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ATTACHMENT F

**Landsat Data Continuity Mission (LDCM)
Implementation Phase
Contract Data Requirements List (CDRL)**

January 6, 2003



Goddard Space Flight Center
Greenbelt, Maryland 20771

CONSULT THE LDCM CM OFFICE
[301-286-6772](tel:301-286-6772)
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DOCUMENT REVISION HISTORY

Document Title: Landsat Data Continuity Mission (LDCM) Implementation Phase Contract Data Requirements List (CDRL)			
Issue	Date	Pages Affected	Description
Initial 427-10-02-003	10-04-02		
427-10-02-003 RFP Review Version I	11-08-02	All	CCRs: 300, 301, 302, 303, 304, 305, 306, 309, 323, 358
427-10-02-003 RFP Review Version II	12-16-02	All	CCRs: 363, 364, 366, 384, 391, 392, 400, 401
427-10-02-003 Baseline Version			

CONTRACT CHANGE HISTORY

Mod. #	Mod Date	CCR #	CCR Effective Date	Section(s)

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1.0 Introduction

This document attachment defines the Contract Data Requirements List (CDRL) items that shall be provided by the LDCM contractor. All CDRL documents may be provided in contractor format, as long as all required content specified is also provided.

Section 2.0 outlines the required CDRL items organized by program category. Section 3.0 identifies the distribution and delivery requirements for the CDRL items. Section 4.0 outlines the hardcopy documentation delivery requirements for the Systems and Program Reviews.

Following the above Sections are a CDRL Summary Table and a CDRL Data Item Description (DID) Table.

2.0 CDRL Category Listing of Deliverable Documentation/Data

System Reviews (SR)

- SR1. Delta Preliminary Design Review Package
- SR2. Critical Design Review Package
- SR3. Instrument Pre-Ship Review Package
- SR4. Pre-Environmental Review Package
- SR5. System Pre-Ship Review Package
- SR6. Initial Operational Capability Review Package

Program Reviews/Reports (PR)

- PR1. Management Program Status Review Package
- PR2. Monthly Operations/Anomaly Report
- PR3. Monthly Schedule Report
- PR4. Evidence of Binding Commitments Report

Systems Engineering (SE)

- SE1. Concept of Operations
- SE2. Calibration/Validation Plan
- SE3. Calibration/Validation Procedures
- SE4. Calibration/Validation Test Reports
- SE5. Calibration/Validation Report
- SE6. Data Specification Compliance Plan
- SE7. Data Specification Compliance Report

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- SE8. Data Flow Test Plan/Procedures
- SE9. Data Flow Test Report
- SE10. Interface Control Documents to Government Systems
- SE11. Data Operations Procedures
- SE12. Data Quality Assurance Plan

Program Management (PM)

- PM1. Program Execution Plan

Data Management (DM)

- DM1. LDCM Data Collection & Processing System Document
- DM2. Data Format Control Documents
- DM3. Flight and Ground Systems Data Processing Algorithms
- DM4. Daily Data Delivery Report

3.0 Distribution and Delivery

The distribution and delivery of the CDRL items are defined by codes in the LDCM CDRL Summary Table below. All CDRL items are identified by their Data Item Description (DID) designation in the Summary Table and the Data Item Description Table.

The original transmittal letter for all deliverables shall be addressed to the LDCM Contracting Officer, Code 427 at GSFC. The contractor shall issue Documentation Change Notices (DCN) whenever updates are required for CDRL items delivered to NASA/GSFC, and if major changes occur a complete revision shall be issued. A transmittal letter to the Officer above shall be delivered with each DCN or Revision. Updates to deliverables requiring government approval shall be subject to additional approvals with each update. The government requires 30 calendar days for the review and approval cycle, and the contractor shall provide clear indication of all documents considered proprietary. The contractor may assume government approval if no notification is received within the 30 days after delivery of the item.

Distribution and Delivery Codes for the CDRL items are identified in the CDRL Summary Table. The Codes are as follows:

A/I

- A- Requires Government approval
- I- Information only

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Media HC/EC

HC- Hardcopy on paper

EC- Electronic copy available on diskette, CD or PC transfer

4.0 Review Documentation Requirements

The LDCM System and Program review requirements are described in this Attachment F in the DID Table. The hardcopy delivery requirements for each of these reviews are shown below. All copies shall be mailed to the LDCM Project Office as indicated in Section 3.0; an agenda shall be provided fourteen (14) days prior to each review and draft review packages five (5) working days prior to each review. The Contractor shall also provide final review packages and electronic distribution of the review material on the day of the review.

Review requirements are based on a few selected, traditional aerospace reviews that have been scaled-down to reflect the LDCM approach, and minimum requirements suitable for progress payment determination. The Contractor may add any additional information or reviews it deems necessary in order to assure the successful development of a system that will satisfy both LDCM and its commercial requirements, and reviews may be combined to include LDCM and commercial considerations to avoid duplication of effort.

<u>Reviews</u>	<u>Preliminary Copies</u>	<u>HC at Review</u>
<u>System Reviews</u>		
Delta Preliminary Design Review	1HC/1EC	30
Critical Design Review	1HC/1EC	30
Instrument Pre-Ship Review	1HC/1EC	30
Pre-Environmental Review	1HC/1EC	30
System Pre-Ship Review	1HC/1EC	30
Initial Operational Capability Review	1HC/1EC	30
<u>Program Reviews</u>		
Management Program Status Reviews	1HC/1EC	20

