary MOC at EROS will serve as the backup MOC during these phases (TBD).

6.1 *Observatory Operations*

[FOT125] The Contractor shall provide observatory operations 24 hours per day, 7 days a week in the Launch MOC (TBD) during the Launch, Early Orbit and Commissioning phases.

[FOT126] The Contractor shall prepare a Launch and Early Orbit Handbook (CDRL O003).

6.2 *Spacecraft Engineering*

[FOT127] The Contractor shall provide at least one spacecraft or subsystem engineer 24 hours per day, 7 days a week in the Launch MOC during the Launch and Early Orbit phases.

[FOT128] The Contractor shall provide on-call availability 24 hours per day, 7 days a week for all spacecraft and subsystem engineering disciplines (systems engineering, attitude control systems, power systems, thermal systems, command & data handling systems, on-board computing) during the Launch, Early Orbit and Commissioning phases.

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6.3 *Ground System Engineering*

[FOT129] The Contractor shall provide ground system engineering support 8 hours per day, 5 days a week in the Launch MOC during the Launch and Early Orbit phases.

[FOT130] The Contractor shall provide on-call availability 24 hours per day, 7 days a week for ground system engineering during the Launch, Early Orbit and Commissioning phases.

6.4 *Mission Planning*

[FOT131] The Contractor shall provide mission planning support for all launch, early orbit and commissioning activities.

6.5 *Flight Dynamics*

[FOT132] The Contractor shall provide flight dynamics support for all launch, early orbit and commissioning activities.

6.6 *Launch Site Support*

[FOT133] The Contractor shall provide temporary launch site support as needed to support pre-launch and launch activities.

6.7 *Commissioning Activities*

[FOT134] The Contractor shall support government personnel in creating a LDCM Commissioning Plan.

[FOT135] The Contractor shall support the activities in the LDCM Commissioning Plan.

[FOT136] Prior to commissioning, the FOT shall perform an independent evaluation of the LDCM ground and space systems and report to the government any deficiencies or issues which might impact commissioning.

[FOT210] At the conclusion of Commissioning, the Contractor shall be responsible for planning and executing a switch of operational responsibility from the Launch MOC to the Primary MOC.

6.8 *Anomaly Resolution*

[FOT137] During the launch, early orbit and commissioning phases, the Contractor shall support NASA in detecting and resolving observatory and ground anomalies.

7 Operations

This section describes the Contractor requirements throughout the operations phase as described in the LDCM Operations Concept Document (Section 2.2 a). During this phase, the Observatory will be operated by the FOT from the Primary MOC.

7.1 *Launch MOC Decommissioning and bMOC Commissioning*

During Launch, Early Orbit and Commissioning phases, the Launch MOC (located at TBD) will have operational responsibility for the LDCM Observatory, and the Primary MOC (located at EROS) will provide backup capability. At the beginning of the Operations phase, the Launch

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MOC and the Primary MOC will swap responsibilities, so that the Primary MOC will have the operational responsibility and the Launch MOC will provide backup capability. After that swap is complete, the FOT will commission the BMOC. When the BMOC is fully commissioned, it will assume the backup responsibility for the Primary MOC and the Launch MOC will be decommissioned.

[FOT222] Within six months of the beginning of operations, the Contractor shall integrate, test and validate operational readiness of the bMOC in accordance with the bMOC Operational Readiness Plan (CDRL MP015).

[FOT223] Upon approval of the government, the Contractor shall switch the backup MOC responsibilities from the Launch MOC to the BMOC.

[FOT224] As directed by the government, the Contractor shall support the decommissioning of the Launch MOC.

7.2 *Observatory Operations*

Observatory operations for LDCM will be conducted at the Primary MOC. Initially, the Primary MOC will be staffed with observatory operators 24 hours per day, 7 days a week. Within nine months of commissioning, LDCM observatory operations is expected to mature to a lights-out (automated) conops where the Primary MOC will be staffed with observatory operators 8 hour per day, five day per week and operate autonomously on evenings and weekends (up to 72 hours).

[FOT138] The Contractor shall initially operate the Observatory 24 hours per day, 7 days a week.

[FOT207] After each real-time contact, the Contractor shall create a Post-Pass Analysis and Summary Report (CDRL MR009).

[FOT139] Within nine months of commissioning, the Contractor shall develop the necessary tools, procedures and conops to reduce observatory operations to an 8 hour per day, five day per week staffing profile.

[FOT140] The Contractor shall develop an Automation Implementation Plan (CDRL MP010) to ensure that all mission requirements will be met during 8x5 operations.

[FOT141] Upon successful completion of the Automation Implementation Plan and direction from the government, the Contractor shall reduce the operations staff at the Primary MOC to 8 hours per day, 5 days a week.

7.3 *Spacecraft Engineering*

The government will provide task-based support from the spacecraft vendor as necessary to augment the FOT's expertise during special events.

[FOT142] The Contractor shall provide quarterly Engineering Reports (CDRL MR008).

[FOT143] The Contractor shall provide engineering expertise for all spacecraft subsystems 8 hours per day, 5 days per week during the Operations phase.

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[FOT144] The Contractor shall provide on-call emergency expertise 24 hours per day, 7 days a week for all spacecraft and subsystem engineering disciplines (systems engineering, attitude control systems, power systems, thermal systems, command & data handling systems, on-board computing) during Operations phase.

[FOT145] The Contractor shall monitor the health and performance of all spacecraft subsystems and report results.

[FOT146] The Contractor shall work with the spacecraft vendor as necessary for special events.

7.4 *Instrument Engineering*

The government will provide task-based support from the instrument vendor as necessary to augment the FOT's expertise for special events.

[FOT147] The Contractor shall provide instrument engineering expertise 8 hours per day, 5 days per week during the Operations phase.

[FOT148] The Contractor shall provide on-call emergency expertise 24 hours per day, 7 days a week for instrument engineering during Operations phase.

[FOT149] The Contractor shall perform routine instrument engineering tasks, such as monitoring the health and performance of the LDCM instruments and performing on-orbit calibration and validation and report results.

[FOT150] The Contractor shall work with the instrument vendor as necessary for special events.

7.5 *Ground System Engineering*

[FOT151] The Contractor shall provide engineering expertise for all LDCM ground systems 8 hours per day, 5 days per week in the Primary MOC during the Operations phase.

[FOT152] The Contractor shall provide on-call emergency expertise 24 hours per day, 7 days a week for all LDCM ground systems during Operations phase.

[FOT153] The Contractor shall monitor the health and performance of all LDCM ground systems and report results.

7.6 *NSN and NGN Support*

[FOT154] The Contractor shall support periodic proficiency contacts for the NASA Ground Network at the Primary MOC and bMOC.

[FOT155] The Contractor shall support periodic proficiency contacts for the NASA Space Network at the Primary MOC and bMOC.

