

ATTACHMENT C

RAPID IV

RFP

CONTRACT DATA REQUIREMENTS LIST (CDRL)

September 11, 2019

Table of Contents

Section	Page
<u>Section 1 – INTRODUCTION</u>	3
1.1 Scope	3
1.2 Contract Data Requirements List (CDRL) Description	3
1.3 Data Item Description (DID) Overview	4
1.4 Delivery Instructions	5
1.5 Delivery Media	5
1.6 Documentation Change Procedures	6
<u>Section 2 - CDRL TABLE</u>	7
2.1 TABLE 1: Rapid IV Contract Data Requirements List	8-10
<u>Section 3 – CDRL DATA ITEMS DESCRIPTIONS</u>	11
DIDs # 1 thru 20G	12-46

ENCLOSURES

CDRL 1, Enclosure 1 (supplied as a separate file)

SECTION 1 - INTRODUCTION

1.1 Scope

This Contract Data Requirements List (CDRL) is the Rapid IV contractual document defining the baseline set of all required data to be provided by the Contractor on each Rapid IV contract delivery order (DO). All CDRLs are referenced in the Rapid IV SOW.

The Government may modify the CDRL list for each mission specific DO.

1.2 Contract Data Requirements List (CDRL) Description

The baseline mission required CDRL items are listed in CDRL Table 1 of this document. All data shall be prepared, maintained, and delivered to the Government in accordance with the requirements of Table 1 and the associated Data Item Description (DID) for each CDRL item.

Table 1 contains the following information on each CDRL item:

- a) CDRL #
The CDRL data items are sequentially numbered. Some CDRLs may have more than one required document or part.
- b) SOW Reference:
Indicates where the CDRL item is called out in the SOW.
- c) CDRL Item Title
- d) CDRL Delivery Information:
‘Yes’ in the Prop (Proposal) column of Table 1 indicates the CDRL Data Item is to be delivered with the Core Spacecraft Proposal in accordance with the Rapid IV RFP Technical Proposal Instructions (Section L.23).

The contract baseline schedule for delivery of CDRL items on delivery orders is shown in the next seven columns of CDRL Table 1 associated with acronyms for the various spacecraft project reviews that form the contract baseline set of payment milestones. (Reference Contract Clause H.9, Performance-Based Payment Events and Completion Criteria; Clause H.10, Acceptance and Final Payment; and SOW Section 4.3.1.4.2, Spacecraft Systems Reviews).

The following Codes apply:

I: Indicates required submission of the **Initial** (preliminary) version of the data or document.
(The proposal submission is considered an Initial version).

U: Indicates required submission of an **Updated** revision.

F: Indicates required submission of the **Final** version of the document.

A/R: Indicates the item delivery is “as required”, depending on circumstances, and is not tied to a specific milestone review.

Unless otherwise indicated in the CDRL item or Table 1, the CDRL item shall be submitted so it is received by the Government 14 days prior to the associated Spacecraft Systems Review.

- e) CDRL Purpose - The Government purpose for each document is defined as follows:

Approval: The Final version of the document is submitted for Government **Approval**. Starting when the Government receives the data, the Contractor shall wait 14 calendar days for written approval from the Government Contracting Officer (CO) before proceeding with the associated work. If a response is not received in the prescribed time, the Contractor may proceed as though approval was received, after notifying the Government of the intention to proceed. **Approval applies only to the Final version of the document.** Otherwise the document is submitted for Government Review.

Review: The document is submitted to the Government for **Review**. Starting when the Government receives the data, the Contractor shall wait 14 calendar days, for Government review and comment; to be sent in writing from the Government Contracting Officer (CO). If a response is not received in the prescribed time, the Contractor may continue with the effort after notifying the Government of the intention to proceed. The contractor may proceed with the associated work while preparing a response to the Government's comments.

Information: Deliverables are sent to the Government for **Informational** purposes. The Government may request changes on deliverables where errors or omissions are noted.

The Contractor shall notify the Government Contracting Officer (CO) and Government Project Management in writing or by email when transmitting each CDRL Data Item.

1.3 Data Item Descriptions (DIDs) Overview

The require data for each CDRL is defined by a corresponding Data Item Description (DID). The CDRL item DIDs required are found in Section 3 of this CDRL.