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LDCM CDRL SUMMARY				
DID #	Title	A/I	Submission Date(s)	Media
SR1	Delta Preliminary Design Review Package	I	EC 5 days prior and HC/EC final at review	HC/EC
SR2	Critical Design Review Package	I		HC/EC
SR3	Instrument Pre-Ship Review Package	I		HC/EC
SR4	Pre-Environmental Review Package	I		HC/EC
SR5	System Pre-Ship Review Package	I		HC/EC
SR6	Initial Operational Capability Review Package	I		HC/EC
PR1	Management Program Status Review Package	I	5 days prior to MPSR	HC/EC
PR2	Monthly Operations/Anomaly Report	I	1st week/month	EC
PR3	Monthly Schedule Report	I	1st week/month	HC/EC
PR4	Evidence of Binding Commitments Report	I	To be proposed	HC or EC
SE1	Concept of Operations	I	Baseline-ΔPDR Final-CDR	HC/EC
SE2	Calibration/Validation Plan	A	Baseline-Proposal Final-CDR	HC/EC
SE3	Calibration/Validation Procedures	I	30 days prior to use	HC/EC
SE4	Calibration/Validation Test Reports	I	Data-14 days post-test Report-30 days post-test	HC/EC
SE5	Calibration/Validation Report	I	IOCR IOCR+6 months End of contract	HC/EC
SE6	Data Specification Compliance Plan	A	Baseline-ΔPDR Final-CDR	HC/EC
SE7	Data Specification Compliance Report	I	Initial-SPSR Final-IOCR	HC/EC
SE8	Data Flow Test Plan/Procedures	I	Plan-CDR Procedures-7 days prior to tests	HC/EC
SE9	Data Flow Test Report	I	1 week after tests	HC/EC

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LDCM CDRL SUMMARY				
DID #	Title	A/I	Submission Date(s)	Media
SE10	Interface Control Documents to Government Systems	A	Baseline-ΔPDR Final-CDR	HC/EC
SE11	Data Operations Procedures	I	Baseline-SPSR Final-IOCR	HC/EC
SE12	Data Quality Assurance Plan	I	Baseline-ΔPDR Final-CDR	HC/EC
PM1	Program Execution Plan	I	ΔPDR	HC/EC
DM1	LDCM Data Collection & Processing Document	I	Baseline-CDR Final-SPSR	HC/EC
DM2	Data Format Control Documents	A	Baseline-CDR Final-SPSR	HC/EC
DM3	Flight and Ground Systems Data Processing Algorithms	I	CDR-IPSR-SPSR Final-IOCR	HC/EC
DM4	Daily Data Delivery Report	I	IOCR-OPS	EC

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DATA ITEM DESCRIPTION (DID)	
DID #: SR1	Delta Preliminary Design Review Package

DESCRIPTION: The Delta Preliminary Design Review (Δ PDR) is the first major review of the LDCM implementation phase and shall be held at the LDCM Contractor's facility. A PDR is normally held when the design is advanced sufficiently to begin some breadboard testing and the fabrication of design models. Changes since the Preliminary Design Review submitted for Implementation Phase award consideration shall be the Review's focus. Detail designs are not expected at this time, but system engineering, resource allocations and design analyses are required to demonstrate that the Contractor's derived requirements will result in compliance with LDCM Data Specifications. A presentation of the design and interfaces by means of block diagrams, signal flow diagrams, schematics, logic diagrams, error budgets, link margins, first interface circuits, configuration and layout sketches, analyses, modeling and any early results are required. Estimates of weight, power, volume and the basis for the estimates of these parameters are required. Supporting data and analyses for mechanical, power, thermal, and electronic design: load, stress, margins, reliability assessments, should be shown. Software requirements, design, structure, logic flow diagrams, Central Processing Unit (CPU) loading, design language and development systems need to be specified. Parts selection, de-rating criteria, and radiation hardness, is an important part of this Review. The identification of single point failure modes needs to be assessed as well as critical design areas which may be life limiting.

The Delta PDR shall cover any changes since PDR for the following items:

- a. LDCM objectives, requirements, data specification
- b. Closure of actions from previous reviews and MPSRs
- c. Observatory performance requirements resulting from LDCM data specification flowdown
- d. Validation Data Product system requirements, performance budgets and margins
- e. Error budget determination
- f. Weight, Power, Data rate, EMI/EMC
- g. Interface requirements
- h. Mechanical/structural design, analyses, and life tests
- i. Electrical, thermal, optical/radiometric design and analyses
- j. Software requirements and design
- k. System performance budgets
- l. Design verification, test flow and calibration/validation test plans
- m. Concept of operations and launch vehicle

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- n. Contamination requirements and controls
- o. Quality Control, EEE parts, Materials and Processes, Reliability and FMEAs, and redundancy
- p. Progress and status of management, business and marketing, schedules, financial status (including current income statement, pro forma statement and status of funding source commitments), risk management and risk list with mitigation plans
- q. LDCM Level 1G-ortho data option

REVIEW SUCCESS CRITERIA: The criteria for successful completion of the Delta PDR are as follows:

- a. System design is at a level of maturity to allow detailed design work to proceed.
- b. System design and concept of operations are consistent with LDCM data specification and data product delivery requirements.
- c. LDCM programmatic risk areas (technical, schedule, and business) have been adequately addressed.
- d. Major action items generated during the Delta PDR are dispositioned subject to the approval of the Contracting Officer.
- e. No business/financial limitations exist that would prevent continued system development according the project master schedule.