7.7 *Flight Dynamics Support*

Flight Dynamics support provides orbit determination and propagation, maneuver planning for World Reference System (WRS) maintenance, orbital products for mission planning, ground and spacecraft resource programming, and other functions. Flight Dynamics will routinely monitor spacecraft ground track and plan for necessary drag makeup, inclination, or retrograde maneuvers as appropriate. Daily product deliveries to mission planning and CAPE will be

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performed for fresh ground target requests, accurate spacecraft gimbaled antenna programming, ground station tracking, and other mission product generation for international cooperators. Additionally, flight dynamics will be responsible for creating and providing orbital elements to external collision and avoidance groups for regular debris close-approach analysis.

[FOT156] The Contractor shall provide flight dynamics expertise as required to meet all mission requirements.

[FOT157] The Contractor shall monitor the LDCM spacecraft orbit and plan orbit maneuvers as necessary to maintain desired orbits, observatory attitude and phasing.

[FOT158] The Contractor shall produce standard flight dynamics data and distribute it to mission data processing and other users.

7.8 *Mission Planning*

The mission planning functions for LDCM will be largely automated and provided jointly by the MOE and the CAPE. The CAPE will receive collection requests from internal and external users as well as the Long-Term Acquisition Plan (LTAP-8), combine these requests with ancillary data such as cloud cover predictions and LDCM ground system usage schedules, and generate a daily collection schedule. This is passed to the MOE for further deconfliction and adjustment to become the operational schedule. Each schedule will cover 72 hours. Scheduling will occur daily during 24x7 operations. During automated operations, scheduling will occur daily during the week, and the Friday schedule will cover the weekend.

[FOT159] The Contractor shall provide mission planning expertise as required to meet all mission requirements, including on-call or emergency mission planning support as needed.

[FOT160] The Contractor shall provide assistance to the LDCM International Cooperators as necessary to resolve mission planning needs.

[FOT161] The Contractor shall interface with the scheduling offices for the GNE, the NASA Space Network and the NASA Ground Network as necessary to support LDCM operations.

[FOT211] The Contractor shall be responsible for operating the CAPE and fulfilling the duties of the Data Acquisition Planner (DAP) as described in the Collection Activity Planning Element (CAPE) Operations Concept Document (OCD).

[FOT212] The Contractor shall be responsible for monitoring the external data inputs to the CAPE (e.g., cloud cover predictions) to ensure their timeliness and availability.

[FOT213] When informed of a change in the availability of an International Cooperator (IC), the Contractor shall be responsible for updating that availability in the CAPE.

[FOT214] When informed of a new International Cooperator, the Contractor shall be responsible for entering the relevant scheduling data into the CAPE and MOE.

[FOT215] The Contractor shall be responsible for monitoring the CAPE to ensure that scheduled reports are generated as required.

[FOT216] The Contractor shall be responsible for reviewing and manually deconflicting the

CAPE collection plan before it is submitted to the MOE.

[FOT217] The Contractor shall be responsible for reviewing, manually deconflicting and approving the MOE collection plan and integrated schedule.

[FOT218] The Contractor shall respond to requests from the Data Acquisition Manager (DAM) to add, delete, or change collection requests in CAPE.

[FOT219] The Contractor shall respond to requests from the Data Acquisition Manager (DAM) to work with users (normally via telephone) to refine complex data collection requests (TBD) (e.g., "I need an image of the Nile River valley") to determine path/rows and to enter the revised collection request into the CAPE.

[FOT220] Upon request of the DAM, the Contractor shall manually initiate a new scheduling cycle (e.g., to include an emergency data collection request).

7.9 *Combined Project Database Maintenance*

During the operational phase of the LDCM program, the FOT will have the responsibility to maintain and manage the combined project database.

[FOT162] The Contractor shall maintain and configuration manage the combined project database.

7.10 *Real-Time and Off-Line Operations*

Real-time operations consist of those activities that are necessary for direct communication with the spacecraft and include telemetry and commanding, orbit and attitude maintenance maneuvers, system configuration, housekeeping telemetry processing, command load uplink and verification, and table and memory load/dump operations. Off-line operations are those non-real-time activities that are necessary for the safe and nominal operation of the spacecraft and include planning and scheduling, orbit determination, stored command load generation, and ephemeris generation. .

[FOT163] The Contractor shall perform all real-time operations of the observatory.

[FOT164] The Contractor shall be responsible for all off-line operations of the observatory.

7.11 *Anomaly Detection, Isolation, Analysis, and Recovery*

An anomaly is defined as the occurrence of any event that causes the spacecraft, instruments, or any of the ground systems to perform in a non-standard manner. An anomaly may occur in either on-orbit or ground-based elements of the Flight Operations Segment (FOS).

Some anomalies may lead the government to create and manage an Anomaly Resolution Team (ART) and augment the technical staff to support anomaly analysis and recovery. The ART will have lead responsibility for analysis of anomalies that are determined to be the result of the performance of an on-orbit system or subsystem, or a result of a procedural error. The ART is also responsible for development of a corrective action recommendation to be given to the government.

[FOT165] The Contractor shall monitor the health of the spacecraft and the LDCM ground systems to detect any anomalies that occur.

[FOT174] The Contractor shall collect all available Housekeeping data from the LDCM spacecraft.

[FOT166] In the event of an anomaly, the Contractor shall follow the anomaly resolution process as defined in the Flight Operations Plan (MP007) and the Contingency Operating Procedures (MProc002).

[FOT167] The Contractor shall report all anomalies to the government.

[FOT168] The Contractor shall recommend corrective actions and implement them as directed by the government.

[FOT169] Under the oversight of the government, the Contractor shall have responsibility for analysis and resolution of anomalies that are determined to be the result of performance or failure of a ground-based system or subsystem, or a result of procedural error.

[FOT170] When there is an anomaly but the government has not established an ART, the Contractor shall have the lead responsibility in detecting, isolating, analyzing, and recovering from anomalies.

[FOT171] When there is an anomaly and the government has established an ART, the Contractor shall participate in the analysis of on-orbit and ground-based anomalies in support of the ART, as directed by the government.

[FOT172] The Contractor shall participate in the Incident Report Process.

[FOT173] The Contractor shall work with the spacecraft vendor, the instrument vendor, the MOE vendor, NASA, USGS and other technical contractor support as necessary for anomaly resolution.

7.12 *Trending and Analysis*

[FOT175] The Contractor shall use the Primary MOC and bMOC systems to maintain an archive of collected Housekeeping data for the lifetime of the mission.

[FOT176] The Contractor shall process, trend and analyze the Housekeeping data on a short term (e.g., daily), long-term and periodic basis as required to maintain health and safety of the spacecraft.

[FOT177] The Contractor shall perform trending and analysis of Housekeeping data for science data characterization.

