

**U.S. GEOLOGICAL SURVEY/EROS CENTER  
TECHNICAL REQUIREMENTS DOCUMENT  
for  
TECHNICAL SUPPORT SERVICES CONTRACT SOLICITATION**

**TRD NUMBER**

018

**PERFORMANCE PERIOD**

Contract Base Year: April 1, 2010 thru March 31, 2011

**PROJECT NAME**

Landsat Data Continuity Mission (LDCM)

# Landsat Data Continuity Mission (LDCM) Technical Requirements Document 0018

## Table of Contents

<b>List of Figures .....</b>	<b>1-5</b>
<b>List of Tables .....</b>	<b>1-5</b>
<b>Section 1 Project Overview .....</b>	<b>1-6</b>
1.1 Landsat Data Continuity Mission (LDCM) Overview .....	1-6
1.2 USGS Project Work Breakdown Structure .....	1-7
<b>Section 2 Project Management and System Engineering Work Description....</b>	<b>2-8</b>
2.1 TSSC Project Management and Controls (PWBS 1.1.4) .....	2-8
2.1.1 Summary .....	2-8
2.1.2 Objectives .....	2-8
2.1.3 Deliverables .....	2-8
2.1.4 Schedule Management Deliverables .....	2-9
2.2 TSSC Ground System Systems Engineering (PWBS 1.3.2) .....	2-10
2.2.1 Summary .....	2-10
2.2.2 Requirements and Interface Management .....	2-10
2.2.3 GS Integration and Test .....	2-11
2.2.4 Risk Management .....	2-12
2.2.5 Configuration Management .....	2-13
2.3 TSSC Quality Assurance (PWBS 1.3.4) .....	2-13
2.3.1 Summary .....	2-13
2.3.2 Objectives .....	2-13
2.3.3 Deliverables .....	2-13
2.4 TSSC Ground System Network Security (PWBS 1.3.5) .....	2-14
2.4.1 Summary .....	2-14
2.4.2 Objectives .....	2-14
2.4.3 Deliverables .....	2-14
<b>Section 3 Science Work Description.....</b>	<b>3-15</b>
3.1 TSSC Science Team Support (PWBS 2.1.2) .....	3-15
3.1.1 Summary .....	3-15
3.1.2 Objectives .....	3-15
3.1.3 Deliverables .....	3-15
3.2 TSSC Science Research & Development (R&D) (PWBS 2.2.3) .....	3-15
3.2.1 Summary .....	3-15
3.2.2 Objectives .....	3-15
3.2.3 Deliverables .....	3-16
3.3 TSSC Cal/Val Development (PWBS 2.3.2) .....	3-16
3.3.1 Summary .....	3-16
3.3.2 Objectives .....	3-16
3.3.3 Deliverables .....	3-17
3.4 TSSC Cal/Val Tool Kit Development (PWBS 2.3.3) .....	3-17
3.4.1 Summary .....	3-17

3.4.2	Objectives:.....	3-18
3.4.3	Deliverables .....	3-18
<b>Section 4</b>	<b>Flight Systems Development Work Description .....</b>	<b>4-19</b>
4.1	TSSC Infrastructure Development (PWBS 3.1.3) .....	4-19
4.1.1	Summary .....	4-19
4.1.2	Objectives .....	4-19
4.1.3	Deliverables .....	4-20
4.2	TSSC Collection Activity Planning Development (PWBS 3.2.2).....	4-21
4.2.1	Summary .....	4-21
4.2.2	Objectives .....	4-21
4.2.3	Deliverables .....	4-22
4.3	TSSC Service Framework Development (PWBS 3.2.3).....	4-23
4.3.1	Summary .....	4-23
4.3.2	Objectives .....	4-23
4.3.3	Deliverables .....	4-24
4.4	TSSC LDCM Ground Network (LGN) Development (PWBS 3.4.2).....	4-24
4.4.1	Summary .....	4-24
4.4.2	Objectives .....	4-24
4.4.3	Deliverables .....	4-25
4.5	TSSC Data Collection and Routing Subsystem (DCRS) Development (PWBS 3.4.3) 4-26	
4.5.1	Summary .....	4-26
4.5.2	Objectives .....	4-26
4.5.3	Deliverables .....	4-27
4.6	TSSC Ground Network Systems Engineering (PWBS 3.4.4).....	4-27
4.6.1	Summary .....	4-27
4.6.2	Objectives .....	4-27
4.6.3	Deliverables .....	4-29
<b>Section 5</b>	<b>Data Processing and Archive System Development Work Description</b>	<b>5-30</b>
5.1	TSSC DPAS Development PM/SE (PWBS 4.1.3).....	5-30
5.1.1	Summary .....	5-30
5.1.2	Objectives .....	5-30
5.1.3	Deliverables .....	5-31
5.2	TSSC System Support (PWBS 4.1.4).....	5-32
5.2.1	Summary .....	5-32
5.2.2	Objectives .....	5-32
5.2.3	Deliverables .....	5-32
5.3	TSSC Ingest Development (PWBS 4.2.2).....	5-33
5.3.1	Summary .....	5-33
5.3.2	Objectives .....	5-33
5.3.3	Deliverables .....	5-35
5.4	TSSC Storage and Archive Development (PWBS 4.3.2) .....	5-36
5.4.1	Summary .....	5-36
5.4.2	Objectives .....	5-37
5.4.3	Deliverables .....	5-38

5.5	TSSC Inventory Development (PWBS 4.3.3)	5-39
5.5.1	Summary	5-39
5.5.2	Objectives	5-40
5.5.3	Deliverables	5-41
5.6	TSSC Metrics Database Development (PWBS 4.3.4)	5-42
5.6.1	Summary	5-42
5.6.2	Objectives	5-42
5.6.3	Deliverables	5-43
5.7	TSSC Product Generation Development (PWBS 4.4.2)	5-44
5.7.1	Summary	5-44
5.7.2	Objectives	5-44
5.7.3	Deliverables	5-46
5.8	TSSC Image Assessment Development (PWBS 4.4.3)	5-47
5.8.1	Summary	5-47
5.8.2	Objectives	5-47
5.8.3	Deliverables	5-49
5.9	TSSC Image Processing Development (PWBS 4.4.4)	5-52
5.9.1	Summary	5-52
5.9.2	Objectives	5-52
5.9.3	Deliverables	5-52
5.10	TSSC Subsetter Development (PWBS 4.4.5)	5-53
5.10.1	Summary	5-53
5.10.2	Objectives	5-53
5.10.3	Deliverables	5-54
5.11	TSSC Data Access Development (PWBS 4.5.2)	5-55
5.11.1	Summary	5-55
5.11.2	Objectives	5-55
5.11.3	Deliverables	5-56
<b>Section 6</b>	<b>Operations Readiness Work Description</b>	<b>6-59</b>
6.1	TSSC International Cooperator Support (PWBS 6.1.4)	6-59
6.1.1	Summary	6-59
6.1.2	Objectives	6-59
6.1.3	Deliverables	6-59
6.2	TSSC Operations Support (PWBS 6.1.5)	6-59
6.2.1	Summary	6-59
6.2.2	Objectives	6-59
6.2.3	Deliverables	6-60
<b>Section 7</b>	<b>LDCM Project Schedule</b>	<b>7-61</b>

## List of Figures

---

Figure 1: LDCM Project Work Breakdown Structure (PWBS) ..... 1-7

## List of Tables

---

Table 1. LDCM Subsystems Releases ..... 7-61

## **Section 1 Project Overview**

---

### **1.1 Landsat Data Continuity Mission (LDCM) Overview**

The Landsat Data Continuity Mission (LDCM) is managed as a partnership between the National Aeronautics and Space Administration (NASA) and the U.S. Geological Survey (USGS). NASA has the lead responsibility for mission definition, launch, and on-orbit checkout. The USGS is responsible for the development and integration of the ground system with the exception of the Mission Operations Element (MOE) and the Mission Operations Center (MOC). NASA will provide the space segment (observatory), launch services (launch vehicle), and provide for the utilization of the NASA space and ground network services.

The USGS will provide the balance of the LDCM Ground System including the development of acquisition planning capabilities, ground based satellite communication antennas and data networks, data capture, archiving, calibration/validation, user interface, and product generation capabilities.

Please note that the USGS LDCM project will be in the development phase of the ground system during the base year (April 2010-2011) of the Technical Support Services Contract (TSSC). Supporting project documents that detail the requirements, operations concept, and schedule information are included in the Bidders Reference Library. These documents include:

- Ground System Requirements Document (GSRD)
- Ground System Interface Requirements Document (GSIRD)
- Element Requirements Documents
- Ground System Architecture Diagram
- Ground System Operations Concept Document
- Element Operations Concept Documents
- Ground System Integrated Master Schedule (IMS)

## 1.2 USGS LDCM Project Work Breakdown Structure

The entire USGS LDCM Project scope is documented in the LDCM USGS Project Work Breakdown Structure (PWBS) used to identify all work across the USGS LDCM Project. TSSC tasks intended to be addressed for this document are color coded blue.

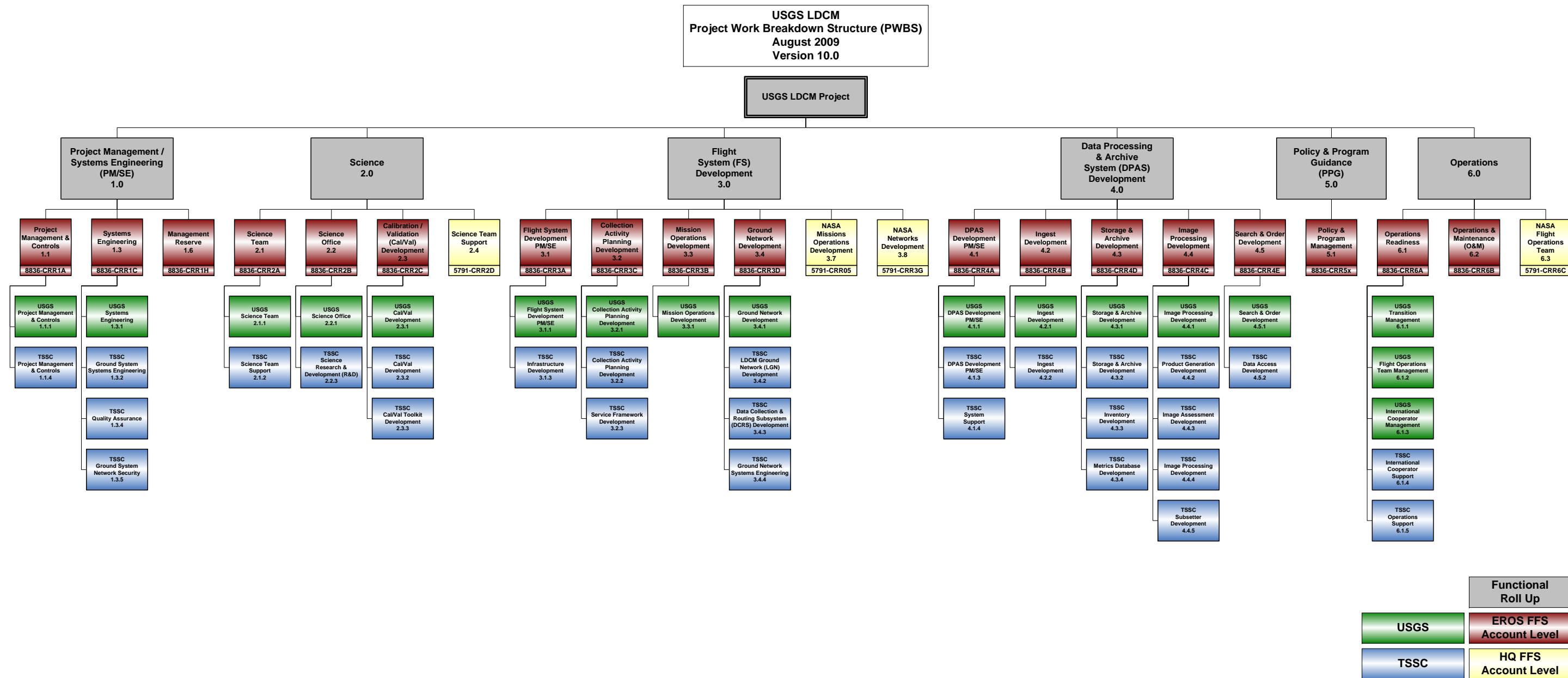


Figure 1:

LDCM Project Work Breakdown Structure (PWBS)

## **Section 2 Project Management and System Engineering Work Description**

---

### **2.1 TSSC Project Management and Controls (PWBS 1.1.4)**

#### **2.1.1 Summary**

The TSSC Project Management and Controls task contains the work to execute the policies, procedures, and systems used to plan, schedule, budget, and measure performance of the project.

#### **2.1.2 Objectives**

The objectives of the TSSC Project Management and Controls task are to provide overall project management and associated necessary controls, including scope, schedule, and budget control and execution for the indicated WBS work packages.