REVIEW DELIVERABLES: The following documents are deliverable at the time of this review:

- a. Baseline Concept of Operations
- b. Program Execution Plan
- c. Baseline Interface Control Documents to Government Systems
- d. Baseline Data Specification Compliance Plan
- e. Baseline Calibration/Validation Plan

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DATA ITEM DESCRIPTION (DID)	
DID #: SR2	Critical Design Review Package

DESCRIPTION: The Critical Design Review (CDR) shall be held at the Contractor's facility and will be the second major review of the Contractor's detailed system design. The CDR is held near the completion of an engineering model, if applicable, or the end of the breadboard development stage. This should be prior to any design freeze, and before any significant fabrication activity begins. The CDR presents a final detailed design using substantially completed drawings, analyses and breadboard/engineering model evaluation testing to show that the design will meet the final performance and interface specifications and the required design objectives to reliably provide LDCM specification-compliant data. The CDR should represent a complete and comprehensive presentation of the entire design. It should present the final design and interfaces by means of block diagrams, power flow diagrams, signal flow diagrams, interface circuits, layout drawings, software logic flow and timing diagrams, design language, modeling results, breadboard and engineering model test results and changes required to the design presented at the Delta PDR. Final estimates of weight, power, and volume are to be presented. Final calculations for mechanical loads, thermal performance, radiation design and expected lifetime are to be presented. Final software requirements and updated system performance estimates should also be presented. Parts selection and screening results, calculated reliability and the results of a FMEA are to be presented. The overall design and status of the ground system is reviewed to assure that the requirements for LDCM Data Packages and VDPs, Calibration/Validation, and supporting analyses are understood and that the proposed concept of operations approach will meet the requirements. The operational interfaces between Government and Contractor systems and ground systems and observatories will be reviewed with respect to proper system engineering of operational trade-offs, constraints, security, performance, reliability and modes of operation. Integration of pre-launch test planning including all planned tests between the flight segment and the ground system will be reviewed. The relationship between planned ground system software releases/capabilities and planned tests with the observatory will be included. The plans and status for flight operations team preparations will be presented.

The CDR shall include all of the items specified for the PDR and the Delta PDR, updated to the final present stage of development process, plus the following additional items:

- a. Evolution and Heritage of the Final Design
- b. Combined optical, thermal, and mechanical budgets or total system performance

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- c. Interface Control Documents
- d. Final implementation plans including: engineering models, prototypes, flight units, and spares
- e. Engineering Model/Breadboard Test Results and Design Margins
- f. Completed design analyses
- g. Specification Compliance Test Plans and Test Flow
- h. Concept of Operations and launch vehicle
- i. Reliability analyses results
- j. Flight software, on-board algorithms and maintenance approach
- k. Pre-launch test plans including: RF compatibility tests, data flow tests, simulations and exercises, launch site and pad tests
- l. Launch and early orbit, including in-orbit checkout overview, contamination avoidance activities and Cal/Val test plans
- m. Interfaces (IRDs, ICDs) with Government facilities progress and status
- n. On-board data memory and storage management
- o. Real-time operations and team build-up/training
- p. Observatory subsystem-level CDR results
- q. Progress and status of management, business and marketing, schedules, financial status (including current income statement, pro forma statement and status of funding source commitments), risk management and risk list with mitigation plans
- r. Validation Data Product system design
- s. LDCM Level 1G-ortho data option
- t. Closure of action items from the previous reviews and MPSRs

REVIEW SUCCESS CRITERIA: The criteria for successful completion of the CDR are as follows:

- a. Final system design is at a level of maturity to allow for the release of drawings and for manufacturing to proceed.
- b. Final system design and concept of operations ensure that LDCM data specification and data delivery requirements are fully met.
- c. LDCM programmatic risk areas (technical, schedule, and business) have been adequately addressed.
- d. Progress in business development, marketing, will-buy commitments, etc. that demonstrate a self-sustaining commercial remote sensing business is being pursued.
- e. Major action items generated during the CDR are dispositioned subject to the approval of the Contracting Officer.
- f. No business/financial limitations exist that would prevent continued system development according to the project master schedule.

REVIEW DELIVERABLES: The following documents are deliverable at the time of this review:

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- a. Baseline LDCM Data Collection & Processing Document
- b. Baseline Data Format Control Documents
- c. Final Calibration/Validation Plan (to include LDCM/Landsat 7 ETM+ Cross Calibration Plan)
- d. Final Data Specification Compliance Plan
- e. Data Flow Test Plan
- f. Final Interface Control Documents to Government Systems
- g. Final Concept of Operations
- h. Data Quality Assurance Plan
- i. Initial Flight and Ground Systems Data Processing Algorithms

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DATA ITEM DESCRIPTION (DID)	
DID #: SR3	Instrument Pre-Ship Review Package

DESCRIPTION: The LDCM Instrument Pre-Ship Review (IPSR) shall be held at the Contractor's or instrument subcontractor's facility and occurs prior to the shipment of the instrument and integration with the spacecraft bus. The purpose of the Instrument PSR is to assure the design of the instrument has been validated through the environmental qualification and/or acceptance test program, that all deviations, waivers and open items have been satisfactorily disposition and that the instrument, along with all the required documentation, operating procedures, etc., is ready for shipment and integration with the spacecraft bus. The Government will evaluate the results of instrument testing, alignment, calibration and end item performance and will evaluate the calibration baseline for use in later testing and on-orbit calibration. The Government will also evaluate the ability to reconstruct imagery, using data acquired by the instrument under simulated operational conditions for all spectral bands. Details shall be provided on the test results, simulations, etc. (as applicable) of the sensor data flow/signal processing chain from the instrument focal plane to the observatory's downlink transmitter. The solutions to all problems encountered during the instrument environmental test and validation program and the solution rationale are to be presented.