[FOT178] As directed by the government, the Contractor shall provide ad hoc trending and analysis as needed for anomaly investigations, maneuver planning and other mission activities.

7.13 *Spacecraft Flight Software Sustaining Engineering*

The spacecraft vendor will provide flight software maintenance and updates for the initial five

years of the LDCM program. The spacecraft vendor will also deliver an initial star catalog. The FOT will have the responsibility of receiving FSW updates from the spacecraft vendor, maintaining the reference copy of the FSW, and performing all routine FSW sustaining engineering, including maintaining the star catalog..

[FOT179] The Contractor shall provide and maintain a Flight Software Maintenance Plan (CDRL MP009) for sustaining engineering of Flight Software, including standard and contingency operations.

[FOT180] The Contractor shall be responsible for all sustaining engineering of the Flight Software, including tasks such as Ground Reference Image dump compares with the FSW reference image, designing, building and maintaining Relative Time Command Sequences (RTCSes), etc.

[FOT181] The Contractor shall maintain and configuration manage the reference ("gold") image of the FSW.

[FOT182] The Contractor shall maintain the star catalog.

[FOT183] The Contractor shall generate and upload accurate star targets yearly or as necessary.

[FOT184] The Contractor shall receive new FSW load images from the FSW maintainer, perform the simulation testing of FSW deliverables, and upload or patch the FSW deliverables.

[FOT185] The Contractor shall be responsible for all loads of new data or instruction words directly into the spacecraft computer memory.

[FOT186] The Contractor shall maintain any necessary MOC-located FSW equipment, tools, and products.

7.14 *LDCM Observatory Simulator Sustaining Engineering*

[FOT187] The Contractor shall maintain the LDCM Observatory Simulator and ensure that it is configured properly for training, rehearsals, validation of command procedures and flight software, and other uses.

7.15 *Primary MOC and bMOC Sustaining Engineering*

[FOT188] The Contractor shall certify, operate, and maintain the hardware and software at the Primary MOC and bMOC.

[FOT189] All Primary MOC and bMOC sustaining engineering functions not provided as GFE (see Section 10.3 Primary MOC and bMOC Sustaining Engineering), such as:

- System fault isolation analysis
- Anomaly detection, isolation, analysis and resolution
- System installation/de-installation
- Equipment relocation
- Property management
- IT Security
- Maintenance of MOE software licenses

shall be the responsibility of the FOT.

7.16 *Collision Avoidance Support*

[FOT190] The Contractor shall interface with an external agency designated by the government (TBD) to obtain collision avoidance information.

[FOT231] The Contractor shall develop a Collision Avoidance Plan (MP015).

[FOT191] The Contractor shall implement and follow the Collision Avoidance Plan (MP015).

7.17 *Emergency Operations*

Emergency operations are required when an event occurs that makes the Primary MOC unable to fulfill some or all of the mission requirements.

[FOT192] The Contractor shall provide an Emergency Plan (CDRL MP011) that describes the FOT response to events that render the Primary MOC unable to fulfill some or all of the mission requirements.

[FOT193] The Contractor shall periodically exercise the Emergency Plan (CDRL MP011) to ensure that it can be successfully implemented.

[FOT194] The Contractor shall implement the Emergency Plan (CDRL MP011) when the Primary MOC is unable to fulfill some or all of the mission requirements.

[FOT195] During events that affect the accessibility of the Primary MOC or bMOC (e.g., weather closures), FOT staff shall be considered mission-essential personnel.

7.18 *Organizational Interfaces*

[FOT196] The Contractor shall support the organizational interfaces defined in Section 1.7 External Organizational Interfaces.

7.19 *International Cooperators Support*

[FOT197] The Contractor shall provide coordination, scheduling and commanding assistance to International Cooperators as directed by the government. This includes but is not limited to anomaly interpretation, manual scheduling for special events, conflict resolution, and modeling ground network expansion and its impacts to on-orbit resources and other Cooperators.

[FOT198] The Contractor shall ensure that the FOT personnel who assist International Cooperators are able to travel internationally as required.

8 Observatory Decommissioning

This section describes the Contractor requirements throughout the decommission phase as described in the LDCM Operations Concept Document (Section 2.2 a).

[FOT199] The Contractor shall prepare a Decommissioning Plan (CDRL MP012).

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[FOT200] The Contractor shall support a Decommission Review of the Decommissioning Plan (CDRL MP012).

[FOT201] The Contractor shall execute the Decommissioning Plan (CDRL MP012) as directed by the government.

[FOT202] The Contractor shall provide adequate staffing for decommissioning activities.

[FOT203] The Contractor shall support the creation of the End of Mission Report.

9 Out of Scope Work

The Government will be responsible for augmenting the Contractor's staff and/or budget to fund actions that are outside the scope of the basic contract. The Contractor may accept these out of scope activities at its discretion.

[FOT204] The Contractor shall identify any actions requested by the Government that are outside the scope of the basic contract.

[FOT205] For actions that are outside the scope of the basic contract, the Contractor shall provide to the government an estimate of the additional LOE required and any potential program impact to complete the action.

[FOT206] The Contractor shall perform actions that are outside the scope of the basic contract only as directed by the government.

10 Government Furnished Equipment (GFE)

The government will supply the contractor, directly or through other contract, the facilities, equipment, software, documentation, and services described below.

10.1 *Supplies*

The government will supply all the office supplies and consumables used in the daily execution of this contract.

10.2 *Facilities*

The government will supply building space at the EROS data center in Sioux Falls, South Dakota. This space includes approximately 1000 sq. ft. of control center and supporting office space, including library space. This space will be appropriately configured and furnished for the operation of LDCM and administrative support anticipated by this SOW.

The government will supply all utilities, including water electricity, and air-conditioning, for those facilities, as well as maintenance, custodial, and physical security services for the space provided.

10.3 *Primary MOC and bMOC Sustaining Engineering*

The government will provide the following hardware and software sustaining engineering of all Primary MOC and bMOC ground systems:

- Facilities management

- Basic network administration, such as management and assignment of IP addresses, maintaining a DNS server, etc.
- Basic system administration of Primary MOC and bMOC systems, such as applying operating system patches, maintaining user logins, performing backups, etc.

10.4 *Hardware*

The government will supply the hardware required in support of activities contained in this SOW. This will include standard office equipment such as office furniture, desktop computers, and printers.

The government will provide all ground segment facilities, subsystems, and related hardware items for use under this contract.

The government will provide the maintenance of all hardware associated with the LDCM Primary and backup Mission Operations Centers.

The government will provide technology refresh of all hardware associated with the Primary MOC and bMOC as necessary.

10.5 *Software*

The government will supply the software required in support of activities contained in this SOW. This will include standard office software such as Microsoft Office, and other software as needed to fulfill the FOT requirements.