#### **2.1.3 Deliverables**

In addition to the deliverables required to meet the overall project objectives from each control account, the following specific TSSC Project Management and Controls deliverables are as follows:

- Identify, provide, and manage project resources appropriately to achieve work package scope, technical requirements, and schedule performance
- Provide, analyze, and maintain tools to effectively manage the approved TSSC scope, schedule, and budget
- Provide and maintain a Contractor Work Breakdown Structure (CWBS) one level below deliverables, and corresponding integrated baseline of scope, schedule, cost
- Provide and maintain actual integrated scope, schedule, cost reports to compare actual to baseline progress, and provide variance reports
- Provide quarterly TSSC self-evaluation input
- Provide monthly status reports to the USGS LDCM Project on all TSSC work activities. Report formats shall be agreed to by the USGS
- For milestone close-out activities, the contractor shall update and deliver all design, development, and test documentation to the USGS in a “as built/as-delivered” configuration; All documentation will be delivered in both hardcopy and electronic format that can be read, edited, and modified using standard office automation packages (i.e. MS Office) and/or the native tool/package used to originally generate the document, imagery, or graphic.
- Based on USGS direction and guidance, maintain and update the following:
  - LDCM Document Management Plan
  - LDCM Communication Management Plan
  - USGS Configuration Management Plan
  - Software Configuration Management Plan
  - Ground System Configuration Management Plan
- Provide technical content editing services to the project as needed

- Maintain TSSC EVM systems and processes and support TSSC integration with the USGS LDCM EVM system per the Government-provided Interface Control Document (ICD)
- Support Ground Systems and Development, configuration control, and schedule management

#### **2.1.4 Schedule Management Deliverables**

For the purposes of this TRD, it is assumed that the LDCM Project shall support all activities and events documented in the LDCM Ground System (GS) Integrated Master Schedule (IMS). This schedule will reflect major mission milestones and development relationships between the mission and segments across NASA, USGS, and their contractors. The LDCM GS IMS will be approved and maintained jointly by NASA and the USGS with support by the LDCM TSSC team. A USGS LDCM Master Schedule provides supporting detail to the GS IMS, reflects the USGS LDCM Project Scope depicted in the PWBS, and will be maintained by the TSSC team. Note that the TSSC team will also maintain Detailed Schedules for the TSSC-developed subsystems, which feed the USGS LDCM Master Schedule.

Support from the TSSC required for USGS LDCM Project schedule management includes the following:

- Provide development and maintenance for the LDCM GS IMS, the USGS LDCM Master Schedule, and the TSSC Detailed Schedules
- Support USGS Project Management as required to maintain and update USGS Detailed Schedules
- Maintain and update the USGS LDCM Schedule Management Plan and associated Schedule Administration document portal (DocuShare)
- Maintain and update the USGS LDCM Schedule Management Interface Control Document (ICD) for defining the relationship between the USGS LDCM Master Schedule and the subordinate Detailed Schedules
- Assist the USGS in overall maintenance and updates to the LDCM GS IMS to include key mission (NASA) milestones, relevant space segment milestones and all significant and principle activities within the GS development and implementation life cycle
- Using the LDCM GS IMS and USGS LDCM Master Schedule, identify and communicate critical path and near-critical path activities for the GS
- Conduct schedule modeling as requested by the USGS to calculate variances to ground systems activities and schedule reserve
- Support the USGS in meetings and discussions with NASA to ensure vertical consistency and traceability of schedules between mission and ground system components
- Coordinate and receive subordinate schedule status updates on a regular basis for incorporation into superior schedules. Facilitate change management, reporting, and analysis subsequent to schedule status updates

## **2.2 TSSC Ground System Systems Engineering (PWBS 1.3.2)**

### **2.2.1 Summary**

This section describes the work to be accomplished by the TSSC contractor in support of USGS LDCM Systems Engineering. The USGS is responsible for the LDCM Ground System and providing support to NASA LDCM systems engineering and system integrator efforts. Therefore the TSSC contractor is expected to provide level-of-effort (LOE) systems engineering support for LDCM Ground System development, implementation, testing and transition to operations and also support for USGS collaborative work with NASA on mission systems engineering. The scope of the mission systems engineering support includes staying abreast of upstream changes (e.g. Level 1 and Level 2 requirements) and interfaces to the other LDCM segments (spacecraft and launch), identifying potential changes to the GS based on upstream changes and working these through the defined system engineering processes. This is expected to be accomplished by participating with USGS and NASA in meetings and reviews.

Systems Engineering processes for the purposes of this document include requirements development and decomposition, interface definition, requirements verification as well as technical control processes for requirements and interface management, risk management and configuration management. The section is organized in 4 sub-sections that further describe the processes to be managed by the TSSC contractor. Each sub-section will provide a narrative of the objectives to be satisfied as well as deliverables to be provided by the contractor. The first subsection will describe requirements and interface management, the second will describe requirements verification work in terms of GS integration and test, the third will describe risk management and the fourth will describe configuration management.

Note that this is an on-going project that has completed initial requirements development and decomposition and interface definition. It will be in the implementation phase with system components at various levels of maturity at the start of contract. It is expected that any changed or new higher level requirements will follow the standard systems engineering processes for decomposition, traceability and verification.

### **2.2.2 Requirements and Interface Management**

#### **2.2.2.1 Objectives**

In support of the LDCM Ground System the TSSC contractor shall provide LOE systems engineering to include, but not be limited to, requirements management, analyses of technical requirements, functional and performance allocation of derived requirements, traceability, definition and maintenance of all interfaces, GS design and verification of all defined, allocated, and derived requirements, systems analyses and special studies as required, and tradeoff analyses.

### **2.2.2.2 Deliverables**

The TSSC contractor systems engineering support shall include but not be limited to, the following specific activities:

- Provide systems engineering technical direction and oversight to TSSC systems engineering staff
- Maintain the Systems Engineering Management Plan (SEMP) in support of the Ground System acquisition, development, integration and test
- Provide LDCM Ground Systems Engineering services including but not limited to engineering processes, requirements management, interface management, requirements traceability, and operations concept and architecture maintenance
- Provide ground system discipline area expertise to support mission systems engineering, including, but not limited to participation in NASA Systems Engineering discussions as well as space and launch segment technical discussions (instrument, spacecraft, etc.) and working groups
- Maintain the currency of Level 3 and Level 4 functional, performance and interface requirements including traceability and the associated Verification Requirements Matrix (VRM)
- Maintain the currency of GS level interface control documentation
- Support all GS peer reviews, project milestone, and status reviews as defined in the GS IMS, and prepare related documentation
- Perform engineering analysis across GS components (required for launch and on-orbit initialization and validation) to determine impacts to design margin, to validate design approach and to ensure appropriate contingency scenarios are addressed within design in accordance with Level 3 requirements
- Performing systems engineering and analysis in support of integration and test at the GS level and mission integration consistent with MRT definitions
- Support GS, DPAS, GNE, CAPE (and MOE as necessary for interface items) technical interface meetings, including technical issue resolution, performance verification plans, pending configuration change requests (CCRs), test data review, anomaly resolution activities, and test support planning
- Administer processes, systems and tools for requirements management (currently Dynamic Object Oriented Requirements System (DOORS))
- Administer processes, systems and tools for USGS GS documentation (currently DocuShare)
- Maintain and control Mission Data Flow Architecture diagram
- Support maintenance of the GS Software Acquisition Management Plan (SAMP)

### **2.2.3 GS Integration and Test**

#### **2.2.3.1 Objectives**

The TSSC contractor shall provide level of effort (LOE) support required by the USGS to plan and conduct Ground Systems Integration and Test activities as well as the infrastructure required to support them.

### **2.2.3.2 Deliverables**

The TSSC contractor systems engineering support shall include but not be limited to:

- Assist the USGS to ensure the various Ground System components and subsystems designs are verifiable to Level 3 requirements
- Assist the USGS and elements developers in integrating elements, subsystems, hardware and networks into the Ground System
- Assist the USGS in test planning, and test activities utilizing subsystems as required for Ground Readiness Tests and Mission Readiness Tests
- Assist the USGS in the generation and maintenance of the Ground System Integration Plan for Data Processing and Archive System (DPAS)
- Assist the USGS in support of NASA planning, and development of the GS Integration and Test Plan and GS Readiness Test Plan
- Support definition and implementation of a GS I&T infrastructure that defines strategy and approach and needed processes for GS I&T activities, including, but not limited to planning and definition of test environments, test resources, test procedures, test cases, test data and test discrepancy reporting processes.
- Maintain the GSRD Verification Requirements Matrix
- Support test dataset generation, including the simulated data identification and resource planning of L3 verification
- Facilitate preparation and execution of GRT TRRs
- Support preparation of I&T material for GS and Mission reviews
- Lead the GRT tests that have a have a nexus to EROS
- Support NASA lead Level 3 Integration and Test execution activities
- Facilitate the Test Discrepancy Board
- Generate test procedures, test data and support test activities, in cooperation with operators analysts and GS SE, for verification of Ground segment Level 3 requirements and Mission Sims
- Participate in the Mission I&T Working Group

### **2.2.4 Risk Management**

#### **2.2.4.1 Objectives**

The TSSC contractor shall provide level of effort (LOE) support required by the USGS to plan and conduct LDCM GS risk management activities.

#### **2.2.4.2 Deliverables**

The TSSC contractor systems engineering support shall include but not be limited to:

- Administer processes, systems and tools for risk management (currently TSSC developed spreadsheet)
- Assist with the identification, mitigation planning and mitigation implementation of Ground Systems risks
- Facilitate the USGS Risk Management Board (RMB)

## **2.2.5 Configuration Management**

### **2.2.5.1 Objectives**

The TSSC contractor shall provide level of effort (LOE) support required by the USGS to plan and conduct LDCM GS configuration management activities.

### **2.2.5.2 Deliverables**

The TSSC contractor systems engineering support shall include but not be limited to:

- Maintain the GS configuration management (CM) processes and documentation
- Administer processes, systems and tools for configuration management (currently NASA supplied and hosted application called Cicero )

## **2.3 TSSC Quality Assurance (PWBS 1.3.4)**

### **2.3.1 Summary**

Quality Assurance is an engineering level process that is performed over the lifecycle of the LDCM project to identify and mitigate any potential design, production, or operations deficiencies that could affect the success of the mission goals. Quality Assurance ties together a variety of project standards and processes that are in place to effectively manage all phases of the project life cycle. The TSSC Quality Assurance task is comprised of the disciplined application of five key process areas: Project Management, Quality Management, Systems Engineering, Risk Management, and Operations Management. Quality Assurance will develop the processes and practices necessary to ensure that products and services are designed and produced to meet or exceed customer requirements (and expectations). Quality Assurance Management will develop the standards and practices to be followed by the quality group, as well as those control processes used by other development groups. Audits will be completed as defined in the Quality Management Plan to verify that processes are still applicable and practical. Non-conformance and corrective action programs will be developed and used by the entire LDCM project. End item product verification will be completed prior to integrated test or turnover of any LDCM hardware, software or process.

### **2.3.2 Objectives**

The TSSC contractor shall provide level of effort (LOE) support required by the USGS to plan and conduct LDCM GS quality assurance activities.

### **2.3.3 Deliverables**

The TSSC contractor systems engineering support shall include but not be limited to:

- Maintain the GS Quality Assurance (aka Mission Assurance) processes and documentation (Mission Assurance Plan and Quality Management Plan)
- Administer processes, systems and tools for GS quality assurance
- Support Mission level MA/QA discussions as needed
- Perform Mission Assurance and Software Quality Assurance activities as specified in the Ground System Quality Assurance Management Plan, including, but not limited to documentation review and feedback, review participation and process verification, as needed

## **2.4 TSSC Ground System Network Security (PWBS 1.3.5)**

### **2.4.1 Summary**

The TSSC Ground System Network Security task is the combination of management, operational and technical controls applied to protect the LDCM Project IT assets from loss, misuse, alteration, unauthorized disclosure or access. The LDCM Security Team is responsible for maintaining IT security for the project's networks and assets per DOI/USGS policy.

### **2.4.2 Objectives**

The TSSC contractor shall provide level of effort (LOE) support required by the USGS to conduct LDCM GS network security activities.

### **2.4.3 Deliverables**

The TSSC contractor systems engineering support shall include but not be limited to:

- Provide LDCM security services including, but not limited to, system security scans, updates and security incident investigation and documentation
- Perform LDCM certification and accreditation activities (C&A) in association with the Landsat C&A, including, but not limited to IT Security Plan, Risk Assessment Reports, Interconnection Security Agreements, IT Security Self Assessment, IT Security Plan of Actions and Milestones document, and any other required C&A documentation and activities
- Support LDCM technical development through the application of security consulting services and participation in TIMs and Working groups as needed
- Coordinate as needed with NASA to support security discussions and preparation of security material for GS and Mission reviews
- Support for infrastructure engineering, design and implementation planning regarding MOC and DPAS GS network configurations, including C&A approach
- Review and provide feedback to LDCM project and Ground System documents for security implications, as required
- Support security aspects of GS documentation generation, including but not limited to the System Disaster Response and Recovery Plan, all infrastructure documents and design documents as requested by the USGS

## **Section 3 Science Work Description**

---

### **3.1 TSSC Science Team Support (PWBS 2.1.2)**

#### **3.1.1 Summary**

The TSSC Science Team Support task includes work associated with the planning of, participation in, and follow-up actions of the semi-annual Landsat science team meetings. It also includes participation in the working groups and committees associated with the Landsat Science Team and other interagency collaborations.