The Instrument PSR materials shall include the following:

- a. Any rework/replacement of hardware, regression testing, or test plan changes should be highlighted during the test flow discussions
- b. Demonstrate baseline instrument calibration
- c. Compliance with test verification and data specification matrices
- d. Measured test margins versus design estimates
- e. Demonstrate qualification/acceptance temperature performance margins
- f. Any data that has been trended to identify compliance with specification
- g. Total failure-free operating time of the instrument
- h. Instrument signal processing/data flow
- i. Could-not-duplicate failures along with assessment of the problem and the residual risk that may be inherent in the instrument and impact LDCM data
- j. Programmatic assessment of any residual LDCM risk
- k. Progress and status of management, business and marketing, schedules, financial status (including current income statement, pro forma statement and status of funding source commitments), risk management and risk list with mitigation plans
- l. Post shipment and integration plans
- m. Instrument calibration and characterization results and trends

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- n. Closure of action items from previous reviews and MPSRs

REVIEW SUCCESS CRITERIA: The criteria for successful completion of the Instrument PSR are as follows:

- a. All instrument-level functional, environmental, and Calibration/Validation testing has been satisfactorily completed to allow for shipment and subsequent integration to proceed.
- b. Baseline calibration and performance data has been documented
- c. Instrument design and testing demonstrates that LDCM data specification and data product delivery requirements are fully met.
- d. LDCM programmatic risk areas have been adequately addressed.
- e. Major action items generated during the Instrument PSR are dispositioned subject to the approval of the Contracting Officer.
- f. No business/financial limitations exist that would prevent continued system development according the project master schedule.

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DATA ITEM DESCRIPTION (DID)	
DID #: SR4	Pre-Environmental Review Package

DESCRIPTION: The LDCM Pre-Environmental Review (PER) shall be held at the Contractor's facility and will be a major review of the detailed LDCM test / verification / calibration program and test flow prior to the start of formal environmental testing of the observatory. The progress and status of LDCM ground systems and interfaces to Government systems will also be included in this review. The purpose of the PER is to evaluate the planned test/calibration program and test flow to assure that it meets the LDCM program requirements and to assure that a proper baseline of performance of the item to be tested has been established, and the item is ready to begin a qualification test program to demonstrate end-to-end or system performance. All performance liens, waivers, action items, malfunction reports and open items should be closed or disposition. Could-Not-Duplicates (CNDs) should not be closed and their discussion or risk assessment should include what fault tree analysis was performed, possible causes, testing/on-orbit impacts, as well as "can we see it" in the follow-on test phases. The test verification matrix, including measurement tolerances, stimuli, contamination control, calibration test sources and facility readiness are to be presented. The results of sub-level testing, results since the last review, and results from comprehensive performance tests should be discussed along with the final results of any life tests. Failure free operating times should be presented. Details shall be provided on the test results, simulations, etc. of the sensor data flow/signal processing chain from the instrument focal plane through the observatory's downlink transmitter. Additionally, updates with respect to data flow testing and simulations (especially with any Government systems/facilities), results of previous data flow testing, and launch, orbital operations, and checkout plans shall be provided.

The following items shall be presented at the PER:

- a. Changes since the Critical Design Review
- b. Program status and general test readiness
- c. Test Plans and procedures addressing:
 - 1) Test objectives/conditions/levels/configuration
 - 2) Test facilities, fixtures and support equipment
 - 3) Instrumentation
 - 4) Success/abort criteria
- d. Test flow including: calibration, when comprehensive performance tests will be performed and number of T/V cycles
- e. Schedule

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- f. Documentation Status
- g. Functional and environmental test history of the hardware
- h. Previous anomalies, deviations, waivers and their resolution
- i. Identification of residual risk items
- j. Calibration and alignment status and results
- k. Instrument signal processing/data flow within the observatory
- l. Status of ground system elements related to planning and scheduling; Active Archive and NSLRSDA Data Packages, Validation Data Product generation, Level 1G-ortho data generation (if appropriate); interfaces to Government systems; mission operations plans for launch readiness and operations readiness
- m. Closure of action items from previous reviews and MPSRs

REVIEW SUCCESS CRITERIA: The criteria for successful completion of the Pre-Environmental Review are as follows:

- a. All prior component and instrument level functional and environmental testing has been satisfactorily completed, the observatory is integrated, and performance baseline has been established to allow for observatory level environmental testing to proceed.
- b. Environmental test plans and procedures are ready to support successful environmental testing.
- c. Observatory testing to date demonstrates that LDCM Data Specification and data product delivery requirements are fully met.
- d. LDCM programmatic risk areas (technical, schedule, and business) have been addressed.
- e. Delivery, installation and component testing of all ground system elements, preliminary interface testing of ground system and interfaces to Government systems for planning, scheduling and data delivery.
- f. Operations and launch readiness plans for vehicle state-of-health telemetry and commanding, training plans/status for personnel containing standard operations and contingency planning development, and launch simulation plans.
- g. Major action items generated during the PER are dispositioned subject to the approval of the Contracting Officer.

REVIEW DELIVERABLES: The following documents are deliverable at the time of this review:

Interim Flight and Ground Systems Data Processing Algorithms

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DATA ITEM DESCRIPTION (DID)	
DID #: SR5	System Pre-Ship Review Package

DESCRIPTION: The LDCM System Pre-Ship Review (SPSR) shall be held at the Contractor's facility and will be a major review of the detailed LDCM system readiness for flight and operations for each observatory that may acquire LDCM data. The PSR occurs prior to the shipment of the observatory for launch. The purpose of the PSR is to assure the design and performance of the observatory has been validated through the environmental qualification and/or acceptance test program and the system can produce spec-compliant LDCM Data Packages and VDPs; and the required documentation, operating procedures, etc., are complete. The results of system testing, alignment, calibration and end item performance are to be demonstrated and documented. The solutions to all problems encountered during the environmental test and validation program and the solution rationale are to be presented.

For subsequent observatories that may acquire LDCM data, comparisons against previous observatories shall also be provided to demonstrate that the observatory's data will be consistent with existing LDCM data.