The government will supply all software required for the operation of the Primary MOC and bMOC.

The government will be responsible for the maintenance of all software associated with the conduct of LDCM Flight Operations.

10.6 *Documentation*

The government will provide the FOT with documentation for all GFE hardware and software.

10.7 *Training*

Prior to mission simulations, the government will provide the FOT with initial training on all MOC systems and the Observatory.

Training provided by the MOE vendor to the FOT is outlined in 2.1 **Error! Reference source not found. Error! Reference source not found.**

10.8 *CM Tools*

The government will provide CM tools for use by the FOT.

11 Deliverables

The following tables detail the deliverables and delivery schedule. The CO will provide the contractor with the names and addresses of any additional distribution for these deliverables. Except as indicated below, or with explicit written permission from the government, Deliverables shall not contain proprietary or copyrighted information or have any restriction on

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reproduction or distribution.

11.1 *Mission Plans*

Name/Number	Description	Frequency	Draft/Final Due
CDRL MP001 - Project Management Plan	This plan provides an overview of the Flight Operations Team management processes and the schedule and activities required to achieve operational readiness. It includes the plans and processes for quality assurance and continuous improvement. The draft plan shall also include a comprehensive approach to EVM, including (a) A description of the EVM system that the Contractor intends to use in performance of this contract, (b) A description of how this EVM system differs from the Contractor's existing management system and modifications proposed to meet the guidelines (c) A checklist that demonstrates how the proposed system complies with the 32 ANSI-EIA Standard 748 and Office of Management and Budget (OMB) Circular A-11, Part 7 requirements. (d) The proposed procedure for administration of guidelines, as applied to subcontracts and (e) Documentation describing the process and results of any third party evaluation of the system's compliance with the EVM guidelines. The draft program management plan should also include a description of the approach to writing all of the Mission Plans CDRLs that are not delivered as part of the proposal. The plan also demonstrates compliance with USGS's IT Security Requirements and includes background investigations and completed government forms.	Updated yearly.	Draft: Due with RFP response Final: Ten (10) days after contract award

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	The draft PMP may contain proprietary information but the inclusion of proprietary information in the final version requires the approval of the government.		
CDRL MP002 - Work Breakdown Structure	A WBS including project management, administration, and all other support throughout each mission phase and modes of operation.	Updated at the request of the government	Submitted as part of the contractor's proposal
CDRL MP003 - Staffing Plan	A plan for staffing the FOT, including position descriptions, management structure, duty hours, duty locations (including temporary and extended TDY away from the Primary MOC) and staffing throughout the mission phases. The plan includes a breakdown of staffing against the proposed Work Breakdown Structure. The plan also contains the plan for the use of subcontractors on the FOT, if applicable. Portions of the staffing plan may be marked proprietary information with approval of the government.	Updated thirty (30) days after contract award	Submitted as part of the contractor's proposal
CDRL MP004 - Training and Certification Plan	The objective of the training and certification plan is to assure mission success by cultivating a diverse, competent staff of FOT professionals. This plan should include an active process of progressive skills enhancement, cross-training and contingency operations readiness for both online and engineering personnel. The plan should include a matrix of FOT positions and skills with defined certification levels and targeted staff certification goals. Training should include certification of subsystem engineers on standard and contingency operations and cross-training of subsystem engineers to provide technical continuity of subsystem operations during vacations, sickness, and attrition. The training materials needed to implement this plan are provided in the FOT Training Materials (CDRL O008).	Updated annually	Draft: Six months prior to MOC integration Final: MOC integration
CDRL MP005 - Phase-Out Transition and	A plan that documents a phase-out transition and training plan. Plan includes training content outline that is	Updated within thirty (30) days of	Draft: Six (6) months after commissioning

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Training Plan	mutually agreeable between the government and the contractor. The training content outline includes at a minimum provision for training in the areas of spacecraft performance analysis, data base management, flight plan preparation, spacecraft telemetry trending, spacecraft command and control operations, anomaly investigation, flight software maintenance coordination, LDCM Observatory Simulator operations maintenance, spacecraft maneuver planning and execution, and MOC product generation. Classroom and "hands on" training are required. The plan explains how the incoming contractor's personnel will be trained and describe the steps that will be taken to prevent any break in the contractor provide services and minimize interference with routine government operations.	government request	Final: Launch plus one year
CDRL MP006 - Configuration Management Plan	The purpose of the configuration management plan is to ensure that the configuration of both space and ground hardware and software systems is not changed without approval of LDCM management and that any changes are properly communicated to all LDCM stakeholders. The plan must follow a multi-level classification of configurable items that conforms to those used in other USGS space missions and is approved by the government. The configuration management system will allow, through either electronic or manual mechanisms, interaction with the USGS program-level configuration management system to accommodate configuration issues that involve elements external to the Primary MOC.	Updated annually	Draft: Six months prior to first MOE release Final: MOC integration
CDRL MP007 - Flight Operations Plan	The LDCM Flight Operations Plan (FOP) is a document explaining how the Flight Operations Team (FOT) does their job. A breakdown of mission objectives and how they will be met is contained within. It details the specifics of spacecraft and ground responsibilities by	Updated annually	Draft: Mission Ops Review Final: Flight Ops Review

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	providing an outline of mission operations including plans, timelines, configurations, and interfaces necessary to coordinate flight and ground resources. It also defines the FOT interactions with other mission segment/elements, agencies, IC's, and the overall observatory environment. The plan provides a basis for the development of detailed flight and ground system operating processes. In addition, the FOP is used as a training tool for the FOT. Sample Contents Breakdown: • Mission purpose, scope, organization, and objectives. • FOT job responsibilities. • FOT Staffing profile • Overview of training and certification. • Mission Operations Center (MOC) management: Logistics, maintenance, contingency plans, and configuration control of the facility. • Description of the MOC hardware architecture. • Mission phase definition and responsibilities: Pre-launch Planning and Testing, Launch, Ascent, and Activation, On-Orbit, and EOL. • Observatory Subsystems and Operations: Description of the spacecraft and instruments along with the operations associated with each system. • Real-time and Support Operations: (1) Pass, command and telemetry, and support operations, (2) Planning and scheduling, spacecraft clock and center frequency maintenance, ephemeris and leap second updates, and maneuver planning, (3) Real-time scenarios and MOC activities timeline. • Anomaly Detection, Isolation, and Recovery: Anomaly handling process, including roles and responsibilities of FOT members, escalation procedures, resolution process, tools used to detect and react, and other resources. • Offline Engineering, Trending and		