#### **3.1.2 Objectives**

This task has the following objectives:

- Support the Landsat Science Team by preparing briefing materials, participating in team meetings and working groups, and supplying technical assistance
- Manage Landsat Science Team data orders and other requests
- Support the Landsat Science Team through the participation in interagency working groups

#### **3.1.3 Deliverables**

This task has the following deliverables:

- Provide content for LDCM web site of Landsat Science Team meeting summaries
- Publish highlights from Landsat Science Team meetings

### **3.2 TSSC Science Research & Development (R&D) (PWBS 2.2.3)**

#### **3.2.1 Summary**

The TSSC Science Research & Development (R&D) task includes the work for conducting user characterization studies in research and investigations for algorithm development, conduction land surface monitoring studies, and facilitating communications and outreach activities.

#### **3.2.2 Objectives**

This task has the following objectives:

- Conduct and publish research and investigations in support of risk mitigation and the definition or verification of requirements for elements of the Data Processing and Archive System and the Flight Operations Segment
- Conduct and publish research into the development and demonstration of new data processing and product generation algorithms that advance the use of Landsat data for land surface monitoring. Including:
  - Provide support to algorithm research and development for automated cloud cover assessment of OLI image data
  - Prepare an algorithm description document and maintain version control of modifications to the document(s)

- Provide support to algorithm research and development on data reduction and scaling of cloud climatology and vegetation seasonality inputs to the LDCM Collection Activity and Planning Element (CAPE) as part of the Long Term Acquisition Plan (LTAP)
- Perform off-line modeling of LDCM LTAP inputs and decision rules for determining scene prioritization for scheduling OLI data collections
- Provide support to algorithm research and development for quantifying pixel-based quality control information to accompany LDCM standard data products
- Provide support to algorithm research, development, demonstration and validation of higher level LDCM data products, such as surface reflectance, brightness temperature, and surface temperature/emissivity
- Development of demonstration datasets for research and applications
- Develop and execute a communications plan that effectively disseminates mission status and technical information to the user community
- Solicit feedback from the user community to document the levels of service required from the LDCM Ground System

### **3.2.3 Deliverables**

This task has the following deliverables:

- White papers and technical reports as needed
- Technical presentations and briefing materials as needed
- Manuscripts for peer reviewed publication of research results
- Cloud cover assessment algorithm description document(s), prototype code, and test data of sufficient maturity for operational implementation
- Design templates and information content for LDCM web site
- Demonstration datasets for evaluation by researchers and applications scientists

## **3.3 TSSC Cal/Val Development (PWBS 2.3.2)**

### **3.3.1 Summary**

The TSSC Cal/Val Development task includes the work to define, develop, and implement the requisite capabilities to perform radiometric and geometric characterization, calibration, and correction of LDCM observatory data. It also includes the development and documentation of algorithms, procedures, and test data, as well as participation in the definition of requirements and methods to validate instrument data and product specifications.

### **3.3.2 Objectives**

This task has the following objectives:

- Develop, maintain, and execute a calibration/validation plan that enables radiometric, geometric, spatial, and spectral characterization of LDCM instrument data during the pre-flight development, on-orbit initialization and verification, and operations phases of the mission. Including:

- Provide support to algorithm research and software development to construct an OLI data simulator
  - Provide support to algorithm research and software development for OLI instrument calibration activities using the USGS Robotic Lunar Observatory
  - Provide input to DPAS developers regarding Algorithm Description Documents comments and questions
  - Provide support to the development of algorithm description documents for spectral, radiometric, geometric, and spatial characterization and calibration of LDCM data
  - Provide support to the analysis of prelaunch instrument test data collected by the instrument developers to characterize the prelaunch performance of the instruments
  - Provide comments to NASA on OLI and Spacecraft vendor CDRLs
- Publish the results of the LDCM instrument radiometric, geometric, spatial and spectral LDCM data characterization studies
  - Provide support to the DPAS and ground system level 5, 4, and 3 requirement verification and validation

### **3.3.3 Deliverables**

This task has the following deliverables:

- LDCM Calibration Plan that is maintained under version control
- Interface Requirements Document between the LDCM Ground System and the USGS Robotic Lunar Observatory (ROLO)
- Manuscripts submitted for peer review publication at the appropriate stages of research and development

## **3.4 TSSC Cal/Val Tool Kit Development (PWBS 2.3.3)**

### **3.4.1 Summary**

The Cal/Val team is responsible for developing the Cal/Val Tool Kit (CVTK) that consists of all algorithms required to perform spectral, radiometric, geometric, and spatial characterization and calibration of LDCM data and for the generation of LDCM standard data products. These algorithms will originate from BATC (OLI instrument contractor), NASA/GSFC, USGS/EROS and South Dakota State University. A process for the delivery, acceptance, documentation, and change control of these algorithms and associated software is to be defined, documented, and adhered to with concurrence from the USGS. These algorithms are then used to develop prototype code that will be provided to software engineers responsible for development and implementation of these algorithms into the operational ground system configuration. The CalVal team will provide regular reports on the status of delivery for the algorithms, documentation, prototype code, and test data.

### 3.4.2 Objectives:

This task has the following objectives:

- Document the process by which algorithm description documents, prototype code, and test data are received, managed under configuration control, and delivered to the software engineers responsible for operational Ground System development and implementation
- Define and document the process by which algorithm description documents, prototype code, and test data are received, managed under configuration control, and used to support pre-launch testing, on-orbit initialization and verification (OIV), and Initial Operational Commissioning (IOC)
- Define and document the sources of simulated data and instrument test data to be used for developing and validating algorithms and software to support pre-launch testing, on-orbit initialization and verification (OIV), and Initial Operational Commissioning (IOC)
- Provide algorithm description documents, prototype code, and test data that are at a high level of maturity in order to achieve rapid transition to development and implementation into the operational ground system

### 3.4.3 Deliverables

This task has the following deliverables:

- Algorithm packages that consist of algorithm description documents (inputs, outputs, description, procedures, maturity); prototype code, and test data (inputs, outputs)
- Configuration controlled repositories of algorithm description documents, algorithms, prototype code, and test data. These shall be managed to ensure explicit version control as follows:
  - Algorithm description documents, algorithms, prototype code, and test data received from BATC without modification
  - Algorithm description documents, algorithms, prototype code, and test data received from BATC but which have been modified and implemented for use in the Cal/Val Toolkit
  - Algorithm description documents, algorithms, prototype code, and test data that are provided for operational implementation
- Test Summary Reports as defined by Project and Mission milestones
  - Algorithm packages tested against simulate and/or instrument test data
  - Cal/Val Toolkit verification of DPAS subsystems implementation
- Schedule of Cal/Val Toolkit development that defines the phases of algorithm package deliveries that meet requirements of the Project and Mission milestones

## **Section 4 Flight Systems Development Work Description**

---

### **4.1 TSSC Infrastructure Development (PWBS 3.1.3)**

#### **4.1.1 Summary**

This task consists of the work for LDCM project-wide network planning and implementation, along with project-wide hardware engineering support in areas that are the responsibility of the USGS as defined in the implementation agreement with NASA.

#### **4.1.2 Objectives**

The objectives below delineate the work covered under this task until the ground system is transitioned to operations.

##### Project-Wide Network Support :

- Support planning and implementation of networking for CAPE, GNE and DPAS
- Coordinate with development staff to ensure network needs are being satisfied in a timely manner (i.e. – servers are getting connected to the LAN, etc.)
- Coordinate with NASA LDCM network engineers, as required, on mission-wide network activities
- Coordinate network planning and implementation activities with LDCM network security to ensure IT security requirements are being addressed
- Represent the LDCM project in overall USGS/EROS center wide network activities (i.e. – firewall rules coordination and implementation, etc.)
- Generate inputs, as required, to ground system reviews and presentations
- Develop a detailed resource plan for the network support activity
- Provide project status reporting as required to assess performance of this task in accordance with overall TRD reporting and communication requirements

##### Project-Wide Hardware Engineering Support:

- Installation of new equipment deliveries
- Coordination with network engineers, systems administrators, and database administrators to set up development and/or operational environments on newly-installed servers, as required
- Hardware modifications to existing servers (i.e. – adding interface cards, adding more storage or memory, etc.)
- Working with development staff to troubleshoot server and/or equipment problems and issues
- Initiate and coordinate warranty repair actions by vendors with the development staff to ensure problems are resolved quickly with minimum disruption to development activities
- Jointly develop a long-term maintenance and support plan for CAPE, GNE and DPAS equipment and systems, in conjunction with element developers, implementers, and sustaining engineering staff
- Maintain a database of equipment configurations and warranty renewal obligations for USGS LDCM equipment

- Generate documentation to support procurement actions required to perform hardware engineering functions and activities (i.e. – repair work orders with vendors, etc.)
- Generate inputs, as required, to ground system reviews and presentations
- Develop a detailed resource plan for the hardware engineering support activity
- Provide project status reporting as required to assess performance of this task in accordance with overall TRD reporting and communication requirements

#### **4.1.3 Deliverables**

The infrastructure team is responsible for the hardware and networks to support the project, GNE and DPAS, as well as the test and development systems of the CAPE. The task deliverables are primarily limited to preparation for assuming the sustaining engineering role in out-years, with some elements of ongoing network support and hardware engineering, and are as follows:

- Detailed CAPE, GNE, and DPAS infrastructure schedule and resource plan for activities listed above
- Participation in infrastructure related meetings, TIMs and working groups, as required
- Infrastructure engineering analyses, as required
- Perform infrastructure planning, engineering and design activities for the USGS-led portions of the GS.
- Inputs to CAPE, GNE, DPAS, and Ground System and Mission presentations and reviews, as required
- Procurement activities and documentation as required to execute the above objectives
- Coordination of CAPE, GNE & DPAS hardware placement, installation, configuration and setup of systems, hardware and network integration of CAPE, GNE & DPAS elements, as required
- Infrastructure activities necessary to meet Level 3 infrastructure requirements for hardware and networks and support requirements verification, as required
- Engineering effort to support network planning and implementation, including, but not limited to the Network Interfaces Planning Document (NIPD)
- CAPE, GNE and DPAS long-term maintenance and support plan for annual renewal of vendor support and/or maintenance contracts and equipment refresh.
- Status reporting inputs, as required
- Inputs to ground system Level 3 requirements verification, GRT, and MRT test plans and procedures
- Infrastructure support during execution of Level 4 testing, as well as GRTs, MRTs, Mission Sims, and RF compatibility testing
- Develop, maintain, and coordinate the Facility Definition Document and Facility Implementation Plan and schedule, in support of development, integration, test, and operational verification, including facility preparation, hardware placement, networks, procurements, schedules, physical security, and other infrastructure activities

## **4.2 TSSC Collection Activity Planning Development (PWBS 3.2.2)**

### **4.2.1 Summary**

This task consists of the work needed to develop, deliver, integrate and test the Collection Activity Planning Element (CAPE) of the LDCM Ground System. The CAPE creates and manages an image acquisition request schedule for each operational LDCM sensor. The acquisition schedule incorporates requests for calibration activities, International Cooperator coverage and other special requests. The schedule is optimized to honor a maximum number of these requests while fulfilling the Long Term Acquisition Plan (LTAP-8) requirements and also considering all engineering constraints and operational policies.

### **4.2.2 Objectives**

This task has the following objectives:

- Implement detailed design approved by the USGS at the CAPE CDR for the 2.0 and 3.0 releases
- Deliver, integrate and test the CAPE 2.0 and 3.0 releases
- Provide technical feedback and participate in the Level 4 requirements change management process
- Provide technical representation of the CAPE in overall project meetings and working groups, as requested by the USGS
- Conduct Level 4 engineering analysis to support the ground system and mission-level system engineering, as required
- Generate inputs, as required, to ground system reviews and presentations
- Generate procurement specifications and support preparation of documents for equipment required to implement, integrate, and test the CAPE 2.0 and 3.0 releases, and as needed, for CAPE sustaining engineering activities
- Provide systems engineering and development expertise in support of CAPE implementation activities, required engineering analysis, associated trade studies, interface control, and implementation
- Generate the test plan for verification of CAPE Level 4 requirements implemented in the CAPE 2.0 and 3.0 releases
- Generate test procedures, test data and support test activities, in cooperation with the Flight Operations Team (FOT), for verification of CAPE Level 4 requirements implemented in the CAPE 2.0 and 3.0 releases
- Support generation of ground system Level 3 requirements verification, ground readiness (GRT), and mission readiness (MRT) test plans and procedures, as required, by serving as a liaison between the test team and station operations staff, and by serving as a subject matter expert on both the end-to-end CAPE implementation and specific pieces of CAPE equipment and/or systems
- Generate and present the CAPE Level 4 test readiness review (TRR) for the 2.0 and 3.0 releases and element pre-ship review
- Conduct CAPE functionality and performance testing to verify Level 4 requirements in the CAPE 2.0 and 3.0 releases