The System PSR materials shall include the following:

- a. Any rework/replacement of hardware, regression testing, or test plan changes should be highlighted during the test flow discussions. For subsequent observatories that may provide LDCM data, hardware and test flow changes from previous LDCM observatories shall be addressed.
- b. Ground system operations, interfaces, and compliance with the Data Specification requirements
- c. Measured test margins versus design estimates
- d. Demonstrate qualification/acceptance temperature margins
- e. Data that has been trended to identify compliance with specification will be presented, especially if there has been a change or drift to the trend, including previous instrument level test results.
- f. Total failure-free operating times
- g. Could-not-duplicate failures should be presented along with assessment of the problem and the residual risk that may be inherent in the item
- h. Contractor assessment of any residual risk
- i. Progress and status of management, business and marketing, schedules, financial status (including current income statement, pro forma statement and status of funding source commitments, risk management and risk list with mitigation plans

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- j. Post shipment plans
- k. Launch and early orbit test planning
- l. Results of instrument level calibration and characterization, observatory level environmental calibration and characterization, baseline calibration parameters and algorithms for initial on-orbit usage, and performance comparison and trending
- m. Confirmation of operational readiness of all ground system elements, personnel, Government interfaces and any launch critical ground elements
- n. Launch and Operation training status report describing the contingencies tested and how well the teams performed during the contingency simulations training exercises.
- o. Closure of action items from previous reviews and MPSRs

REVIEW SUCCESS CRITERIA: The criteria for successful completion of the System Pre-Ship Review are as follows:

- a. All observatory functional, environmental, and Calibration/Validation testing has been satisfactorily completed to allow for shipment and subsequent launch operations to proceed.
- b. All observatory testing; end-to-end testing of planning and scheduling; Active Archive and NSLRSDA Data Packages; VDP generation; testing of Level 1G-ortho data generation (if appropriate); and testing of interfaces to Government systems demonstrates that LDCM Data Specification delivery requirements are fully met, and documented.
- c. Ground system operations procedures baselined and staff training completed.
- d. LDCM concept of operations has been demonstrated and shown to meet data specification and data product delivery requirements.
- e. Launch, Commissioning, and post-IOC LDCM operations plans and procedures have been reviewed and approved.
- f. Commands and observatory telemetry successfully sent and received from the operations facility.
- g. LDCM programmatic and mission risk areas have been adequately addressed.
- h. Major action items generated during the System PSR are dispositioned subject to the approval of the Contracting Officer.
- i. Progress in business development, marketing, will-buy commitments, etc. that demonstrate a self-sustaining commercial remote sensing business is continuing to develop (update only required for subsequent observatories).
- j. No business/financial limitations exist that would prevent continued system development according the project master schedule.

REVIEW DELIVERABLES: The following documents are deliverable at the time of this review:

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- a. Initial Data Specification Compliance Report
- b. Final LDCM Data Collection & Processing Document
- c. Final Data Format Control Documents
- d. Flight and Ground Systems Data Processing Algorithms
- e. Baseline Data Operations Procedures

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DATA ITEM DESCRIPTION (DID)	
DID #: SR6	Initial Operational Capability Review Package

DESCRIPTION: The LDCM Initial Operational Capability Review (IOCR) shall be held at the Contractor's facility and will be the final major review of the detailed system status, prior to full operation, LDCM product generation and distribution for each observatory, following successful launch and Commissioning.

For each observatory that may acquire LDCM data, the IOC Review shall address the following at a minimum:

- a. Launch and early orbit operations results
- b. On-orbit checkout results
- c. Calibration/Validation results up to IOC, including observatory environmental, and comparison to pre-launch baselines
- d. Results of data flow testing including planning and scheduling, and delivery of specification-compliant LDCM Data Packages and VDPs
- e. Algorithms and calibration coefficients
- f. For subsequent observatories, comparison of characterization, calibration, and performance data to previous observatories/existing data
- g. Closure of action items from previous reviews and MPSRs

REVIEW SUCCESS CRITERIA: The criteria for successful completion of the IOC Review are as follows:

- a. Observatory checkout completed
- b. Reliable delivery of spec-compliant Data Packages has been demonstrated through data flow tests and repeat cycle demonstration
- c. Cal/Val results demonstrate that LDCM Data Packages and VDPs meet Data Specification requirements
- d. Concept of operations proven to meet data product delivery requirements
- e. Successful completion of the Data Flow Test(s) and 16-day data acquisition tests
- f. Closure of action items from previous reviews and MPSRs

REVIEW DELIVERABLES: The following documents are deliverable at the time of this review:

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- a. Final Data Specification Compliance Report
- b. Daily Data Delivery Report (continuing through mission life)
- c. Data Operations Procedures
- d. Final Flight and Ground Systems Data Processing Algorithms
- e. Calibration/Validation Report (follow-up 6 months after IOC)

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DATA ITEM DESCRIPTION (DID)	
DID #: PR1	Management Program Status Review Package
SUBMISSION PERIOD: Contract Start-IOCR/Quarterly after IOCR	

DESCRIPTION: The Contractor shall provide a Management Program Status Review (MPSR) and shall include all aspects of the LDCM program. The Program Status reviews shall include the following at a minimum:

- a. Accomplishments since last review and action item status
- b. System technical status and progress, risk list updates, and residual risk assessment
- c. Program status including forthcoming events and activities
- d. Performance and quality assurance status
- e. Overall company and LDCM-related business and financial status, including funding profiles, business base, cash flow analysis, financial exposure, risk posture, profitability projections and changes in funding source commitments
- f. Program schedule status
- g. Contract issues

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DATA ITEM DESCRIPTION (DID)	
DID #: PR2	Monthly Operations/Anomaly Report
SUBMISSION PERIOD: Launch-Contract End	

DESCRIPTION: The Contractor shall provide a Monthly Operations/Anomaly Report to the government as a means of monitoring system performance, as it affects data product quality and delivery. Monthly operational reports shall be submitted to the government the first week after completion of the previous month's activities.