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	Analysis: Offline engineering activities necessary for spacecraft operations (routine and non routine). • Software and Database Configuration and Maintenance: Configuration control and maintenance of the numerous databases, procedures, and software components • Operational Interfaces		
CDRL MP008 – Commissioning Plan	A plan containing the details of activities between launch and commissioning when responsibility of flight operations transitions from NASA to USGS. It defines the roles and responsibilities for launch and early orbit activities and details the FOT's portion of launch and early orbit operations. It also defines the handover criteria and the process for accepting handover.		Draft: Mission Ops Review Final: Flight Ops Review
CDRL MP009 - Flight Software Maintenance Plan	The FSW Maintenance plan includes the plan for: • Maintenance of Star Catalogs • Generation and update of accurate Star Catalogs • Reception of a load image from the FSW management facility • Simulation testing of FSW deliverables • Uploading or patching of FSW deliverables • Loads of new data or instruction words directly into s/c computer memory. • FSW maintenance activities such as Ground Reference Image dump compares with a FSW image. • Maintenance of MOC located FSWM equipment, tools, and products		Draft: Mission Ops Review Final: Flight Ops Review
CDRL MP010 – Automation Implementation Plan	This plan describes the steps and includes the products to achieve Primary MOC operation on an 8x5 schedule with occasional unmanned operations for as long as 72 hours and a test plan to ensure that this automation can be accomplished without endangering mission requirements. Design and creation of automation is expected to start in the pre-Launch phase and continue through the Operations.	Updated within thirty (30) days of government request	Draft: Mission Ops Review Final: Flight Ops Review
CDRL MP011 – Emergency Plan	A plan that describes the actions that take place when an event occurs that makes the Primary MOC unable to fulfill	Updated annually	One (1) month prior to Mission

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	some or all of the mission requirements. It includes an inclement weather plan that ensures minimum essential personnel are available as required to maintain mission functionality. The plan discusses methods to determine the severity of the loss and take affirmative action to restore functionality. One action described in this plan is how mission functionality will be transferred to the bMOC. This plan includes contingency plans for a long-term or permanent shift of mission responsibilities from the Primary MOC to the bMOC (e.g., in the case of a catastrophic loss of the Primary MOC). Key considerations for this contingency include: Purchase of equipment for bMOC to replicate full Primary MOC functionality at the bMOC (e.g., reliability requirements) USGS support of long term relocation for all/key FOT staff to bMOC		Simulations
CDRL MP012 – Decommissioning Plan	The plan for decommissioning the observatory. To be developed jointly, by the Government and the Contractor, within the initial performance period of this contract. The decommissioning plan includes a risk mitigation plan for loss of staff prior to decommissioning.	Updated within thirty (30) days of government request	Twelve months after commissioning
CDRL MP013 – Project Budget Plan	This document shows the planned budget and expenditures for the contract lifetime, with breakdowns by staffing position and WBS.	Updated quarterly	Ten (10) days after contract award
CDRL MP014 – Mission Simulation Plan	This document describes the operational activities during mission sims and the plan for developing the procedures to support Mission simulation activities.		Draft: Mission Operations Review (MOR) Final: First Mission Sim
CDRL MP015 – bMOC Operational Readiness Plan	This document describes the processes the FOT will follow to prepare the bMOC for operational readiness. This shall include any necessary transfer and installation of MOC equipment (e.g., transfer of the MOE from the Launch MOC to the bMOC), facility preparation, personnel changes, and the tests that will ensure operational readiness. The		Draft: Six months prior to launch Final: At Commissioning

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	document will also address any mission risks incurred during the preparation of the bMOC and implement appropriate mitigations.		
CDRL MP016 – Collision Avoidance Plan	This document describes the processes the FOT will follow to determine when the Observatory is in danger of collision and the escalation procedures to be followed. This document will include warning volumes, alert volumes, collision prediction frequency, emergency maneuver procedures, etc.		Draft: Six months prior to launch Final: At Commissioning

11.2 *Mission Reports*

Name/Number	**Description**	**Frequency**	Draft/Final Due
CDRL MR001 – Monthly Activity Report and Review	A report summarizing the activities of the preceding month. The report includes the technical, schedule and developmental/operational performance in accordance with the WBS to adequately describe the activities of the FOT to the government. This report includes, but is not limited to, a summation of standard operational events, a listing of special activities, an accounting of instruments activities including non-nominal events, development activities for each of the MOC subsystems, issues from the month, non-nominal events due to FOT errors, instrument statistics, staffing status, special initiatives, and planned activities. The government may require additional items to be addressed on a periodic basis. A softcopy of this report will be provided to the COTR on the day of the presentation.	Monthly	30 days after contract award
CDRL MR002 – Special Event Activity Reports	Special events are unusual or unique operational situations such as extended eclipse events, leap second events, etc. This report includes, at a minimum, operations plans, command definitions, and expected subsystem performance. Post-event reports confirm that the event was executed per the operational plan, no anomalies were observed, and the subsystems performed as predicted with no detrimental impact.	Within 30 days of special event	
CDRL MR003 – Ad Hoc	Other ad hoc reports as directed by the government	Within 30 days of request by the	

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Reports		government	
CDRL MR004 – Metrics Report	A report containing the actual measurement of metrics jointly determined by the government and contractor. The following metrics are intended as example indicators of the LDCM mission accomplishments and performance relative to mission requirements and objectives • Spacecraft contacts successfully supported is a key element of measurement, reflecting the frequency and nature of LDCM spacecraft contacts that are routinely and successfully supported on a daily basis. • Successful vs. unsuccessful preparation and execution of command and control sequences reflects performance of the FOT with regard to accuracy and timeliness of the process to formulate and execute instructions to the on-orbit asset. • Scenes requested but not acquired (U.S. and international) are a measure of the problems encountered in attempting to fill out a data acquisition schedule, and of the operational practice of identifying and documenting failures in daily acquisition management. • International ground stations supported is a measure of operational effectiveness of the flight operations team in coordinating and executing the daily interactions with the international network of ground stations. • Anomalies detected, analyzed, reported and resolved is a measure of the operational response to ad hoc situations and unexpected occurrences, and the performance of the Contractor in responding to these demands. • Interface coordination activities are a measure of the effectiveness of coordinating and communicating with the various operational elements of the LDCM system required to carry out daily operational activities. • State of documentation (procedures, operating instruction, etc.) is a measure of the attention to detail and the thoroughness applied to maintaining documentation files regarding the state of the systems and operational procedures employed in flight	Updated Monthly	Sixty (60) days after contract award