- a) Each DID describes the CDRL item Title, # (number), Reference documents, Use, Related Documents and required Preparation Information. The delivery requirements and "Purpose" (defined in Table 1) for the CDRL item may also be reiterated in the DID.
- b) **Much of the information requested in the DIDs may already exist in your documentation and in your own format. Existing documents and formats may be used if they meet the intent of DID requirements.** In this case, a matrix or notation shall be supplied with your CDRL item and documents where in your documents the information that satisfies the requirement can be found.

1.4 Delivery Instructions

For each Delivery Order (DO), the Contractor shall deliver each data item via the indicated media (see below), in the specified quantities, in accordance with any special instructions indicated in the CDRL/DID List and in accordance with the Contract or the mission specific Delivery Order DO requirements and provisions. CDRL's required by the Contract Request for Proposal (RFP) shall be provided in accordance with the RFP instructions.

Mission Specific CDRL data shall be delivered to the following address:

Mission Project Office Contracting Officer
(Address to be supplied with DO)

In addition to the above, the original transmittal letter for all deliverables shall be addressed to:

Goddard Space Flight Center
Attn: RSDO Contracting Officer
Rapid Spacecraft Development Office
Code 401.1
Greenbelt, MD 20771

The following shall be provided for each data item submission:

- a) Electronic Data Delivery - Formats for electronic media delivery are defined in paragraph 1.5 of this CDRL.
- b) For the baseline DO effort, the contractor shall assume the delivery requirement is one hard copy and one electronic copy (on one or more CDs) for each CDRL delivery, except for the Spacecraft Systems Reviews, CDRLs 20A through 20G. For CDRLs 20A through 20G, the contractor shall supply twenty-five (25) additional hard copies, provided to the Government attendees at the meeting.

1.5 Delivery Media

- a) There are two media in which data may be documented, defined as follows:
 - 1. Hard Copy - Data typed, drawn or printed on paper by common conventional practices.
 - 2. Electronic - Data which is recorded on CD ROM or provided by other electronic means (e.g. email, etc.).
- b) Documentation delivery (in hardcopy or electronic format) for each DO shall be as specified in that mission's Delivery Order.

1.6 Documentation Change Procedures

Unless otherwise defined in the mission specific DO:

- a) The Contractor shall issue Documentation Change Notices (DCNs), starting with the number 001, whenever minor changes are made in “Final” versions of data items that have been delivered to the Government.
- b) Change bars or “change tracking” shall be used to indicate the locations of changes unless the particular file type does not have those features available. The details of the changes shall also be described on a Changes Page in the associated text file.
- c) When major changes to a document are made, a complete revision of the document shall be issued and delivered to the Government in accordance with the DO instructions for the data item. A description of all changes incorporated into the new revision shall be included in the new document or otherwise documented.
- d) No change bars are used when a document is updated by revision and the DCN numbers for that document shall be automatically recycled to 001.

SECTION 2

CDRL TABLE

RAPID IV RFP # 80GSFC19R0016 Rev 4

2.1 TABLE 1: Rapid IV Contract Data Requirements List

See CDRL INTRODUCTION, and Notes (below) for meaning of letter codes and additional Information.

CDRL Reference Information			CDRL Delivery Information for DO								
CDRL #	SOW Ref.	Title	Due at (See Note 4)								Purpose (See Note 2)
			Prop (Note 3)	SRR	PDR	CDR	IIRR	PER	PSR	OAR	
1	4.3.4.1 4.3.7.3	Core Spacecraft Performance Specification	Yes	U	U	F	-	-	-	-	Approval
2	4.3.2.2.1 4.3.4.4	Instrument Interface Control Document (IICD)	Yes	U	U	F	-	-	-	-	Approval
3	4.3.4	Spacecraft Performance Verification Plan	Yes	--	U	U	U	F	--	--	Review
4	4.3.4	Spacecraft Integration and Test (I&T) Plan	Yes	--	U	U	U	F	--	--	Review
5	4.3.2.2	Telemetry and Command Requirements Documentation	-	-	I	U	U	F	-	-	Information
6	4.3.2.2	External Interfaces, Models and Analysis	-	-	I	U	U	U	F	-	Review
7	4.3.2.2.2	Flight Operations Ground System Interface Documentation	-	-	I	U	U	F	-	-	Review
8	4.3.2.2.3	Launch Vehicle Documentation	-	-	I	U	U	U	F	-	Approval
9	4.3.3.1	As Built Parts List (ABPL)	-	(See Note 5)						Review	
10	4.3.3.2	Failure Mode Effects Analysis (FMEA) & Critical Items List (CIL) (See DID for early submissions requirements)	-	--	I	U	U	U	F	--	Review
11	4.3.3.4	Contamination/Cleanliness Control Plan and Data	-	I	U	U	U	U	U	F	Review
12	4.3.1.5	Engineering Change Proposals (Deviations and Waivers)	-	A/R						Per DID	