The Monthly Operations/Anomaly Report shall include the following items at a minimum:

- a. Cal/Val updates and activities, including the number and type of operations, identification and location of the data sets used in calibration operations, and any updates to the operational calibration parameters
- b. System operations anomalies that may jeopardize LDCM data delivery and data product quality, including plans and resolution of anomalies under investigation
- c. Scheduled versus delivered data product summary
- d. Data quality summary including updates to long term system performance trends
- e. Supporting data in electronic format, where applicable
- f. System configuration changes including hardware, software, and algorithm changes
- g. Overall company and LDCM-related business and financial status, including funding profiles, business base, cash flow analysis, financial exposure, risk posture and profitability projections
- h. Operational status including forthcoming events and activities, e.g. planned maneuvers, system upgrades

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DATA ITEM DESCRIPTION (DID)	
DID #: PR3	Monthly Schedule Report
SUBMISSION PERIOD: Contract Start-IOCR	

DESCRIPTION: The Contractor shall provide a Monthly Schedule update to the Contractor's LDCM master schedule. It is the intent of the Government to use the Contractor's in-house schedule system as a mechanism for monitoring program progress. The monthly schedule update shall be submitted to the Government the first week after completion of the previous month's activities.

Schedules and subsequent updates shall include the following items:

- a. Maintain the original schedule baseline dates for comparison with current dates
- b. Define planned start and completion dates and time durations for all tasks, activities, events, and milestones (for Instrument, Spacecraft, Ground System, I&T)
- c. Define internal relationships between events etc. so that slack / float and critical path may be determined

Schedules shall be submitted electronically, in a mutually agreeable format. The schedules shall allow for the generation of reports/listings, milestone charts and networks, and shall provide differentiation between Level 1, 2, and 3 networks.

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DATA ITEM DESCRIPTION (DID)	
DID #: PR4	Evidence of Binding Commitments Report
SUBMISSION PERIOD: One time TBP month(s) after contract award	

DESCRIPTION: The Contractor shall provide an Evidence of Binding Commitment report, which will be used for determining successful completion of the Evidence of Binding Commitment milestone.

Information in this report should detail any binding commitments, related to the LDCM contract, with partners, subcontractors, suppliers, or other parties. The report should detail the parties of the agreement, the nature of the commitment, the approximate length of time the commitment is for, and the value of the commitment. Commitments could cover areas such as major partnerships, flight hardware, ground systems, supplies and services, and long lead parts.

In addition, the report should provide, in the same detail, evidence of commitments between the Contractor and any significant source of debt/equity funding.

SUCCESS CRITERIA: Delivery of the Evidence of Binding Commitments report and successful demonstration that binding commitments have been executed.

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DATA ITEM DESCRIPTION (DID)	
DID #: SE1	Concept of Operations

DESCRIPTION: The Contractor shall provide a Concept of Operations for the LDCM system. Emphasis should be on the methodology for satisfying LDCM data delivery requirements.

The Concept of Operations shall include the following material at a minimum:

- a. Launch and early orbit operations, commissioning, transition to operations and contingency operations
- b. Time ordered sequence of mission activities and modes of operation
- c. Scheduling LDCM data acquisition and conflict resolution
- d. System architecture and technical interfaces to existing government systems
- e. A “day in the life” of mission operations
- f. Command, Control and Communications operation
- g. Creation and delivery of LDCM Data Packages and Validation Data Products
- h. Data flow and processing from the LDCM sensor to the contractor’s storage facility
- i. System performance margins for data delivery
- j. System upgrades and maintenance strategies
- k. Plans for integrating with existing government systems or facilities
- l. Strategy for data quality assurance

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DATA ITEM DESCRIPTION (DID)	
DID #: SE2	Calibration/Validation Plan

DESCRIPTION: The Contractor shall provide a Calibration/Validation Plan for the LDCM Instrument/Observatory System that describes the approach for characterizing the qualities of the LDCM Sensor Data, ensuring that the LDCM data products satisfy the LDCM Data Specification requirements Pre-Launch, Commissioning and Post-IOC in accordance with the Calibration/Validation requirements.

The Calibration/Validation Plan shall incorporate the following information at a minimum:

- a. A description of planned tests including:
 - what is being tested and how it relates to instrument performance and the data specification
 - integration level for test, i.e. unit, component, instrument, observatory
 - environmental conditions for test, e.g. ambient, thermal-vacuum, on-orbit
 - operational phase of testing, i.e. pre-launch, Commissioning, or post-IOC
 - theoretical basis for the test (how the test is performed, how the data are reduced and why it is done this way-equations and physics)
 - test equipment and setup
 - description of test results usage, i.e. processing algorithms that use test results or calibration parameters generated by the test
- b. A test schedule and flow chart
- c. How test results are made available
- d. Government access and participation in pre-launch testing including a GFE transfer radiometer/EOS radiometric scale realization activities and any government diffuser BRDF characterization activities
- e. Description of COTS and custom analysis tools
- f. A description of the On-Orbit Calibration capabilities of the LDCM sensors, their design, how they are characterized, and how they are used
- g. On-Orbit process for Calibration Parameter generation
- h. Reference Standards and their calibration traceability
- i. Support data requirements, e.g. GCP, DEM, reference images

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DATA ITEM DESCRIPTION (DID)	
DID #: SE3	Calibration/Validation Procedures

DESCRIPTION: The Contractor shall provide Calibration/Validation procedures for each planned test. The procedures shall minimally include step-by-step instructions, test equipment and calibration reference requirements, assumptions, associated algorithms, analysis techniques, expected results, output data format, and pass/fail criteria. Descriptions of each test shall include (at a minimum): test facilities, mechanical & electrical ground support equipment, stimuli, levels, durations, configurations, sequence of events, and trending of performance characteristics during verification testing.