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	operations. • Adherence to existing and developed configuration control mechanisms will be an indication of the procedural discipline enforced by the Contractor and their commitment to sound engineering and operational practices. • Subcontract management reflects the attention placed on establishing and maintaining sub-contract agreements with the various suppliers of sustaining engineering services regarding the various sub-elements of the space and ground systems employed in flight operations. • The smooth operation of the LDCM system relies on a well-trained and motivated FOT. Reports on the status of staffing levels, training and certification activities and identity any known areas of future attrition will ensure smooth operation of the LDCM.		
CDRL MR005 – Financial Report	A report detailing the contract expenditures to date aligned with the WBS. This report also includes graphical projections of planned (CDRL MP013) versus actual costs to date and projected for the remainder of the CLIN. At anytime during the contract period, the government may request additional financial data. These requests are not limited to but may include detailed information into expenditures, time accounting for individual personnel categories, and impact statements for any operational concept changes. The report includes OCDs, as applicable.	Monthly	30 days after contract award
CDRL MR006 – Contract Performance Reports (CPR)	This report provides complete information on contract performance, including EVM. It shall provide the following information broken down by WBS: (a) Budgeted cost of work scheduled (planned value) (BCWS) (b) Budgeted cost of work performed (earned value) (BCWP) (c) Actual cost of work performed (actual cost) (ACWP) (d) Budget at completion (BAC) (e) Estimate at completion (EAC) (f) Performance graphs plotting past data and future projections of budgeted and	Monthly	

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	actual costs. The report shall explain the reasons for all variances that exceed the statutory threshold of 10%. They shall discuss the corrective actions that will be taken to mitigate variances, the associated risks, and how close the mitigations will bring the project to the original baseline. Based upon the work accomplished, the report will explain whether performance goals will be achieved and the impact to the cost and schedule goals defined in the original baseline.		
CDRL MR008 – Engineering Reports	This document provides the engineering summary of analysis and observations from previous quarter. It includes analysis of critical parameters with deviations explained, description of anomalies encountered with the attempted and successful remedies, and a watch list of future concerns.	Quarterly	Launch
CDRL MR009 Post-Pass Analysis and Summary Report	This report provides a summary of each real-time Observatory contact and provides analysis of any discrepancies.		Next working day

11.3 *Mission Procedures*

Name/Number	Description	Frequency	Draft/Final Due
CDRL MProc001 – Standard Operating Procedures	This handbook defines the procedures used to perform standard operational activities in the MOC, e.g., pre-pass setup, creating an ephemeris load, etc.		Draft: 30 days prior to final test sequence Final: Operational Readiness Review
CDRL MProc002 – Contingency Operating Procedures	This handbook defines the procedures used to respond to anomalies and other non-standard (contingency) situations in the MOC, e.g., loss of a ground station communications, an incorrect command load, etc.		Draft: 30 days prior to final test sequence Final: Operational Readiness Review
CDRL	This handbook contains all the procedures to		Final:

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MProc003 – Ground Readiness Test Procedures	support the Ground Readiness Test Plan		Ground Readiness Test
CDRL MProc004 – Mission Readiness Test Procedures	This handbook contains all the procedures to support the Mission Readiness Test Plan		Final: Mission Readiness Test
CDRL MProc005 – Mission Simulation Procedures	This handbook contains all the procedures to support Mission Simulation		Final Mission Simulation

11.4 *Other Deliverables*

Name/Number	Description	Frequency	Draft/Final Due
CDRL O001 – Inventory Databases	A computer database in the format proposed by the contractor and approved by the government containing. An accurate record of the Primary MOC and bMOC hardware including tag numbers and locations and the Primary MOC and bMOC software including installed computer identification and license information as appropriate.	Monthly	Thirty (30) days after contract award
CDRL O002 – Combined Project Database Deliveries	The government will provide the initial delivery of the Project Database. This electronic deliverable will document all updates and maintenance modifications to government-provided Project Database. (ELECTRONIC DELIVERY ONLY – NO HARD COPIES)	Quarterly	6 months after MOE installation
CDRL O003 – Launch and Early Orbit Handbook	The L&EO Handbook is a common reference guide to the Launch MOC for the FOS team supporting launch and early orbit. It will contain information such as: – Call Signs – Go/NoGo Criteria for Operations and Ground Segment – Launch Management – Launch Project Engineering – Launch FOT Management – Voice Etiquette – DSN Contact List – GN Contact List – Control Center Layout – Launch Support Room Layout		Draft: One year prior to launch Final: Operational Readiness Review

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	– L&EO TIMELINES – Daily Activity Plans – Contingencies handbook Etc.		
CDRL O004 – Mission Operations Review (MOR) Package	This document includes the slides and other supporting material presented at the MOR.		Final: 3 months prior to MOR
CDRL O005 – Final Operations Review (FOR) Package	This document includes the slides and other supporting material presented at the FOR.		Final: 3 months prior to FOR
CDRL O006 – Operating Procedures Style Guide	This guide defines the format and content of the mission procedures CDRLs shown in Section 11.3.		Draft: 3 months prior to MOR Final 3 months after MOR
CDRL O007 – Phase-Out Training Materials	This deliverable includes all the necessary materials to fulfill the Phase-Out Transition and Training Plan (CDRL MP005)	Updated annually	Six months after MOC integration
CDRL O008 – FOT Training Materials	This deliverable includes all the training materials required by the Training and Certification Plan (CDRL MP004).	Updated annually	Draft: Six months prior to MOC integration Final: MOC integration
CDRL O009 – Integrated Baseline Review (IBR) Package	The Integrated Baseline Review (IBR) is a joint FOT Contractor and Government assessment of the Project Management Plan (CDRL MP001) and the Project Budget Plan (CDRL MP013). The purpose of the IBR is to confirm that that performance measurement baseline covers the entire technical scope of work, that the work is realistically and accurately scheduled, that the proper amount of and mix of resources are assigned to accomplish all contractual requirements, and that both the government and the contractor understand and mutually agree to the nature and possible impacts of the risks associated with the program baseline.		Draft: five days prior to IBR IBR: 90 calendar days after contract award Final: Two weeks post IBR

12 Performance Evaluation

The USGS intends to award a performance-based contract for the work defined in this SOW. This section discusses the criteria that will be used to judge performance and the award fee plan.

12.1 *Performance Criteria*

This section describes the criteria that will be used to evaluate the Contractor's performance. Since the nature of the FOT tasking will change substantially when the program enters the Operations Phase, different performance criteria are shown for the Pre-Operations Phases and the Operations Phase.

The tasking and challenges facing the FOT are not completely known at this time. Future events and developments may significantly change the role of the FOT within LDCM and the larger USGS enterprise. For that reason, the government reserves the right to adjust these criteria, and how they are measured, to better serve the LDCM program.

While performance evaluation must necessarily be subjective, where possible we have shown objective metrics than can be used to help guide the evaluation process.

12.1.1 Performance Criteria during Pre-Operation Phases

The primary goals of the FOT during the pre-Operation phases of LDCM are to (1) support NASA and USGS in successfully acquiring the LDCM Observatory and ground systems, (2) successfully integrate the LDCM Observatory and ground systems, and (3) build expertise and knowledge in the LDCM Observatory and ground systems to ensure successful launch and operations of LDCM. The performance criteria during these phases are intended to reflect these goals.