- Provide CAPE Level 4 test results and final requirements verification package for the 2.0 and 3.0 releases
- Perform integration and installation of the CAPE 2.0 and 3.0 releases into the Goddard MOC and associated networks
- Coordinate installation of the 2.0 and 3.0 releases with the FOT staff, as required
- Provide a list of all tools and packages required to maintain, modify, and enhance the CAPE for each CAPE release
- Deliver final versions of all CAPE source, object code and executables as necessary, including any tools and utilities required to build and/or make the CAPE
- Deliver final versions of all source and object code for Government-Off-the-Shelf systems used in the CAPE (i.e. MPS)
- Support integration of CAPE infrastructure into the GS, as needed, after delivery of the initial release of the CAPE
- Develop a detailed resource plan for the CAPE sustaining engineering activity
- Jointly develop a long-term maintenance and support plan for CAPE equipment and systems, in conjunction with element developers and implementers, and hardware engineering
- Coordinate with NASA, the FOT, and the infrastructure group to execute the plan for long-term maintenance and support of vendor equipment
- Delivery all government-procured hardware and/or software used to design, develop, integrate, or test each CAPE release
- Generate training materials, as required, for CAPE transition into operations for each release
- Provide training on the CAPE installation, configuration, and operations to operators and sustaining engineering staff, as required for each release
- Provide user's manuals and configuration guides for each release
- Update all documentation to as-built/as-tested/as-delivered for each CAPE release and any bug fixes implemented
- Provide LOE CAPE sustaining engineering, in conjunction with MOC staff, the FOT, and infrastructure staff
- Provide project status reporting as required to assess performance of this task in support of overall project reporting and communication requirements

#### **4.2.3 Deliverables**

This task has the following deliverables:

- Subject matter expert support for GRTs on CAPE design and operations, aiding the FOT in development of operational procedures for use of the CAPE, aiding the GRT test team and FOT in definition of test cases and scenarios, resolution of Test Discrepancy Reports (TDRs), implementation of bug fixes as needed, and analysis/reduction of GRT test results as needed
- Inputs to Ground System Level 3 requirements verification, GRT, and MRT test plans and procedures
- Implementation of the CAPE 2.0 release

- Generation of test plans and procedures for the 2.0 release, including presentation of a TRR
- Integration and Level 4 requirements verification for the CAPE 2.0 release
- Generation and presentation of a pre-ship/acceptance review for CAPE 2.0
- Any new source code, executables, tools, or other materials for the 2.0 release
- Partial implementation of the CAPE 3.0 release
- Technical feedback on the requirements/change maintenance and control process, as required
- Procurement documentation and specifications, as required
- System engineering support, as required for GRTs
- Updated schedule and other project management materials, as necessary, to assess the progress of the CAPE 2.0 and 3.0 implementation effort
- Status reporting inputs, as required

### **4.3 TSSC Service Framework Development (PWBS 3.2.3)**

#### **4.3.1 Summary**

The Service Framework Development task includes the level of effort (LOE) support to maintain the Service Oriented Architecture (SOA)/web services framework used to support MOE and CAPE messaging. This task includes maintenance of the services framework software, implementation of enhancements and bug fixes required to address issues that arise in segment/element development, integration, and test, and support for use of the services framework during MOE and CAPE development, integration, and test.

#### **4.3.2 Objectives**

This task has the following objectives:

- Maintain documentation and training materials on the service framework
- Generate any procurement support documentation required for sustaining engineering of the service framework
- In coordination with the CAPE development team and the infrastructure team, execute the annual refresh plan for any components of the service framework requiring maintenance or support contract renewals
- Maintain the service framework and perform sustaining engineering efforts to support utilization of the service framework by CAPE and MOE, specifically:
  - Support CAPE and MOE development efforts where the service framework is used
  - Support CAPE and MOE integration efforts where the service framework is used
  - Support CAPE and MOE testing efforts where the service framework is used
  - Modify services in the service framework as required to address issues that arise in the CAPE and MOE development, integration, and test efforts

- Add/host new services in the service framework as required to address issues that arise in the CAPE and MOE development, integration, and test efforts
- Perform repairs and “bug fixes” for the service framework as required to address issues that arise in the CAPE and MOE development, integration, and test efforts
- Provide project status reporting as required to assess performance of this task in support of overall project reporting and communication requirements

### **4.3.3 Deliverables**

This task has the following deliverables:

- Implementation of any bug fixes, as required
- Documentation updates for any changes made to the service framework
- Any new source code, executables, tools, or other materials for any updates or bug fixes made to the service framework
- Inputs to the requirements/change maintenance and control process, as required
- System engineering support, as required for GRTs
- Procurement documentation and specifications, as required
- Status reporting inputs, as required

## **4.4 TSSC LDCM Ground Network (LGN) Development (PWBS 3.4.2)**

### **4.4.1 Summary**

The LDCM Ground Network (LGN) task consists of the work performed by Landsat Data Capture and Processing Facility (DCPF) staff to support the implementation of the USGS/EROS LGN station by the GNE development team, per an agreement between the LDCM and Landsat projects.

### **4.4.2 Objectives**

This task has the following objectives:

- Provide DCPF staff engineering and technical expertise for participation in LDCM project meetings, TIMs and Working Groups, as required
- Develop detailed schedule and resource plan for DCPF participation in LGS engineering and integration activities
- Generate inputs, as required, to GNE and ground system reviews and presentations
- Coordinate with the GNE development team for modifications and enhancements to the USGS/EROS LGN Station to meet LDCM requirements
- Assist the GNE development team in generating procurement support documentation and specifications for equipment required for implementing the LGS LGN station
- Assist the GNE development team in conducting element-level engineering analysis to support GS and mission-level system engineering, as required

- Support LGS integration into the LGN, including assisting in the installation and checkout of ground station equipment by the GNE development team, as required, and testing for L4 requirements verification by operations staff
- Support out-year operational LGS activities in support of ground readiness (GRT) and mission readiness (MRT) testing, generate ops procedures for testing, provide inputs to generation of test cases, operate the LGS station for execution of GRTs and MRTs involving the LGS, provide engineering and troubleshooting for resolution of any test discrepancies in cooperation with the GNE development team and sustaining engineering, participate in other launch preparation activities
- Jointly generate a plan for long-term maintenance and support of vendor equipment required for LDCM usage of LGS, in cooperation with the Landsat project and the infrastructure team
- Generate training materials and SOPs in cooperation with the GNE development team, as required, for LGS transition into LDCM operations
- Provide training of operations staff, as required
- Develop a detailed resource plan for DCPF implementation of LDCM-specific requirements, integration, testing, and operational staffing of mission-level test activities
- Provide project status reporting as required to assess performance of this task in accordance with overall TRD reporting and communication requirement

#### **4.4.3 Deliverables**

This task has the following deliverables:

- Attendance at LDCM project meetings and working groups, as required
- Inputs to ground system reviews and presentations, as needed
- Detailed LGN schedule and resource plan
- LGN engineering analyses, as required
- Engineering and technical expertise to assist the GNE development team in modifications and enhancements to the LGS station to meet LDCM requirements
- Support for LGS integration into the LGN and GNE, as required, including assisting the GNE development team in the installation and checkout of ground station equipment and testing for L4 and L3 requirements verification
- Procurement support documentation and specifications for equipment and services, as required
- LGN equipment long-term support/maintenance plan for annual refresh of support and/or maintenance contracts, developed in cooperation with the Landsat project, the GNE development team, and sustaining engineering
- Updated operations procedures for LDCM operations in support of GNE Level 4 testing and GRTs, as required
- Participation in GNE Level 4 testing and GRTs, as required
- Operator training material, as required
- Operator training, as required
- Status reporting inputs, as required

## **4.5 TSSC Data Collection and Routing Subsystem (DCRS) Development (PWBS 3.4.3)**

### **4.5.1 Summary**

The Data Collection and Routing Subsystem (DCRS) task covers all work to develop, implement, integrate, test, document, and deliver the DCRS to the Ground Network Element (element-level). This also includes work required to address test discrepancies found in Level 4 and 5 GNE testing that lead to modifications of the DCRS.

### **4.5.2 Objectives**

This task has the following objectives:

- Develop detailed schedule and resource plan to complete implementation of the DCRS, including integration with the overall GNE schedule
- Generate procurement support documentation and specifications for DCRS host equipment, as needed
- Implement DCRS detailed design approved by the USGS at GNE CDR
- Provide the DCRS source code, along with any tools or scripts required to build/make/install the DCRS application
- Test DCRS modifications and enhancements to verify existing DCRS Level 5 requirements are satisfied
- Provide the completed test procedures and test results package for the DCRS (Level 5 test and requirements verification)
- Generate and provide the documentation package to support DCRS and GNE operations and sustaining engineering
- Support preparation of GNE design review(s)
- Support preparation of ground system design review(s)
- Support integration of the DCRS into the GNE
- Support Level 4 testing of the GNE for DCRS functions
- Provide modifications and “bug fixes” as required to support GNE Level 4 testing
- Generate training material for operations staff
- Provide training materials and train operations staff to use the DCRS to support LDCM operations
- Provide level of effort (LOE) DCRS sustaining engineering following successful completion of GNE Level 4 testing
- Provide support for DCRS integration into and testing with the ground system
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support integration, GRTs and MRTs
- Provide updated documentation to reflect the as-built/as-installed DCRS, including periodic updates as required when bug fixes and/or enhancements are implemented
- Provide project status reporting as required to assess performance of this task in support of overall TRD reporting and communication requirements

### **4.5.3 Deliverables**

This task has the following deliverables:

- Completed DCRS Release 1.0
- Inputs to GNE and other ground system reviews, as needed
- DCRS source code, along with any tools or scripts required to build/make/install the DCRS application
- Completed test procedures and test results package for the DCRS Level 5 test and requirements verification
- Documentation package to support DCRS operations and sustaining engineering
- Support for GNE Level 4 testing, GRTs, and MRTs, as needed
- Modifications and bug fixes as required to support integration, GRTs, and MRTs
- Operator training material, as required
- Operator training, as required
- Status reporting inputs, as required

## **4.6 TSSC Ground Network Systems Engineering (PWBS 3.4.4)**

### **4.6.1 Summary**

The TSSC Ground Network Systems Engineering task covers the contract systems engineering support provided by the TSSC to assist the USGS with the design, implementation, integration, testing, documentation, and delivery of the Ground Network Element (GNE) of the LDCM Ground System.

### **4.6.2 Objectives**

This task has the following objectives:

- Provide technical feedback and participate in the Level 4 and Level 5 requirements change management process
- Represent the GNE in overall project meetings and working groups, as required
- Conduct element-level engineering analysis to support GNE and mission-level systems engineering, as required
- Generate inputs, as required, to ground system reviews and presentations
- Prepare and conduct the GNE design reviews for test readiness and pre-ship/acceptance
- Close out review actions, as directed by the USGS
- Generate procurement specifications and support preparation of documents for equipment required to implement, integrate, and test the GNE, as required, and as needed, for GNE sustaining engineering activities
- Provide systems engineering and development expertise in support of GNE design activities, required engineering analysis, associated trade studies, interface control, and element implementation
- Implement the GNE design using the DCRS, the NOAA ground station at Gilmore Creek, AK (GLC), and the USGS/EROS ground station at Sioux Falls, SD (LGS)

- Develop and maintain a detailed schedule and resource plan for implementation of the GNE
- Coordinate and support modifications and enhancements performed by USGS LGS DCPF and NOAA GLC staff to meet LDCM requirements
- Support procurements of LDCM Demodulators by reviewing factory and site acceptance testing, as required, and integrating the Demodulators into LGN stations
- Support procurements of LDCM Command and Telemetry Processor (CTP) units from NASA/GSFC contractors by integrating the CTPs into LGN stations
- Integrate LDCM-provided GNE components and subsystems into the GLC and LGS stations
- Support integration and configuration of the GLC and LGS ground stations for LDCM
- Generate test procedures, in cooperation with GLC and LGS station staff, for verification of GNE level 4 requirements
- Generate and present the GNE level 4 test readiness review (TRR)
- Support conducting of GNE level 4 testing and requirements verification
- Generate the GNE level 4 test results and final requirements verification package
- Support GNE integration into the Ground System, as required
- Provide updated documentation to reflect the as-built/as-installed GNE, including periodic updates as required when bug fixes and/or enhancements are implemented prior to completion of level 4 requirements verification testing
- Where applicable, deliver final versions of all GNE source, object code and executables as necessary, including any tools and utilities required to build and/or make any equipment used in the GNE
- Jointly develop and execute a long-term maintenance and support plan for GNE equipment and systems, in conjunction with LGN station staff and LDCM infrastructure staff
- Provide a list of all tools and packages required to maintain, modify, and enhance the GNE
- Delivery of all government-procured hardware and/or software used to design, develop, integrate, or test the GNE
- Provide training to TSSC sustaining engineering and operations staff as required to ensure the TSSC and/or station staff can maintain the GNE during GRTs, MRTs, and operations
- Support generation of ground system Level 3 requirements verification, ground readiness (GRT), and mission readiness (MRT), and RF compatibility test plans and procedures, as required, by serving as a liaison between the test team and station operations staff, and by serving as a subject matter expert on both the end-to-end GNE implementation and specific pieces of GNE equipment and/or systems
- Develop a detailed resource plan for the GNE sustaining engineering activity
- Provide LOE sustaining engineering for the GNE, LDCM equipment installed

- Provide any material required for sustaining engineering training
- Provide user's manuals and configuration guides
- Provide project status reporting as required to assess performance of this task in support of overall project reporting and communication requirements

#### **4.6.3 Deliverables**

This task has the following deliverables:

- Procurement documentations and specifications, as needed
- Implementation of the GNE using the existing LGS and GLC stations
- Level 4 requirements verification procedures
- Level 4 requirements verification test data package
- Plan for long-term maintenance and support of vendor equipment
- Final versions of all GNE documentation, source, object code, and executables as necessary, including any tools and utilities required to build and/or make any equipment used in the GNE
- All government-procured hardware and/or software used to design, develop, integrate, and test the GNE
- List of all tools and packages required to maintain, modify, and enhance the GNE
- Bug fixes and updates, as required, to address problems found in Level 4 requirements verification testing, integration, and/or GRTS
- Operator and sustaining engineering training material, as required
- Operator and sustaining engineering training, as required
- User's manuals and configuration guides
- Support for integration and/or GRTs, as needed
- Status reporting inputs, as required

## **Section 5 Data Processing and Archive System Development Work Description**

---

### **5.1 TSSC DPAS Development PM/SE (PWBS 4.1.3)**

#### **5.1.1 Summary**

The TSSC Data Processing and Archive System (DPAS) Development PM/SE task provides the contractor project planning and management services and the systems engineering services for the Data Processing and Archive System. The on-going tasks for this area include:

- Contract budget management and planning
- Contract staff planning, coordination, and scheduling
- Contract cost account management
- Systems engineering support for DPAS design reviews
- Element documentation support for requirements, operations concepts, design and architecture
- Provide support for level 4 and level 5 requirements control, traceability, allocation, and verification
- Support risk and issue identification and mitigation

#### **5.1.2 Objectives**

For the DPAS tasks identified in this TRD, the contractor shall work iteratively with the USGS DPAS systems engineer and DPAS work manager to modify existing heritage requirements to include LDCM requirements. It is expected that the contractor will map heritage software specifications to existing LDCM requirements. To accompany this process, the contractor shall provide systems engineering support at the subsystem level and work in conjunction with any similar tasks specified in the Landsat TRD (TRD 17). The contractor shall use engineering practices that comply with the USGS LDCM Systems Engineering Management Plan and the USGS LDCM Software Management Plan.