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DATA ITEM DESCRIPTION (DID)	
DID #: SE4	Calibration/Validation Test Reports

DESCRIPTION: The Contractor shall provide a Calibration/Validation Test Report for each planned test. All supporting data shall be provided in electronic format, where applicable.

The Calibration/Validation Reports shall include at a minimum:

- a. Identification of test article or component with date of test
- b. Performance trends during and between each planned test
- c. Problems or failures with tests or procedures
- d. Anomalies and deviations from plans or procedures
- e. Test results, including any calibration parameters to be used for on-orbit processing and comparison of results with expectations and requirements

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DATA ITEM DESCRIPTION (DID)	
DID #: SE5	Calibration/Validation Report

DESCRIPTION: The Contractor shall provide a Calibration/Validation Report in three phases. The Pre-Launch report shall describe the pre-launch calibration process and results and is delivered at IOC; the Commissioning Report shall describe the calibration process and results from launch to IOC and is delivered six months after IOC, and the Final Report shall describe cal processes and results for all observatories at the end of the contract. Each shall document the state of the instrument calibration relative to the Data Specification. The reports shall include details of any anomalies affecting the data, descriptions of the instrument calibration and characterization tests, references to the test reports from DID SE4, and long term trending results. The Commissioning Report shall include any changes to the calibration parameters and algorithms during the Commissioning period. These reports shall be designed to serve as instrument calibration references for current and future users of the LDCM data set.

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DATA ITEM DESCRIPTION (DID)	
DID #: SE6	Data Specification Compliance Plan

DESCRIPTION: The Contractor shall provide a Data Specification Compliance Plan that identifies tests and analysis through the pre-launch and post-launch phases of the LDCM that supports LDCM Data Specification compliance.

The plan shall provide at a minimum:

- a. Performance Verification Matrices which map performance as specified in the LDCM Data Specification against the LDCM Observatory and Ground Segment verification testing program
- b. Matrix which maps Data Specification requirements against the contractor's LDCM System Specification requirements
- c. Description of all LDCM observatory, instrument and ground segment tests that are required to fully characterize the performance of the system and assure data product quality. Tests shall include (but not be limited to): mechanical, electrical, functional, performance, environmental, data flows, and observatory alignment tests. Descriptions of each test shall include (at a minimum): test facilities, mechanical & electrical ground support equipment, stimuli, levels, durations, configurations, sequence of events, pass/fail criteria, and trending of performance characteristics during verification testing.
- d. Description of a set of baseline performance characteristics, the methods used to track the current performance, the process by which the current performance is compared to the baseline, and the criteria used to determine if current performance and performance trends are acceptable.

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DATA ITEM DESCRIPTION (DID)	
DID #: SE7	Data Specification Compliance Report

DESCRIPTION: The Contractor shall provide a Data Specification Compliance Report that summarizes the results of performance verification testing to specification compliance. To avoid duplication, any data already delivered in other CDRL items may be included by reference.

The report shall include at a minimum:

- a. Summary of system test results that demonstrate compliance with the data specification
- b. Summary and resolution of any problems meeting data specification requirements or margins
- c. Performance trending of Observatory/Ground Segment components

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DATA ITEM DESCRIPTION (DID)	
DID #: SE8	Data Flow Test Plan/Procedures

DESCRIPTION: The Contractor shall provide a data flow test plan and procedures for a phased series of tests to exercise the interfaces between the contractor and Government-provided portions of the LDCM system. At a minimum, the plan shall address phasing of data flow testing, both pre and post launch, anticipated Government involvement, and how the accuracy and completeness of databases and algorithms are verified. To avoid duplication, any procedures already delivered in other CDRL items may be included by reference.

For each test, the plan shall provide at a minimum:

- a. The test goals and requirements
 - Government interface tests shall include verification of timeliness, format, and readability at the government interface
- b. Schedule of the test and coordination of resources.
- c. Description of the supporting data products used during the test.
- d. Description of test facilities, mechanical & electrical ground support equipment, stimuli, levels, durations, configurations, sequence of events, pass/fail criteria, trending of performance characteristics, and actual versus design margins during verification testing.

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DATA ITEM DESCRIPTION (DID)	
DID #: SE9	Data Flow Test Report

DESCRIPTION: The Contractor shall provide a report of the results of each Data Flow Test. The reports shall contain the following, at a minimum:

- a. The test goals, success criteria, and requirements
- b. A description of the hardware (real or simulated) used, including its location, configuration and environment
- c. A description of any simulated data and supporting data used
- d. Test results relative to success criteria, including a description of any anomalies and their resolution, problems, lessons learned, and future improvements to remaining data flow testing

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DATA ITEM DESCRIPTION (DID)	
DID #: SE10	Interface Control Documents to Government Systems

DESCRIPTION: The Contractor shall provide Interface Control Documents for all Government systems in the LDCM data network. At a minimum, a unique ICD is required for interfaces to: the USGS/EDC Active Archive, NSLRSDA, the USGS/EDC acquisition and planning system, NASA Goddard Space Flight Center and the Calibration/Validation System. The documents will define the functional and performance characteristics that exist between the Contractor data system and Government systems.

The Interface Control Documents shall contain at a minimum:

- a. Data and media formats
- b. Data rates
- c. Duty cycles
- d. Protocols
- e. Physical interfaces
- f. Error conditions
- g. Timing
- h. Security

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DATA ITEM DESCRIPTION (DID)	
DID #: SE11	Data Operations Procedures

DESCRIPTION: The Contractor shall provide a detailed set of standard operations procedures for the interface between the Contractor and Government systems. These procedures shall include nominal operations, contingency recovery and reporting; and shall include training by the Contractor on procedure use. The procedures shall include definition of configurable items (e.g. passwords, seasonality files) in the interface and procedures for changing and maintaining them. The procedures shall describe the roles and responsibilities for conducting operations and contact information for operators, engineers and system support for configuration, maintenance and operation of the interface between Contractor and Government systems. This document shall be maintained during the operations phase of the LDCM contract and shall be modified as necessary during training, operations exercises and procedure reviews.