1. Program Management (35%). This criterion judges how well the Contractor has managed the FOT contract. This includes:
    a. Compliance with the requirements listed in Sections 3 and 4 of the SOW.
    b. Compliance with the Project Management Plan (CDRL MP001).
    c. Compliance with the Staffing Plan (CDRL MP003). Metrics for assessing this could include:
        i. Percentage of positions staffed on schedule.
        ii. Retention rates for key personnel.
    d. Sufficient staff expertise and compliance with the Training and Certification Plan (CDRL MP004). Metrics for assessing this could include:
        i. Percentage of staff with required training and certifications.
    e. Budget performance and compliance with the Project Budget Plan (CDRL MP013).
    f. Demonstrated commitment to quality assurance and continuous improvement of the FOT's performance and cost.
2. Technical Performance (65%). This criterion judges how well the Contractor has addressed the technical requirements of this SOW. This includes:
    a. Compliance with the requirements listed in Sections 5 and 6 of the SOW.
    b. On-time and successful completion of all FOT contributions to LDCM program milestones.
    c. On-time and successful completion of scheduled Integration and Test (I&T) activities.
    d. On-time and complete delivery of all required CDRLs.
    e. Completion and verification of the Combined Product Database.

12.1.2 Performance Criteria during Operation Phase

The primary goals of the FOT during the Operation phase of LDCM are to (1) maintain the health, safety and operational capability of the LDCM Observatory and ground systems, (2)

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maximize the value of the mission data product delivered to the ground, (3) continuously improve the performance and reduce the total operating costs of the LDCM system, and (4) create an integrated community of flight operations expertise at the Primary MOC. The performance criteria during these phases are intended to reflect these goals.

1. Program Management (35%). This criterion judges how well the Contractor has managed the FOT contract. This includes:
    a. Compliance with the requirements listed in Sections 3 and 4 of the SOW. Metrics for assessing this could include:
        i. Accuracy and completeness of inventory database.
        ii. Accuracy and completeness of configuration management.
        iii. Retention rates for key personnel.
    b. Compliance with the Project Management Plan (CDRL MP001)
    c. Compliance with the Staffing Plan (CDRL MP003). Metrics for assessing this could include:
        i. Percentage of positions staffed on schedule.
        ii. Retention rates for key personnel.
    d. Sufficient staff expertise and compliance with the Training and Certification Plan (CDRL MP004). Metrics for assessing this could include:
        i. Percentage of staff with required training and certifications.
    e. Budget performance and compliance with the Project Budget Plan (CDRL MP013).
    f. Demonstrated commitment to quality assurance and continuous improvement of the FOT's performance and cost. Metrics for assessing this could include:
        i. Number of added MOC capabilities or functions.
        ii. Reduction of MOC O&M costs.
2. Technical Performance (65%). This criterion judges how well the Contractor has addressed the technical requirements of this SOW. This includes:
    a. Compliance with the requirements listed in Section 7 of the SOW. Metrics for assessing the performance of the FOT will include:
        i. Number of operator errors.
        ii. Percentage of successful scheduled Observatory contacts.
        iii. Mission data capture statistics.
        iv. Successful anomaly resolutions.
        v. Percentage successful command loads.
        vi. Percentage successful special events.
        vii. bMOC readiness exercises.
    b. On-time and complete delivery of all required CDRLs.

12.2 *Award Fee Plan*

The PEB will document the Contractor's performance along with explanations of scores above or below the standard. Semi-annually the PEB will determine an overall rating for the contractor's performance, and convert that rating to an award fee.

12.2.1 Performance Evaluation Board (PEB)

The evaluation and award fee determination will be done by the Performance Evaluation Board (PEB). The PEB will consist of the following members:

Sr. Advisor, Technical Services Contracts/ Contracting Officer's Representative	Chairman

Flight Systems Manager (FSM)	Member
Mission Management Office Representative	Member
NASA Advisor *	Member
Fee Determination Official	Member

* The PEB will include a NASA Advisor only during the Pre-Operations Phases.

12.2.2 Performance Evaluation Process

The nature of the performance criteria (12.1 Performance Criteria) is such that it cannot be measured with mathematical precision. Evaluation of contractor performance is instead based on subjective analysis that reflects the evaluators' opinions and impressions regarding the level of performance achieved. Each performance criterion will be rated according to the grading table shown in 12.2.5 Grading Table. To be effective, the PEB must be as informed as possible. Frequent, open and both formal and informal communication between the contractor and members of the PEB is an important part of the evaluation process.

12.2.3 Contractor Self-Assessment

Semi-annually, the Contractor will provide the PEB with a self-assessment of the Contractor's performance during the previous six months. The self-assessment will review the performance criteria and metrics described in Section 12.1 Performance Criteria, and discuss issues, problems, and corrective measures taken.

12.2.4 Actions and Schedule for Determining Award Fee Earned

	Action	Schedule
1.	Members of the Performance Evaluation Board (PEB) discuss contractor performance with the contractor	Ongoing and informally
2.	Contractor provides self-assessment to PEB	Semi-annually
3.	PEB prepares semi-annual summary evaluation and FDO presents to contractor	Within 30 days of Step 2.
4.	Contractor provides comments on the evaluation document to the FDO	Within 5 days after the semi-annual evaluation documents are received
5.	PEB meets to review contractor's comments and to arrive at a fee recommendation; PEB submits fee recommendation to the FDO	Within 10 days after receipt of the contractor's comments
6.	FDO makes a fee determination and advises contractor in writing	Within 10 days after receipt of the recommendation
7.	Contractor appeal (if exercised)	Within 15 days after receipt of the determination
8.	FDO's final Determination	Within 5 days after receipt of the contractor's appeal

12.2.5 Grading Table

Rating	Definition	Points
Superior +	Performance exceeds standard* by a substantial margin. Few elements for improvement are	96 and above

	identified, all of which are minor. Contractor earns all performance points for open performance criteria	
Superior	Performance exceeds standard. Few elements for improvement are identified, all of which are minor.	91 - 95
Excellent	Performance exceeds standard. Although there may be several elements for improvements, these are more than offset by better performance in other elements	86 - 90
Satisfactory	Performance is standard. Lower graded performance are approximately offset by higher graded performance in other elements	76 - 85
Marginal	Performance is less than standard. Although there are elements of standard or better performance, these are more than offset by lower graded performance in other elements	66 - 75
Unsatisfactory	Performance is below minimum acceptable. Improvement in overall contract performance is required to avoid possible termination action.	65 and Below

Standard performance is the level normally expected of a competent contractor. This corresponds to a numerical rating of 85 on the rating scale.

12.2.6 Award Fee Conversion Chart

The contractor receives an Award Fee based on performance. An evaluation score of 65 yields no award fee; an evaluation score above 95 yields 100 percent award fee.