- Support the following milestone reviews for the DPAS element:
  - Critical Design Review
  - Test Readiness Review
  - Operational Readiness Review (when delivered to the GRT and/or MRT environment)
- Assist DPAS level engineering tasks necessary to complete the requirements, architecture, data flow, design and integration of components at the subsystem level.
- Assist the USGS to ensure the various DPAS subsystem designs are traceable to approved Level 4 and Level 5 requirements, generating the DPAS Design Document.
- Assist the USGS to ensure the various DPAS subsystem requirements and designs are verifiable to Level 4 requirements, generating the DPAS VRM.
- Assist the USGS in the planning, preparation, and execution of Ground System and Mission level reviews.

- Support the USGS in the DPAS planning, preparation and participation in technical discussions of TIMs and Working Groups and engineering reviews as needed.
- Support engineering analysis for updates and changes to DPAS Level 4 requirements, as needed.
- Provide DPAS requirements management at Level 5.
- Provide DPAS interface management between subsystems, including the generation of a DPASIRD
- Review and provide feedback to subsystem plans and technical documents as required.
- Generate the test plan for verification of DPAS Level 4 requirements
- Generate test procedures, test data and support test activities, in cooperation with the TSSC Operations Support task, for verification of DPAS Level 4 requirements
- Generate and present the DPAS Level 4 test readiness review (TRR) and Element Preship Review
- Conduct DPAS functionality and performance testing to verify Level 4 requirements
- Provide DPAS Level 4 test results and final requirements verification package
- Perform integration and installation of the DPAS into the Landsat Operations and associated networks
- Deliver final versions of all DPAS source, object code and executables as necessary, including any tools and utilities required to build and/or make the DPAS
- Deliver final versions of all DPAS source and object code for any Government-Off-the-Shelf systems used in the DPAS
- Generate plan for long-term maintenance and support of vendor equipment
- Provide a list of all tools and packages required to maintain, modify, and enhance the DPAS
- Delivery all government-procured hardware and/or software used to design, develop, integrate, or test the DPAS
- Generate training materials, as required, for DPAS transition into operations for each release
- Provide training on the DPAS installation, configuration, and operations to operators and sustaining engineering staff, as required for each release
- Provide user's manuals and configuration guides for each release
- Provide project status reporting as required to assess performance of this task in support of overall TSSC project reporting and communication requirements
- Generate test procedures, test data and support test activities, in cooperation with operators, for verification of Ground segment Level 3 requirements and Mission Sims.

### **5.1.3 Deliverables**

- Critical Design Review materials
- Test Readiness Review materials

- Operational Readiness Review materials
- Test plan and procedures
- Training materials
- Status reporting inputs, as required

## **5.2 TSSC System Support (PWBS 4.1.4)**

### **5.2.1 Summary**

This task will provide all systems administration, systems security administration (excludes mission security), and database administration services for the LDCM ground system that is the responsibility of USGS. While much of the work in this task is considered level of effort (LOE), the number of systems and databases needed to reuse the heritage architecture to meet LDCM requirements provides a basis for estimate. The contractor shall assume the system:

- Is based on heritage Landsat processing architecture and LDCM storage and archive architecture
- Consists of reuse of existing LDCM equipment to create a separate environment (minimal impact to the existing Landsat project)
- Replaces old outdated equipment with new equipment when necessary
- Will use a phased in approach that allows for a small footprint (~<20) of systems during development and integration test. More equipment will be purchased to support throughput prior to launch of LDCM.
- Database installations for DPAS will be similar to heritage databases (same databases with LDCM specific schemas)

### **5.2.2 Objectives**

This task has the following objectives:

- System setup and configuration
- Routine system administration such as creating accounts, installing patches, and routine system backups
- Database administration including database install support, backups, and install support for software patches
- Support of LDCM Asset Tracking
- Advanced Scripting and Automation
- Support of GRTs and MRTs
- Support any development and integration activities and provide necessary inputs for subsystem reviews
- Support system build and configurations
- Support USGS Ground System hardware procurements including system specifications
- Track system configuration and system change requests

### **5.2.3 Deliverables**

This task has the following deliverables:

- System configurations to support development, integration, testing and operational environments.
- System patch installations as necessary
- System COTS software installation as necessary
- Any input necessary for subsystem reviews. (i.e. Physical architecture design documents, hardware configuration plans, etc)
- Support for configurations to support development, integration, testing and operational environments.
- System and database backups
- Inventory of LDCM systems
- System configuration and change requests

### **5.3 TSSC Ingest Development (PWBS 4.2.2)**

#### **5.3.1 Summary**

This task includes developing a new subsystem to produce LORa data from mission data. Specifically, the Ingest subsystem:

- Gathers the inputs necessary to produce LORa data from mission data and perform any interval characterizations.
- Produces LORa Data.
- Calls appropriate storage and archive routines to archive mission data and store LORa data.
- Creates mission, scene, and interval inventory.
- Performs interval characterizations.
- Writes interval characterizations to the IAS database.
- Generates LORp WRS Scene data from LORa data, creating scene inventory

#### **5.3.2 Objectives**

##### **Ingest Subsystem Objective #1: Provide Engineering and Development for the LDCM Ingest Subsystem**

The contractor shall implement the Ingest Subsystem system in support of LDCM activities including:

- Define the subsystem operations concept for using heritage Ingest Subsystem to meet LDCM requirements
- Modify existing subsystem requirements documents to add LDCM requirements that map to government supplied level 4 requirements
- Develop traceability matrix between Ingest Subsystem requirements and LDCM requirements
- Modify the Ingest Subsystem test plan for implementation of changes to meet LDCM requirements
- Test the Ingest Subsystem to verify USGS Supplied Level 4 Ingest allocated requirements
- Patch the Ingest Subsystem system as necessary

- Define modifications and/or enhancements required for baseline of the Ingest Subsystem to meet LDCM requirements
- Develop detailed schedule and resource plan to implement the Ingest Subsystem modifications and enhancements, including integration with the DPAS schedule
- Provide a release package for delivery of the Ingest Subsystem to the USGS
- Generate procurement support documentation for additional Ingest Subsystem host equipment to meet LDCM requirements
- Generate/update documentation package to support modified/enhanced of the Ingest Subsystem sustaining engineering
- Support preparation of the Ingest Subsystem design review(s)
- Support preparation of ground system design review(s)
- Support integration of the Ingest Subsystem into the DPAS
- Generate training material for operations staff
- Train operations staff to use the Ingest Subsystem to support LDCM operations
- Provide support for DPAS integration
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall reporting and communication requirements
- Provide release documentation that describes the changes and content of each subsystem release
- Perform installation in the GRT, MRT and Operational Environments
- Create a simulator that produces Mission Data compliant to the Data Format Control Book (DFCB) for the purpose of testing DPAS components at all levels

**Ingest Subsystem Objective #2: Generate LORa Data and LORp Data**

The contractor shall develop a ingest system which will produce LORa data from Mission Data and LORp data from LORa data.

**Ingest Subsystem Objective #3: Modify the Ingest Subsystem for GRT and MRT Updates. Include Capabilities to Perform Interval Cal/Val Characterizations**

The contractor shall modify the engineer and develop the Ingest Subsystem to include the interval characterizations necessary for image processing and Cal/Val trending as defined in the Cal/Val Algorithm Theoretical Basis Documents (ATBDs). The contractor shall also include any discrepancies or bug fixes found during ground system testing.

**Ingest Subsystem Objective #4: Expand Ingest Capabilities to Reprocess LDCM Data**

The contractor shall perform any modifications necessary to the Ingest Subsystem, where applicable, to expand ingest capabilities to reprocess data using automated methods.

### 5.3.3 Deliverables

#### **Objective #1 Deliverables:**

As part of the engineering process, the contractor shall produce documents where applicable for the Ingest Subsystem. This includes the following documents:

- Update Subsystem Requirements Specification / Allocation (in DOORS)
- Subsystem Verification Matrix
- Subsystem Test Plan(s)
- Updates to Subsystem Interface Specifications
- Preliminary Database Design
- Subsystem Design Document
- Implementation and Integration Schedule Including Detailed Design
- Release Documentation
- Lead the on-going revisions to the LORa Data Format Control Book and LORp Data Format Control Book including ancillary and metadata file definition (This includes updating the draft DFCBs as well as leading data format working groups that involves the Cal/Val Team, Landsat operations, and Instrument Vendor).
- Mission Data Format Control Book
- Lead the GNE to DPAS ICD development
- Modify other Landsat documents as necessary in support of LDCM activities.
- Mission Data Simulator

In support for DPAS integration, ground readiness and mission readiness tests, the contractor shall:

- Provide training to operations staff
- Provide maintenance releases or bug fixes in support of DPAS integration

#### **Objective #2 Deliverables**

For this objective, the contractor shall provide a software release of the Ingest Subsystem on USGS supplied hardware to perform the following capabilities. It is recognized that simulated test mission data will also need to be developed by the contractor to use in testing.

- Produce LORa data from Mission Data
- Receive Interval Definition Files (IDFs) from the GNE
- Receive interval data from the GNE
- Receive manually-generated Calibration Parameter Files (CPFs)
- Inventory Mission and LORa data using inventory software functions as part of the heritage inventory system. This must include scene and interval metadata
- Call appropriate archive and data storage routines as part of the storage and archive system to archive Mission and store LORa data
- Perform metrics, checks and controls and other quality checks
- Perform error handling
- Provide an operational control log or GUI to DPAS operators

#### **Objective #3 Deliverables**

The contractor shall provide releases of the Ingest Subsystem system as needed for the following situations:

- Minor Release(s) to accommodate issues found during GRTs
- Performance modifications to accommodate MRTs
- Retrieve CPFs from the IAS as defined in the Ingest to IAS ICD
- Perform the Impulse Noise Characterization algorithm delivered from the Cal/Val toolkit and defined as part of the impulse noise ATBD
- Perform the Saturated Pixel Characterization from the Cal/Val toolkit and defined as part of the impulse noise ATBD
- Perform the Histogram Statistics Characterization from the Cal/Val toolkit and defined as part of the impulse noise ATBD
- Perform the Bias Model Calibration from the Cal/Val toolkit and defined as part of the Bias Model Calibration ATBD
- Dropped Frame Characterization from the Cal/Val toolkit and defined as part of the Bias Model Calibration ATBD
- Store output from calibrations in the IAS database

#### **Objective #4 Deliverables**

The contractor shall provide a release of the Ingest Subsystem system with the following capabilities:

- Receive “re-ingest” requests based on reprocessing requests or manual entries (as a result of missing or incorrect LORa data on the internal cache)
- Regenerate characterizations or biases using LORa as input rather than reading Mission Data from Archive Cache
- Any automation necessary for IOC

## **5.4 TSSC Storage and Archive Development (PWBS 4.3.2)**

### **5.4.1 Summary**

The TSSC Storage and Archive Development task will provide the software necessary to perform LDCM storage and archive functions for Mission Data, LORa, LORp, L1, Cal/Val, Quality Band, and Browse for the mission. This task involves all work necessary to store and archive LDCM data including:

- Provide software functions that provide storage and archive ingest capabilities including data quality checks, data moves, and other storage and archive ingest routines to other subsystems
- Provide an interface specification for subsystems to store and archive data
- Provide an archive cache for and archive mission data
- Provide an on-site and off-site archive for mission data
- Provide the capability to archive mission system backups to support mission disaster recovery
- Provide internal and external storage caches for LORa, LORp, L1 (standard products), Cal/Val data, Quality Band, and Browse data
- Provide quality assurance routines to perform inventory to archive checks as necessary

- Provide other storage and archive utilities necessary to perform quality data stewardship and management of LDCM data

#### **5.4.2 Objectives**

##### **Storage and Archive Objective #1: Provide Engineering and Development of the Storage and Archive (SA) Subsystem**

In support of the sustaining engineering activities for the Storage and Archive (SA) subsystem components, the contractor shall:

- Define operations concept for using the SA to meet LDCM requirements
- Define modifications and/or enhancements required for baseline SA to meet LDCM requirements
- Create SA requirements documents
- Develop traceability matrix between SA requirements and LDCM requirements
- Create SA test plan
- Develop detailed schedule and resource plan to implement SA subsystem
- Generate procurement support documentation for additional SA equipment to meet LDCM requirements
- Implement SA subsystem to meet LDCM requirements
- Test SA modifications and enhancements
- Generate/update documentation package to support modified/enhanced SA sustaining engineering
- Support preparation of GS and SA design review(s)
- Support integration of the SA into the DPAS
- Support L4 testing of the SA for DPAS functions
- Provide modifications and “bug fixes” as required to support SA Level 4 testing
- Generate training material for operations staff
- Train operations staff to use modified/enhanced SA to support LDCM operations
- Provide level of effort (LOE) SA sustaining engineering following successful completion of SA Level 4 testing
- Provide support for DPAS integration
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall TRD reporting and communication requirements
- Provide release documentation that describes the changes and content of each subsystem release
- Continued SA research including trade study updates or new technology investigations or recommendations

## **Storage and Archive Objective #2: Integrate the Storage and Archive subsystem to support archiving mission data and storing LORa data to support Ground Readiness Tests**

The contractor is required to integrate the Storage and Archive subsystem to perform LDCM storage and archive functions as outlined in the storage and archive data flow summary necessary to archive Mission Data. The contractor shall also allow for the capability to store test LORa data produced as a result of GRTs. The contractor shall provide the necessary APIs to archive and store these data.