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DATA ITEM DESCRIPTION (DID)	
DID #: SE12	Data Quality Assurance Plan

DESCRIPTION: The Contractor shall provide a listing of its corporate practices, processes, and procedures documents, used in the accomplishment of the LDCM contract requirements, that cover the topics described below. That set of documents shall be considered the Contractor's 'Data Quality Assurance Plan'. For any of these topics where the Contractor does not have an applicable documented process, the Contractor shall describe its process for accomplishing the item/task listed.

The topics that are encompassed in the plan are:

- a. Process used to establish a verification program
- b. Process used for selecting parts and materials and a description of the screening methods employed
- c. Internal and subcontractor audit, walkthrough, peer review, non-conformance and corrective action tracking processes
- d. Configuration Management Processes
- e. Reliability processes, including means by which margins are established and redundancy and life-test decisions are made
- f. Software design practices, configuration management, and software assurance processes
- g. System safety processes
- h. Contamination control processes including; inspections, measurement techniques, cleaning, clean-room and launch-site practices
- i. Stray light design practices and testing / measurement techniques
- j. EMI / EMC control processes including design principles and measurement and testing techniques
- k. Launch-site processes (tests, inspections, etc.) that are used to ensure launch and data product generation readiness

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DATA ITEM DESCRIPTION (DID)	
DID #: PM1	Program Execution Plan

DESCRIPTION: The Contractor shall provide a Program Execution Plan that defines the Contractor's approach for total project management of the LDCM Implementation Phase.

The Program Execution Plan shall contain the following items at a minimum:

- a. Project management including partners and subcontracts
- b. Project organization and government partnerships and relationships
- c. Technical and engineering management of system implementation
- d. Business management and commercial business strategy, including marketing approaches and methods for attracting and establishing non-Government customers
- e. Risk management and mitigation, including approaches for evaluating financial exposure and performing vulnerability assessments
- f. Issue resolution process pre-IOC and post-IOC

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DATA ITEM DESCRIPTION (DID)	
DID #: DM1	LDCM Data Collection & Processing System Document

DESCRIPTION: The Contractor shall provide non-proprietary descriptions of the system used to acquire LDCM data and of the LDCM Data Packages and Validation Data Products delivered to the Government. The information in this document is intended for public dissemination. The following items shall be described at a minimum:

- a. An overview and description of the observatory(ies) and instrument(s) acquiring LDCM data.
- b. An overview of the flow of LDCM data from the observatory(ies) to the USGS/EDC Active Archive and NSLRSDA including the ground system architecture.
- c. A description of calibration procedures and processes.
- d. An overview of the data processing, both on-board and ground processing, resulting in the generation and delivery of LDCM Data Packages
- e. A description of the algorithms and processes used to generate the LDCM Validation Data Products
- f. A characterization of the quality of the LDCM Validation Data Products including, but not limited to, radiometric and geolocation accuracies

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DATA ITEM DESCRIPTION (DID)	
DID #: DM2	Data Format Control Documents

DESCRIPTION: The Contractor shall provide LDCM Data Format Control Documents that provide detailed format and content of the LDCM Data Packages and VDPs delivered to the USGS/EDC Active Archive, NSLRSDA, and the Government's Calibration/Validation system.

The following items shall be included at a minimum:

- a. An overview of each item within a given data package or product
- b. A description of the package or product file structure, organization, and naming convention(s)
- c. A description of the contents and record structure of each package or product file
- d. A description of the contents and format of the data fields including units, where applicable, in each package or product record type
- e. A description of any package or product variants or optional product components
- f. A description of how the package or product is structured in each supported distribution medium

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DATA ITEM DESCRIPTION (DID)	
DID #: DM3	Flight and Ground Systems Data Processing Algorithms

DESCRIPTION: The Contractor shall provide Onboard and Ground System Data Processing Algorithms required to create LDCM Sensor data, and produce LDCM Data Packages and VDPs. The Contractor shall provide descriptions and theoretical basis for all data processing algorithms. The information in these documents is intended for public dissemination.

The algorithm description shall include at a minimum:

- a. An overview of the algorithm including the objective or purpose of the algorithm
- b. The rationale for the algorithm and the data package or product it supports
- c. A description of any external ancillary data (e.g. digital elevation data) used by the algorithm
- d. A description of the algorithm outputs
- e. A mathematical description of the algorithm
- f. An error analysis showing the expected accuracy of the algorithm results
- g. A description of the methods used to validate the algorithm
- h. A list of the LDCM data components used by the algorithm
- i. A list of references

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DATA ITEM DESCRIPTION (DID)	
DID #: DM4	Daily Data Delivery Report
SUBMISSION PERIOD: IOCR-Contract End	

DESCRIPTION: The Contractor shall provide a Daily Data Delivery Report to the Government commencing at the Initial Operation Capability phase of the LDCM and continuing throughout the operational life of the LDCM contract. The daily report shall cover the previous day's data acquisitions with a running total of the percentage of the seasonality listings taken for the current quarter, a status of the system's performance over the last 24 hours, any anomalies that may impact the quality of the data or the ability to acquire data that occurred, resolutions or plans for restoring data quality issues, and a listing with status of any special data acquisitions requested and processed over the last 72 hours.

The Daily Data Delivery Report shall contain the following at a minimum:

- a. Scheduled daily LDCM scene acquisitions versus delivered scenes with cloud cover assessment per scene
- b. Number of Active Archive Data Packages and NSLRSDA Data Packages delivered and total number of scenes per package
- c. Updated listing of WRS-2 scenes taken versus the WRS-2 scenes requested in the seasonality file