Performance Points	Percent of Award Fee	Performance Points	Percent of Award Fee
96 - 100	100.0	80	70.0
95	95.0	79	68.0
94	92.5	78	66.0
93	90.0	77	64.0
92	87.5	76	62.0
91	85.0	75	55.8
90	82.5	74	49.6
89	81.0	73	43.4
88	79.5	72	37.2
87	78.0	71	31.0
86	76.5	70	24.8
85	75.0	69	18.6
84	74.0	68	12.4
83	73.0	67	06.2
82	72.0	66	0.0
81	71.0	65	0.0

12.2.7 Sample Computation

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1. Assume an award fee of $250,000.
2. Performance points are calculated for each quarter, and two quarters are averaged to determine the semi-annual score.
3. Points are an average of each Performance Evaluation Board member's score.

Criteria	Weight	Period 1 Points	Period 1 Weighted Score	Period 2 Points	Period 2 Weighted Score	Average Score
Program Management	35	80	28.0	85	29.75	28.875
Technical Performance	65	90	58.5	91	59.15	58.825
Totals			86.5		88.9	87.7

A rating of 87 performance points yields a percentage of 78 in the Award Fee Conversion Chart. The additional 0.7 performance points yields an additional percentage of 1.05 (0.70 times 1.5) for a total of 79.05.

Annual Award Fee (79.05% of $250,000) = $ 197,625.

13 USGS IT Security Requirements Summary

1. Background Investigation - Applicable
Contractor employees who will have access to federal information technology (IT) systems are subject to background investigations by the Federal Office of Personnel Management. Procedures for investigations and obtaining identity credentials are described in clause GS1414. The level of investigation required will be the same as would be required for federal employees holding positions involving similar duties.

2. Non-disclosure Agreement - Applicable
Prior to receiving access to USGS computers, contractor employees shall be required to sign nondisclosure or other system security agreements, depending on the systems to be used and level of access granted.

3. Training - Applicable
Contractor employees shall complete USGS-defined Federal Information Systems Security Awareness computer security training before being granted system access and must renew the training annually. Failure to complete training within the required timeframe may result in loss of system access for that user. Contractor employees with significant IT security responsibilities shall also complete specialized role-based training.

4. Personnel Changes - Applicable
Before starting work, the contractor will provide a listing to the COR/technical liaison identifying contractor and subcontractor employees requiring access to USGS systems for performance of work hereunder and will assign each person a unique user ID conforming to USGS policy in Survey Manual Chapter 600.2.1. The contractor shall immediately advise the USGS Project Officer when any of their personnel no longer require USGS computer access so

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that those IDs and access privileges can be cancelled. When possible, the COR must be notified in advance of any potentially unfriendly termination of an employee or subcontractor.

5. Contractor Location - Applicable
No portion of the services to be performed hereunder may be performed outside the United States without the express written permission of the Contracting Officer. If a contractor proposes to perform services outside the United States, the contractor must submit a Security Plan to address mitigation of security issues due specifically to location. The Security Plan Template is available upon request from the Contracting Officer. Such proposals will not be accepted unless the contractor can demonstrate that the Government systems or data would be no more vulnerable than if work were performed domestically.

6. Applicable Standards - Not Applicable
Contractors shall follow the DOI System Development Life Cycle (SDLC), NIST SP 800-64, and the DOI SDLC Security Integration Guide.

7. Asset Valuation - Not Applicable
Asset valuation on USGS systems to which the Contractor may have access under this contract will be conducted by the Government or another of its contractors.

The Contractor shall use the DOI Asset Valuation Guide to determine mission impact, data sensitivity, risk level, bureau/departmental/national criticality for Contractor-owned and operated systems used to provide services under this contract, and to determine whether the system is a Major Application, Minor Application, or General Support System.

8. Property Rights - Applicable
The Government shall be granted unlimited rights in software or data produced hereunder as described in FAR clause 52.227-17, Rights in Data-Special Works, incorporated by reference herein.

9. Independent Verification and Validation (IV & V) - Not Applicable
Software will be independently verified and validated by the Government or another selected contractor prior to being moved into production. Contractor will ensure that independent verification and validation is performed on software deployed on contractor managed systems containing USGS data, in accordance with DOI SDLC Security Integration Guide.

10. Certification & Accreditation - Not Applicable
The contractor will perform Certification and Accreditation (C&A) services on the application developed or maintained hereunder prior to going into production. The application must be re-accredited every three years or whenever there is a major change that affects security. C&A documents will be provided to the COR in both hard copy and electronic forms. The contractor must follow NIST SP 800-37, 800-18, 800-30, 800-60, 800-53A, Federal Information Processing Standard (FIPS) 199 and 200, the associated DOI guides/templates, the DOI Security Test & Evaluation (ST&E) Guide, and the DOI Privacy Impact Assessment. NIST documents are available on the internet at http://csrc.nist.gov/publications/nistpubs/. FIPS documents are available on the internet at http://csrc.nist.gov/publications/nistpubs/. The contractor may request copies of DOI documents by contacting the Contracting Officer. The government reserves the right to conduct the ST&E, using either Government personnel or an independent contractor. The contractor will take immediate and timely action to correct or

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mitigate any weaknesses discovered as necessary to bring the application or system into compliance with the above requirement.

11. Internet Logon Banner - Applicable
Web-based applications developed or maintained under this contract must contain a USGS approved logon banner.

12. Incident Reporting - Applicable
Contractor employees must report any computer security incidents (viruses, intrusion attempts, system compromises, offensive e-mail, etc.) which may affect Government data or systems in accordance with the DOI Computer Incident Response Guide. Report computer security incidents to USGS help desk or Security Point of Contact (SPOC).

13. Quality Control (Malicious Code) - Applicable
All software and hardware shall be free of malicious code.

14. Self Assessment - Applicable
Self-assessment on USGS systems to which the Contractor may have access under this contract will be conducted by the Government or another of its contractors.

15. Vulnerability Analysis - Applicable
Vulnerability Analysis on USGS systems to which the Contractor may have access under this contract will be conducted by the Government or another of its contractors.

16. Logon Banner - Applicable
Applications developed or maintained under this contract must contain a USGS approved logon warning advising users of rules, restrictions, and privacy expectations for that application. The text of such warning will be provided by the COR.

17. Security Controls - Applicable
The Contractor shall be responsible for Information Technology security for all non-government-owned systems used in the development of and systems intended for eventual delivery to the USGS/DOI in fulfillment of contract requirements. This includes information technology, hardware, software, databases, networks, and telecommunications systems.

18. Contingency Plan - Applicable
The Contractor shall submit a contingency plan for restoration and testing of software and resumption of maintenance support during a contingency operation. The plan must conform to applicable portions of NIST SP 800-34 and DOI Contingency Plan Guide. The Contractor shall submit contingency plans to the COR.

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