## **Storage and Archive Objective #3: Integrate the Storage and Archive Subsystem to support LDCM storage or archive of LORp, L1, Cal/Val, Quality Bands, and Browse Data**

The contractor is required to integrate the Storage and Archive Subsystem to perform LDCM storage and archive functions as outlined in the storage and archive data flow summary necessary to provide storage or archive for LDCM LORp, L1, Cal/Val, Quality Bands, and Browse Data . The contractor shall provide the necessary APIs to archive and store these data.

## **Storage and Archive Objective #4**

For this objective, the contractor shall augment additional government supplied hardware into the Storage and Archive subsystem to support LDCM operations.

### **5.4.3 Deliverables**

#### **Storage and Archive Objective #1 Deliverables**

As part of the engineering process, the contractor shall deliver the following documents:

- Storage and Archive Requirements Specification / Allocation
- Storage and Archive Verification Matrix
- Storage and Archive Test Plan
- Storage and Archive Design Document
- Implementation and Integration Schedule Including Detailed Design
- Interface Specifications Document(s) (ISDs) for Storage and Archive Functions or APIs
- Release Documentation
- Baseline Document Updates
- Supporting procurement paperwork for Storage and Archive software and hardware

In support for DPAS integration, ground readiness and mission readiness tests, the contractor shall:

- Provide training to operations staff

- Provide any necessary maintenance releases or bug fixes in support of DPAS integration

### **Storage and Archive Objective #2 Deliverables**

- The contractor shall deliver, integrate and test the storage and archive software components necessary to store LORa and archive MD.
- The contractor shall integrate, test and support USGS supplied storage hardware components.
- The contractor shall deliver storage components bundled in a release with the following capabilities:
  - Software for data quality checks, data moves, and other storage and archive ingest routines for Mission and LORa Data
  - Archive Cache for Mission Data
  - Archive Mission Data
  - Archive Mission System Backups
  - Store LORa Data (enough space to support testing)

### **Storage and Archive Objective #3 Deliverables**

- Software for data quality checks, data moves, and other storage routines for storing LORp, L1, Cal/Val, Quality Bands, and Browse Data
- Integrate internal and external storage caches for LORa, LORp, L1, Cal/Val, Quality Bands and Browse Data using government supplied hardware
- Host the Stand-alone Subsetter (delivered by the Ingest work package) including software for subsystems to create subset requests and stage LORp products
- Software for staging of mission data
- Archive Mission Data Backups
- Maintenance releases or bug fixes as needed

### **Storage and Archive Objective #4 Deliverables**

**In support of LDCM Operations, the contractor shall implement the SA subsystem to:**

- Provide the capacity and throughput necessary for LDCM IOC
- Provide software QA routines and any custom storage and archive utilities
- Continued updates and automation

## **5.5 TSSC Inventory Development (PWBS 4.3.3)**

### **5.5.1 Summary**

TSSC Inventory Development consists of engineering, design and development for database schemas, tables and procedures leading to the integration of LDCM requirements into the Landsat Mission Database (LMD) and Searchable Inventory (SI) component.

- Provide engineering and design support for LDCM related database inventories using established Landsat architectures and schema frameworks known as the Landsat Mission Database
- Support database engineering and design requirements for LDCM subsystem development
- Compose and release a version of the Landsat Metadata Description Document (LMDD) describing the LDCM implementation
- Provide documentation support for subsystem, element and segment reviews
- Ensure that LDCM interfaces developed to access the LMD are secure and tuned no matter the method used (SQL, PL/SCL scripts embedded SQL etc).
- Assist system administration with patches to the database that are delivered from the database vendor
- Ensure database backup procedures are adequate to guarantee data safety and results in recoverable database instances
- Support and control LDCM related database network security, user security, group access and Operating System related threats
- Assist with recommendations and implementation of performance improvements for database queries to reduce wait times

### **5.5.2 Objectives**

#### **Objective #1: Provide Engineering and Development of the Inventory Subsystem**

The contractor shall implement the Inventory Subsystem system in support of LDCM activities including:

- Define the subsystem operations concept for using the Inventory Subsystem to meet LDCM requirements
- Develop Inventory Subsystem requirements that map to government supplied level 4 requirements
- Develop traceability matrix between Inventory Subsystem requirements and DPAS requirements
- Develop a Inventory Subsystem test plan
- Test the Inventory Subsystem to verify USGS supplied Level 4 Inventory allocated requirements
- Support Ground Readiness and Mission Readiness Tests
- Patch the Inventory Subsystem system as necessary
- Develop detailed schedule and resource plan to implement the Inventory Subsystem, including integration with the DPAS schedule
- Provide a release package for delivery of the Inventory Subsystem to the USGS
- Generate/update documentation package to support Inventory Subsystem sustaining engineering
- Support preparation of the Inventory Subsystem design review(s)
- Support preparation of ground system design review(s)
- Support integration of the Inventory Subsystem into the DPAS
- Generate training material for operations staff

- Train operations staff to use the Inventory Subsystem to support LDCM operations
- Provide support for DPAS integration
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall reporting and communication requirements
- Provide release documentation that describes the changes and content of each subsystem release
- Perform installation in the GRT, MRT and Operational Environments

### **Inventory Objective #2: Provide Initial Inventory Capability**

The contractor is required to provide a capability to capture and provide inventory records from and to various subsystems within the DPAS. The initial capability is limited to the subsystems that are necessary to support early GRTs.

### **Inventory Objective #3: Provide Final Inventory Capability**

The contractor is required to provide a capability to capture and provide inventory records from and to various subsystems within the DPAS. The final capability encompasses all of the inventory requirements for the DPAS.

## **5.5.3 Deliverables**

### **Inventory Objective #1 Deliverables**

As part of the engineering process, the contractor shall deliver the following documents as defined in the review process identified in section 4.1.3 DPAS PM/SE.

- Inventory Requirements Specification / Allocation
- Inventory Verification Matrix
- Inventory Test Plan
- Inventory Design Document
- Implementation and Integration Schedule Including Detailed Design
- Inventory Interface Specification Documents (ISD)
- Release Documentation
- Baseline Document Updates

### **Inventory Objective #2 Deliverables**

The contractor shall provide a release of the Inventory Subsystem system with the following capabilities:

- Provide database tables and an API (as specified by the Inventory ISD) for the Ingest subsystem to provide Level 0Ra (interval and scene) inventory records
- Provide database tables and an API to provide scene-based Level 0Ra metadata to the Subsetter subsystem

### **Inventory Objective #3 Deliverables**

- Provide database tables and an API (as specified by the Inventory ISD) for the LPGS subsystem to provide Level 1 and Level 0Rp inventory records
- Provide database tables and an API for the MDS subsystem to retrieve Level 0 and Level 1 metadata
- Provide database tables and an API for the User Portal subsystem to query Level 0Ra, Level 0Rp, and Level 1 metadata
- Provide database tables and an API for the Storage and Archive subsystem to provide product availability updates

## **5.6 TSSC Metrics Database Development (PWBS 4.3.4)**

### **5.6.1 Summary**

The TSSC Metrics Database Development task consists of engineering, design and development for database schemas, tables and procedures leading to the integration of LDCM requirements for metrics information into the Landsat operational Mission Management Office (MMO) Database Subsystem (MDS).

- Provide Engineering support to help identify metric requirements for the LDCM
- Provide Engineering and development support for database structures that support collection of required metrics
- Provide engineering development and support to identify and produce LDCM reports from the MDS
- Support LDCM design reviews and related documentation
- Ensure that LDCM interfaces developed to access the MDS are secure and tuned no matter the method used (SQL, PL/SCL scripts embedded SQL etc).
- Assist system administration with patches to the database that are delivered from the database vendor
- Ensure database backup procedures are adequate to guarantee data safety and results in recoverable database instances
- Support and control LDCM related database network security, user security, group access and Operating System related threats

### **5.6.2 Objectives**

#### **MDS Objective #1: Provide Engineering and Development of the MDS Subsystem**

The contractor shall implement the MDS Subsystem system in support of LDCM activities including:

- Define the subsystem operations concept for using the MDS Subsystem to meet LDCM requirements
- Develop MDS Subsystem requirements that map to government supplied level 4 requirements
- Develop traceability matrix between MDS Subsystem requirements and DPAS requirements
- Develop a MDS Subsystem test plan

- Test the MDS Subsystem to verify USGS supplied Level 4 MDS allocated requirements
- Patch the MDS Subsystem system as necessary
- Develop detailed schedule and resource plan to implement the MDS Subsystem, including integration with the DPAS schedule
- Provide a release package for delivery of the MDS Subsystem to the USGS
- Generate/update documentation package to support MDS Subsystem sustaining engineering
- Support preparation of the MDS Subsystem design review(s)
- Support preparation of ground system design review(s)
- Support integration of the MDS Subsystem into the DPAS
- Generate training material for operations staff
- Train operations staff to use the MDS Subsystem to support LDCM operations
- Provide support for DPAS integration
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall reporting and communication requirements
- Provide release documentation that describes the changes and content of each subsystem release
- Perform installation in the GRT, MRT and Operational Environments

### **MDS Objective #2: Provide Initial Metrics Gathering Capability**

The contractor is required to provide a capability to gather specified metrics from various subsystems within the DPAS. The initial capability is limited to the subsystems that are necessary to support early GRTs.

### **MDS Objective #3: Provide Final Metrics Gathering Capability**

The contractor is required to provide a capability to gather specified metrics from various subsystems within the DPAS. The final capability will include all metrics from all subsystems through product generation and distribution.

## **5.6.3 Deliverables**

### **MDS Objective #1 Deliverables**

As part of the engineering process, the contractor shall deliver the following documents as defined in the review process identified in section 4.1.3 DPAS PM/SE.

- MDS Requirements Specification / Allocation
- MDS Verification Matrix
- MDS Test Plan
- MDS Design Document
- Implementation and Integration Schedule Including Detailed Design
- MDS Interface Control Documents (ICDs)

- Release Documentation
- Baseline Document Updates

### **MDS Objective #2 Deliverables**

The contractor shall provide a release of the MDS Subsystem system with the following capabilities:

- Retrieve processing metrics from the Ingest subsystem
- Retrieve processing metrics from the Subsetter subsystem
- Retrieve Level 0 and Level 1 metadata from the Inventory subsystem

### **MDS Objective #3 Deliverables**

- Retrieve processing metrics from the LPGS subsystem
- Retrieve order information statistics from the User Portal subsystem

## **5.7 TSSC Product Generation Development (PWBS 4.4.2)**

### **5.7.1 Summary**

This task includes modifying the Level 1 Product Generation System (LPGS), where applicable, to support production of LDCM L1T data products. The government will supply the hardware. The contractor working on this task shall work closely with the IAS team to check out code and infrastructure (work order parameters, etc) as necessary to produce LDCM data products. Specifically, the contractor performing these activities will receive code from the IAS and place it into the LPGS environment to produce products as needed based on LDCM production requirements. It is expected that the contractor will reuse the existing Landsat environment to the maximum extent possible in an effort to maximize reuse. To support LDCM, the heritage framework of the LPGS may need to be modified to include production deliverables such as the ability to receive and complete production orders. To accomplish this work, the LPGS deliverables are mapped into objectives in a phased approach listed below.