RAPID IV RFP # 80GSFC19R0016 Rev 4

CDRL Reference Information			CDRL Delivery Information for DO								
CDRL #	SOW Ref.	Title	Due at (See Note 4)								Purpose (See Note 2)
			Prop (Note 3)	SRR	PDR	CDR	IIRR	PER	PSR	OAR	
13	4.3.4.5 4.3.4.6	Storage, Shipment and Handling Plan	Yes	-	-	U	U	F	-	-	Review
14	4.3.2.2.3	Observatory Launch Site Operations and Test Plan	Yes	-	-	U	U	U	F	-	Review
15	4.3.2.2.3	Observatory Launch Site Operations and Test Procedures	-	-	-	I	U	U	F	-	Approval
16	4.3.2.2.2 4.3.6.1	Flight Operations Support Plan	Yes	-	U	U	U	U	F	-	Information
17	4.3.2.2.2 4.3.7.2	Spacecraft Operations Description Manual	-	-	-	I	U	U	F	-	Information
18	4.3.7.4	End Item Acceptance Data Package	-	-	-	-	I	U	U	F	Approval
19	4.3.3.5	Orbital Debris Generation Analysis Report	-	-	I	U	U	F	-	-	Review
20A	4.3.1.4.2	Spacecraft (S/C) Systems Requirements and Systems Definition Review (SRR/SDR) Information Requirements	-	F	-	-	-	-	-	-	Information
20B	4.3.1.4.2	S/C Preliminary Design Review (PDR) Information Requirements	-	-	F	-	-	-	-	-	Information
20C	4.3.1.4.2	S/C Critical Design Review (CDR) Information Requirements	-	-	-	F	-	-	-	-	Information
20D	4.3.1.4.2	Instrument Integration Readiness Review (IIRR) Information Requirements	-	-	-	-	F	-	-	-	Information
20E	4.3.1.4.2	Observatory Pre-Environmental Review (PER) Information Requirements	-	-	-	-	-	F	-	-	Information
20F	4.3.1.4.2	Observatory Pre-Shipment Review (PSR) Information Requirements	-	-	-	-	-	-	F	-	Information

RAPID IV RFP # 80GSFC19R0016 Rev 4

CDRL Reference Information			CDRL Delivery Information for DO								
CDRL #	SOW Ref.	Title	Due at (See Note 4)							Purpose (See Note 2)	
			Prop (Note 3)	SRR	PDR	CDR	IIRR	PER	PSR		OAR
20G	4.3.1.4.2 4.3.7.3	Observatory Acceptance Review (OAR) Information Requirements	-	-	-	-	-	-	-	F	Information
21	4.3.1	Project Management Plan	Yes	Updates as may apply to the Delivery Order							Information
22	4.3.2	Systems Engineering Plan	Yes	Updates as may apply to the Delivery Order							Information
23	4.3.3	Systems Assurance Plan	Yes	Updates as may apply to the Delivery Order							Information

Notes:

- 1. The Data Item Descriptions (DIDs) for the above CDRLs are found in Section 3 of this CDRL Document.**
- 2. “Approval” applies only to Final “F” version of these documents.**
- 3. Proposal “Yes” indicates baseline versions are submitted with the core spacecraft proposal.**
- 4. Unless stated otherwise, CDRLs shall be provided to the Government Project 14 calendar days prior to the indicated Milestone Systems Review.**
- 5. For Review by the Government, submit an initial ABPL to the Government Project Office as the first components are assigned their parts and approved by the Contractor’s Parts Control Board (PCB). Submit updates to the ABPL monthly, as additional parts are approved by the Contractor’s PCB. Submit the Final ABPL 15 business days prior to the Pre-Ship Review (PSR) meeting.**

(End of CDRL Table)