### **5.7.2 Objectives**

#### **Objective #1 – Provide Sustaining Engineering of the LPGS to support the LDCM mission**

In support of the sustaining engineering activities for the LPGS subsystem components, the contractor shall:

- Define operations concept for using heritage LPGS to meet LDCM requirements
- Define modifications and/or enhancements required for baseline LPGS to meet LDCM requirements
- Modify LPGS requirements documents to add LDCM requirements
- Develop traceability matrix between LPGS requirements and LDCM requirements
- Modify LPGS test plan for implementation of changes to meet LDCM requirements
- Develop detailed schedule and resource plan to implement LPGS modifications and enhancements, including integration with the DPAS schedule
- Generate procurement support documentation for additional LPGS equipment and software to meet LDCM requirements

- Implement LPGS modification and enhancements to meet LDCM requirements
- Test LPGS modifications and enhancements
- Generate/update documentation package to support modified/enhanced LPGS sustaining engineering
- Support preparation of LPGS design review(s)
- Support preparation of ground system design review(s)
- Support integration of the LPGS into the DPAS
- Level 4 Requirements Verification
- Provide modifications and “bug fixes” as required to support LPGS Level 4 testing
- Generate training material for operations staff
- Train operations staff to use modified/enhanced LPGS to support LDCM operations
- Provide level of effort (LOE) LPGS sustaining engineering following successful completion of LPGS Level 4 testing
- Provide support for DPAS integration
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall TRD reporting and communication requirements
- Provide release documentation that describes the changes and content of each subsystem release
- Perform installation in the GRT, MRT and Operational Environments

### **Objective #2 – Provide Initial Production Capability based on IAS Objective # 4**

The contractor shall modify the heritage Landsat Product Generation System (LPGS), where applicable, to include the priority 1 and priority 2 algorithms already integrated into the Image Assessment System (IAS) to perform data production. Using heritage engineering methodologies, the contractor shall receive code from the heritage IAS and place it into the heritage LPGS. As part of this functionality, the heritage LPGS framework must be able to support image processing.

### **Objective #3 – Full Production Capability based on IAS Objective #5**

The contractor shall modify the heritage Landsat Product Generation System (LPGS), where applicable, to include the priority 3 algorithms and any updates to priority 1 or 2 algorithms that are already integrated into the Image Assessment System (IAS) to perform data production. Using heritage engineering methodologies, the contractor shall receive code from the heritage IAS and place it into the heritage LPGS. As part of this functionality, the heritage LPGS framework must be able to support image processing. As part of this release, the heritage LPGS environment may be modified with government supplied hardware and/or software to meet LDCM throughput specifications.

## **5.7.3 Deliverables**

### **LPGS Objective #1 Deliverables**

As part of the engineering process, the contractor shall augment existing heritage system documents, where applicable, for LDCM specific additions. Document deliverables include:

- Subsystem Requirements Specification / Allocation
- Subsystem Verification Matrix
- Subsystem Test Plan(s)
- Updates to Subsystem Interface Specifications
- Preliminary Database Design
- Subsystem Design Document (focus on deltas for LDCM - updates to document, not new doc)
- Implementation and Integration Schedule Including Detailed Design
- Release Documentation
- Procurement Support Paperwork as Necessary
- Note: Control books for L0Rp and L1 data are included in the Ingest and IAS Work Package
- Release documentation

In support for DPAS integration, ground readiness and mission readiness tests, the contractor shall:

- Provide training to operations staff
- Provide any necessary maintenance releases or bug fixes in support of DPAS integration

### **LPGS Objective #2 Deliverables**

The contractor shall deliver a release of the LPGS subsystem to perform production of data that:

- Incorporates IAS code that includes priority 1 and 2 algorithms
- Is the initial LPGS release to meet functional production requirements
- Includes modifications necessary to conduct production requests
- Does not include performance requirements to scale on-demand (refer to LPGS objective #3)
- Make data available to the public and to the Data Access browse generator

### **LPGS Objective #3 Deliverables**

The contractor shall deliver a release of the LPGS subsystem to perform production of data that:

- Incorporates IAS code that includes priority 3 algorithms
- Incorporates IAS code that includes priority 1 and 2 updates
- Incorporates performance requirements necessary to perform on-demand
- Provides scalability to meet LPGS performance requirements

## **5.8 TSSC Image Assessment Development (PWBS 4.4.3)**

### **5.8.1 Summary**

This task includes modifying the heritage Landsat Image Assessment System (IAS), where applicable, to support algorithms provided by the Cal/Val analysts through the Cal/Val toolkit. This work package activity must be in a close working relationship with the Cal/Val team. Specifically, the contractor performing these activities will iteratively receive Algorithm Description Documents (ADDs) and associated prototype code (already integrated into the Cal/Val toolkit) and integrate them into the Landsat IAS heritage system. To support LDCM, the heritage framework may need to be modified to include deliverables such as production of the LDCM CPF and BPF files. To accomplish this work, the IAS deliverables are mapped into objectives in a phased approach listed below.

### **5.8.2 Objectives**

#### **Objective #1 – Provide Sustaining Engineering of the Heritage Image Assessment System (IAS) to support the Landsat Data Continuity Mission (LDCM)**

In support of the sustaining engineering activities for the IAS subsystem components, the contractor shall:

- Modify the IAS operations concept to support LDCM
- Define modifications and/or enhancements required for baseline IAS to meet LDCM requirements
- Modify IAS subsystem requirements to add LDCM requirements
- Develop traceability matrix between IAS requirements and LDCM requirements
- Modify IAS test plan for implementation of changes to meet LDCM requirements
- Develop detailed schedule and resource plan to implement IAS modifications and enhancements, including integration with the DPAS schedule

- Generate procurement support documentation for additional IAS equipment and software to meet LDCM requirements
- Implement IAS modification and enhancements to meet LDCM requirements
- Test IAS modifications and enhancements
- Generate/update documentation package to support modified/enhanced IAS sustaining engineering
- Support preparation of IAS design review(s)
- Support preparation of ground system design review(s)
- Support integration of the IAS into the DPAS
- Perform level 4 requirements verification
- Generate training material for operations staff
- Train operations staff to use modified/enhanced IAS to support LDCM operations
- Provide support for DPAS integration
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall reporting and communication requirements
- Provide release documentation that describes the changes and content of each subsystem release
- Perform installation in the GRT, MRT and Operational Environments

### **Objective #2 – Heritage Initial Image Assessment System (IAS) with LDCM Algorithms**

Objective 2 incorporates the initial heritage IAS, where applicable, that iteratively receives algorithm code from the Cal/Val toolkit and the latest ATBDs and integrates them into the heritage IAS framework. It also includes any necessary heritage framework medications in support of the LDCM. It is expected that the integrator of the heritage IAS system will iteratively adapt the heritage system by adding the algorithms and code as they are provided by the Cal/Val team. It is expected that the IAS team will provide several “snapshot” releases in an iterative environment so the Cal/Val team can verify IAS output as the algorithm code is integrated from the Cal/Val toolkit.

### **Objective #3: Heritage Image Assessment System (IAS) Final Priority 1 Algorithms**

The contractor shall continue to modify the heritage system, where applicable, defined in the IAS objective #2 to create a formal release that includes documentation, formal system testing, and a release package. This release should also include any latest priority 1 algorithm updates from the Cal/Val toolkit or Cal/Val team.

### **Objective #4: Heritage Image Assessment System Priority 2 Algorithms and P1 Algorithm Updates**

The contractor shall continue to adapt the heritage system, where applicable, to integrate priority 2 and any changes to priority 1 algorithms. For this objective, the contractor shall identify any automation necessary to the heritage system to meet LDCM operational calibration and validation expectations for LDCM. The contractor

shall identify a schedule for automations and include any automations that provide the greatest value.

This objective defines a formal release but it is expected that the contractor will continue to work iteratively with the Cal/Val team to deliver 'snapshots' of the IAS to the Cal/Val team as necessary for initial IAS checkout.

### **Objective #5: Image Assessment System Priority 3 Algorithms with P1 and P2 Algorithm Updates**

The contractor shall continue to adapt the heritage system to integrate priority 3 and any changes to priority 1 and 2 algorithms. For this objective, the contractor shall continue to deliver automation necessary to the heritage system to meet LDCM operational calibration and validation expectations for the LDCM as agreed upon by the USGS DPAS management.

This objective defines a formal release but it is expected that the contractor will continue to work iteratively with the Cal/Val team to deliver 'snapshots' of the IAS to the Cal/Val team as necessary for initial IAS checkout.

### **5.8.3 Deliverables**

#### **IAS Objective #1 Deliverables**

As part of the engineering process, the contractor shall augment existing heritage system documents where applicable for LDCM specific additions. Document deliverables include:

- Subsystem Requirements Specification / Allocation
- Subsystem Verification Matrix
- Subsystem Test Plan(s)
- Updates to Subsystem Interface Specifications
- Preliminary Database Design
- Subsystem Design Document
- Implementation and Integration Schedule
- L1 Data Format Control Book
- Bias Parameter File (BPF) Definition
- Calibration Parameter File (CPF) Definition
- Release Documentation
- Procurement Support Paperwork as Necessary

In support for DPAS integration, ground readiness and mission readiness tests, the contractor shall:

- Provide training to operations staff
- Provide any necessary maintenance releases or bug fixes in support of DPAS integration

#### **IAS Objective #2 Deliverables**

The contractor shall iteratively deliver releases of the heritage IAS in an integration environment until the IAS can:

- Generate an initial CPF (includes parameters in support of Priority 1 algorithms)
- Generate necessary Bias Parameters
- Incorporate P1 algorithms

Perform Initial Capability to Produce Standard L1 Products (for Cal/Val purposes and demonstrate capability to produce products)

Perform Initial Capability to Produce Cal/Val Products Necessary for Algorithm Analysis

### **IAS Objective #3 Deliverables**

**The contractor shall integrate a formal release of the heritage IAS that:**

- Is built from the iterative releases defined in objective 2
- Is the first formal heritage IAS release (includes formal release documentation, system testing, following all processes, etc)
- Includes the Latest Priority 1 Algorithms from Cal/Val Team (from Ball CDRL CV-07)
- Includes CPF Definition Updates
- Includes BPF Definition Updates (if applicable)
- Includes any updates found from initial (less formal) release
- Includes a system test plan
- Includes system test results
- Includes a release package that documents the contents of the release
- Meets allocated Level 4 requirements

As part of the release delivery, the contractor shall provide training to operators and/or Cal/Val analysts.

### **Image Assessment Objective #4 Deliverables**

The contractor shall integrate priority 2 algorithms and priority 1 algorithm updates from the Cal/Val toolkit and/or Cal/Val team into the heritage IAS. This shall be included in a heritage IAS release that:

- Includes all P2 Algorithms
- Includes continued updates to Priority 1 Algorithms if needed by Cal/Val
- Includes any CPF Updates (based on P2 algorithms and P1 Algorithm Updates)
- Includes patches or maintenance items found in previous releases
- An itemized list of automation candidates to the heritage IAS
- Any automation updates agreed upon by DPAS management
- Is the second formal heritage IAS release to incorporate LDCM algorithms

### **Image Assessment Objective #5 Deliverables**

The contractor shall integrate priority 3 algorithms and priority 1 and 2 algorithm updates from the Cal/Val toolkit and/or Cal/Val team into the heritage IAS. This shall be included in a heritage IAS release that:

- Includes Priority 3 Algorithms

- Includes any Priority 1 and Priority 2 Updates Necessary
- Includes other Fixes or Issues found at OIV
- Includes automation updates as agreed upon by USGS DPAS management
- Includes CPF Updates (based on P3 algorithms and P1 and P2 updates)
- Is the heritage IAS that will be deployed at IOC

## **5.9 TSSC Image Processing Development (PWBS 4.4.4)**

### **5.9.1 Summary**

The purpose of the TSSC Image Processing Development task is to provide subject matter expertise from the Landsat sustaining engineering team to support the development work for the Product Generation and Image Assessment subsystems.

### **5.9.2 Objectives**

This task has the following objectives:

- Support the LDCM team in the definition of the operations concept for using heritage IAS to meet LDCM requirements
- Support the LDCM team in the definition of the modifications and/or enhancements required for baseline IAS to meet LDCM requirements
- Support the LDCM team modification of the existing IAS requirements documents to add LDCM requirements
- Support the LDCM team development of a traceability matrix between IAS requirements and LDCM requirements
- Support the LDCM team modification of the existing IAS test plan for implementation of changes to meet LDCM requirements
- Support the LDCM team implementation of the IAS modification and enhancements to meet LDCM requirements
- Support the LDCM team testing of the IAS modifications and enhancements
- Support preparation of DPAS design review(s)
- Support preparation of ground system design review(s)
- Support integration of the IAS into the DPAS
- Support Level 4 testing of the DPAS for IAS functions
- Support the LDCM team in providing modifications and “bug fixes” as required to support DPAS Level 4 testing and where it cannot be provided by LDCM staff
- Provide support for DPAS integration and testing
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall TRD reporting and communication requirements

### **5.9.3 Deliverables**

This task has the following deliverables:

- Support, as required, for LDCM modifications and implementation of the IAS to meet LDCM requirements
- Status reporting inputs, as required.

## **5.10 TSSC Subsetter Development (PWBS 4.4.5)**

### **5.10.1 Summary**

This task will provide the software necessary to spatially subset LDCM L0Ra intervals into L0Rp datasets as defined by the Level 0Rp Data Format Control Book. The LDCM Subsetter work package involves all work necessary to spatially subset L0Ra data including:

- Provide an interface specification for subsystems (IAS and LPGS) to request L0Rp datasets
- Provide a method by which the Subsetter can be invoked standalone (i.e., without a request from the other DPAS subsystems)
- Retrieve scene metadata from the inventory
- Retrieve L0Ra intervals from the Internal Cache
- Spatially subset L0Ra intervals as defined by input parameters
- Write L0Rp datasets to the Internal Cache
- Provide processing metrics to the MMO Database System (MDS)

### **5.10.2 Objectives**

#### **LDCM Subsetter Objective #1: Provide Engineering and Development of the Subsetter Subsystem**

The contractor shall implement the Subsetter Subsystem system in support of LDCM activities including:

- Define the subsystem operations concept for using the Subsetter Subsystem to meet LDCM requirements
- Develop Subsetter Subsystem requirements that map to government supplied level 4 requirements
- Develop traceability matrix between Subsetter Subsystem requirements and DPAS requirements
- Develop a Subsetter Subsystem test plan
- Test the Subsetter Subsystem to verify USGS supplied Level 4 Subsetter allocated requirements
- Patch the Subsetter Subsystem system as necessary
- Develop detailed schedule and resource plan to implement the Subsetter Subsystem, including integration with the DPAS schedule
- Provide a release package for delivery of the Subsetter Subsystem to the USGS
- Generate/update documentation package to support Subsetter Subsystem sustaining engineering
- Support preparation of the Subsetter Subsystem design review(s)
- Support preparation of ground system design review(s)
- Support integration of the Subsetter Subsystem into the DPAS
- Generate training material for operations staff
- Train operations staff to use the Subsetter Subsystem to support LDCM operations
- Provide support for DPAS integration

- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall reporting and communication requirements
- Provide release documentation that describes the changes and content of each subsystem release
- Perform installation in the GRT, MRT and Operational Environments

### **LDCM Subsetter Objective #2: Provide Stand-Alone Spatial Subsetting Capability**

The contractor is required to provide a capability to produce spatially subsetting Level 0Rp datasets in a stand-alone capacity to support early Ground System readiness test activities. Since this is a stand-alone capability, the interfaces with IAS, LPGS and MDS are not required for this objective.

### **LDCM Subsetter Objective #3: Integrate Subsetter Subsystem to Support Product Generation and Calibration / Validation**

The contractor is required to provide the remainder of the integration of the Subsetter subsystem into the DPAS. In particular, this is the LORp request interface with LPGS/IAS and the processing metrics interface with the MDS.

## **5.10.3 Deliverables**

### **Subsetter Objective #1 Deliverables**

As part of the engineering process, the contractor shall deliver the following documents as defined in the review process identified in section 4.1.3 DPAS PM/SE.

- Subsetter Requirements Specification / Allocation
- Subsetter Verification Matrix
- Subsetter Test Plan
- Subsetter Design Document
- Implementation and Integration Schedule Including Detailed Design
- Subsetter Interface Specification Document (ISD)
- Release Documentation
- Baseline Document Updates

### **Subsetter Objective #2 Deliverables**

The contractor shall provide a release of the Subsetter Subsystem system with the following capabilities:

- Provide a method by which the Subsetter can be invoked standalone (i.e., without a request from the other DPAS subsystems)
- Retrieve scene metadata from the inventory
- Retrieve LORa intervals from the Internal Cache
- Spatially subset LORa intervals as defined by input parameters
- Write LORp datasets to the Internal Cache

### **Subsetter Objective #3 Deliverables**

- Minor release(s) to accommodate changes found in GRTs
- Provide an interface specification for subsystems (IAS and LPGS) to request LORp datasets
- Provide processing metrics to the MMO Database System (MDS)

## **5.11 TSSC Data Access Development (PWBS 4.5.2)**

### **5.11.1 Summary**

This work package will provide the software necessary to provide the LDCM user community with search and order access to LDCM products and metadata. Specifically, the Data Access work package will:

- Provide access to LDCM data and metadata through the EROS NEW Earth Explorer System
- Provide methods for registering and authenticating users
- Provide order and delivery software to support the on-demand ordering of standard products
- Provide operational LDCM services for use by both internal and external clients
- LDCM specific additions to the Landsat mission web site; these include various interfaces for LDCM specific data, as well as the interface for authorized users to submit LDCM collection requests

### **5.11.2 Objectives**

#### **Objective #1: Provide Sustaining Engineering of the Data Access Components to support LDCM**

In support of the sustaining engineering activities for the data access components, the contractor shall:

- Define operations concept(s) or high-level design(s) for using LDCM data access components as directed by the USGS
- Define modifications and/or enhancements required for baseline data access components to meet LDCM requirements
- Perform any necessary modifications to data access requirements documents to add LDCM requirements
- Develop traceability matrix between data access requirements and LDCM requirements
- Modify data access test plan for implementation of changes to meet LDCM requirements
- Develop detailed schedule and resource plan to implement data access modifications and enhancements, including integration with the DPAS schedule
- Generate procurement support documentation for additional data access equipment and software to meet LDCM requirements
- Implement data access modification and enhancements to meet LDCM requirements
- Test data access modifications and enhancements

- Generate/update documentation package to support modified/enhanced data access sustaining engineering
- Support preparation of data access and DPAS design review(s)
- Support preparation of ground system design review(s)
- Support integration of the data access components into the DPAS
- Support L4 testing of the data access components for DPAS functions
- Provide modifications and “bug fixes” as required to support data access Level 4 testing
- Generate training material for operations staff
- Train operations staff to use data access components to support LDCM operations
- Provide level of effort (LOE) data access component sustaining engineering following successful completion of data access Level 4 testing
- Provide support for DPAS integration
- Provide support for ground readiness (GRT) and mission readiness testing (MRT)
- Provide modifications and “bug fixes” as required to support DPAS integration, GRTs and MRTs
- Provide project status reporting as required to assess performance of this task in support of overall TRD reporting and communication requirements
- Provide release documentation that describes the changes and content of each subsystem release

#### **Objective #2: EROS Enterprise Ordering Updates**

This objective includes the work necessary to modify the heritage EROS enterprise transaction reporting and Metrics (TRAM) system to support LDCM ordering

#### **Objective #3: New Earth Explorer and Data Access Components**

This objective includes the work necessary to modify existing data access systems to perform LDCM data access requirements. This work package includes data access requirements for submitting collection requests, browse generation and registration and authentication of users.

#### **Objective #4: Provide Data Access Services and Continued Web Site Updates.**

This work objective includes providing advanced data services capabilities to LDCM data. The contractor for this objective shall iteratively adopt emerging standards and data access techniques in an effort to provide community access to LDCM data.

### **5.11.3 Deliverables**

#### **Objective #1 Deliverables**

As part of the engineering process, the contractor shall deliver the following documents and services as defined in the review process identified in section DPAS PM/SE.

- High-Level Design
- Requirements Specification / Allocation
- Verification Matrix

- Test Plan
- Design Document
- Implementation and Integration Schedule Including Detailed Design
- ICD Updates
- Release Documentation
- Baseline Document Updates

In support for DPAS integration, ground readiness and mission readiness tests, the contractor shall:

- Provide training to operations staff
- Provide any necessary maintenance releases or bug fixes in support of DPAS integration

### **Objective #2 Deliverables**

The contractor shall incrementally support modifications to the TRAM system to support LDCM orders to interface with the Landsat Product Generation System and Image Assessment System to handle on-demand LDCM orders. The TRAM system shall:

- Provide the capability to accept on-demand orders from the data access system (internal interface)
- Deliver the orders to the heritage image processing system
- Utilize existing interfaces where possible

The contractor shall perform any LDCM web site updates necessary.

### **Objective #3 Deliverables**

The contractor shall modify and release Data Access components. The contractor shall implement the following:

- Perform modifications to the new EROS Earth Explorer system to incorporate the LDCM data and metadata
- Release software for submitting collection requests
- Release software for browse generation
- Release software for registering and authentication users
- Perform any LDCM web site updates necessary.

### **Objective #4 Deliverables**

The contractor shall deliver data access software integrated into the LDCM environment. This software will operate on government supplied hardware. In addition, the contractor shall include any web site updates necessary to the LDCM web site. For this objective, the contractor shall deliver:

- Software services that include image server (WMS/WCS browse and product delivery), RSS feeds and KML access, download broker, consumer service, and qualified subscription service
- Web site updates that provide access to and/or interfaces to:
  - RSS Feeds
  - KML Network files

- Cal/Val Reports and Algorithms
- Acquisition Schedule
- Ground Control Points
- Bias Parameter Files
- Bulk Metadata Request
- International Cooperator (IC) Metadata Input
- Qualified Subscriptions and Registration/Login
- CPF updates

## **Section 6 Operations Readiness Work Description**

---

### **6.1 TSSC International Cooperator Support (PWBS 6.1.4)**

#### **6.1.1 Summary**

The TSSC International Cooperator Support task contains the work to prepare the International Cooperators for the LDCM system in an Operations and Maintenance phase.

#### **6.1.2 Objectives**

The objectives of the TSSC International Cooperator Support task are to provide the necessary communications, coordination, and LDCM development team support to adequately prepare the LDCM system and the International Cooperator network for LDCM Operations and Maintenance.

#### **6.1.3 Deliverables**

This task has the following deliverables:

- Provide coordination, planning, and document preparation services between USGS and the International Cooperator (IC) community including but not limited to Landsat Technical Working Group (LTWG) and Landsat Ground Station Operators Working Group (LGSOWG) meeting agendas, plenary and one-on-one meeting minutes, and action item preparation
- Ensure assigned LTWG and LGSOWG actions are kept current in the action item database in Team Track
- Incrementally support the preparation of the LDCM IC web portal, including LTWG and LGSOWG meeting proceedings and other IC-related content
- Incrementally support the preparation and review of the Data Validation & Exchange (DV&E) Documents (Archive Data Validation & Exchange Plan, Product Data Validation Plan)
- Prepare and facilitate the review of the Space-to-IC interface document
- Prepare and facilitate the review of the IC-to-Ground interface document

### **6.2 TSSC Operations Support (PWBS 6.1.5)**

#### **6.2.1 Summary**

The TSSC Operations Support task consists of the work performed by Landsat Archive and Production (A&P) staff to support the implementation of the USGS/EROS DPAS elements, per an agreement between the LDCM and Landsat projects. As the DPAS operator and stakeholder, A&P operations will test, accept delivery and ultimately operate the DPAS Subsystems.

#### **6.2.2 Objectives**

- Provide A&P staff engineering and technical expertise for participation in LDCM project meetings, TIMs and Working Groups, as required

- Develop detailed schedule and resource plan for A&P participation in LGS engineering and integration activities
- Coordinate with the DPAS development team for modifications and enhancements needed to meet LDCM requirements
- Support DPAS integration into the ground segment, including assisting in the installation and checkout of ground station equipment by the DPAS development team, as required, and testing for L4 and L3 requirements verification by operations staff
- Support out-year operational planning activities in support of ground readiness (GRT) and mission readiness (MRT) testing, generate ops procedures for testing, provide inputs to generation of test cases, operate the DPAS subsystems for execution of GRTs and MRTs involving the DPAS, provide engineering and troubleshooting for resolution of any test discrepancies in cooperation with the DPAS development team and ground system sustaining engineering, participate in other launch preparation activities
- Participate in L4 and L5 testing by executing test and identifying test discrepancies
- Generate training materials and SOPs in cooperation with the DPAS development team, as required, for LGS transition into LDCM operations
- Develop a detailed resource plan for DPAS implementation of LDCM-specific requirements, integration, testing, and operational staffing of mission-level test activities

### **6.2.3 Deliverables**

- Detailed schedule and resource plan for operations participation in engineering, integration and test activities
- Generate test procedures, test data and support test activities, in cooperation with ground systems engineers, for verification of Ground segment Level 3 requirements and Mission Sims.
- Standard operating procedures and operator training materials

## Section 7 LDCM Project Schedule

The critical delivery requirement dates for the project are provided in the full Ground System Integrated Master Schedule (IMS) that can be located in the Bidder's Reference Library. The table below identifies the key development subsystem releases to be provided by the TSSC in this TRD. It can be used as a reference to locate the required delivery schedule as identified in the GS IMS.

The vendor should strive to ensure appropriate development reserve, in advance of these no earlier than (NET) dates, is identified and managed according to USGS expectations. Appropriate reserve is approximately one month per year of development.

**Table 1. LDCM Subsystems Releases**

PWBS #	Function	Activity or Release Title
3.2.2	CAPE	CAPE R2 (GRT 4a)
		CAPE R3 (Closeout Release)
3.4.3	Data Capture Service	DCRS (GRT 4a)
4.2.2	Ingest	Ingest R1 (GRT 4a)
		Ingest R2 (Interval Characterization)
		Ingest R3 (Reprocessing and Closeout)
4.3.2	Storage and Archive	S&A R1 (Mission and L0Ra Data)
		S&A R2 (L0Rp and L1 Data)
		S&A R3 (Closeout)
4.3.3	Inventory	Inventory R1 (GRT4a)
		Inventory R2
4.3.4	Metrics Database	MDS R1
		MDS R2
4.4.2	Product Generation	LPGS R1
		LPGS R2 (Closeout Release)
4.4.3	Image Assessment	IAS R1 (Iterative Cal/Val Release)
		IAS R2 (GRT 4b - P1 Alg)
		IAS R3 (P2 Alg)
		IAS R4 (P3 Alg and Closeout)
4.4.5	Subsetter	Subsetter R1 (GRT 4a)
		Subsetter R2
4.5.2	User Portal	User Portal R1 (TRAM)
		User Portal R2 (DAT)
		User Portal R3 (Closeout)