SECTION 3

CDRL DATA ITEM DESCRIPTIONS

<p><u>Title:</u> Core Spacecraft Performance Specification</p>	<p><u>DID for CDRL #:</u> 1 – (Part 1)</p>
<p><u>Reference:</u> SOW Section 4.3.4.1 & 4.3.7.3</p>	
<p><u>Use:</u> To specify the performance and characteristics of the Core Spacecraft. The intent of this document is to present the top-level system performance separately from the detailed component and subsystem descriptions. In other words, <i>what</i> the Core Spacecraft does is captured in the first section, <i>how</i> it gets it done is in the second section.</p>	
<p><u>Related Documents:</u> EXCEL file “CDRL 1 enclosure.xls”</p>	
<p><u>Preparation Information:</u> The Core System Performance Specification consists of two main sections: 1) a Performance Characteristics section and 2) a Systems and Subsystems Description section.</p> <p>1) CORE SYSTEM PERFORMANCE CHARACTERISTICS</p> <p>The offeror shall detail the top-level performance characteristics of the proposed Core Spacecraft System (Top level system performance characteristics only in Part 1 of this DID, component descriptions are in Part 2). The offeror is strongly encouraged to provide any additional performance characteristics which will help the Government understand the Core System and Option(s) offered, beyond those characteristics outlined here. Explanatory text, in addition to the completed enclosure, is allowable.</p> <p>1.1 Observatory (or Mission) Level Performance (Complete EXCEL Spreadsheet “CDRL 1 enclosure.xls” Part 1 provided as Enclosure 1 to this DID)</p> <p>1.2 Core Spacecraft Major Systems Performance (Complete EXCEL Spreadsheet “CDRL 1 enclosure.xls” Part 2 provided as Enclosure 1 to this DID)</p> <p><i>On a Mission Specific DO, this CDRL is replaced by the Mission Spacecraft Performance Specification.</i></p>	

<p><u>Title:</u> Core Spacecraft Performance Specification (continued)</p>	<p><u>DID FOR CDRL #:</u> 1– (Part 2)</p>
<p><u>Reference:</u> SOW Section 4.3.4.1 & 4.3.7.3</p>	
<p><u>Use:</u></p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information (cont'd):</u></p> <p>2) CORE SYSTEM AND SUBSYSTEM DESCRIPTIONS</p> <p>The offeror shall describe the make-up of the Core System and major subsystems using component descriptions, block diagrams and subsystem performance characteristics. The description shall provide the basis for performance claims made in CDRL 1 – Part 1 and confirm the design margins.</p> <p>2.1 <i>Structural/Mechanical Subsystem</i></p> <p>2.2 <i>Power Subsystem</i></p> <p>2.3 <i>Propulsion Subsystem</i></p> <p>2.4 <i>Attitude Control Subsystem</i></p> <p>2.5 <i>Command and Data Handling Subsystem</i></p> <p>2.6 <i>Communications Subsystem</i></p> <p>2.7 <i>Thermal Control Subsystem</i></p> <p>2.8 <i>Flight Software/Firmware</i></p> <p>2.9 <i>Ground Support Equipment</i></p> <p>This section shall contain an equipment list or table itemizing all core system components down to the subsystem “component level” (that is, core system structure, solar array, battery vessel and cell type and number, wire harness, star tracker etc., high-density boards and electronics should be itemized at the box level). For each component show the manufacturer, model, mass, power, and heritage.</p> <p>A suggested format for this information is included in the enclosure “CDRL 1 enclosure.xls” (Part 2).</p> <p>The offeror is strongly encouraged to provide any additional component descriptions which will help the Government understand the Core System offered, beyond those components outlined here.</p>	

<p><u>Title:</u> Instrument Interface Control Document (IICD)</p>	<p><u>DID FOR CDRL # 2</u></p>
<p><u>Reference:</u> SOW Section 4.3.2.2.1 & 4.3.4.4</p>	
<p><u>Use/Purpose:</u> To coordinate and control all interface items between the Core Spacecraft and the payload-instrument(s) to provide efficient electrical and mechanical integration.</p>	
<p><u>Related Documents:</u> Mission specific payload instrument documents</p>	
<p><u>Preparation Information</u></p> <p>The offeror shall provide detailed information regarding the Core Spacecraft interfaces for payload instrument(s). On a mission specific DO, the data provided by the payload instrument, in the form of written words, drawings, and schematics, will be incorporated into this combined instrument and Core Spacecraft ICD for applicable signatures.</p> <p>For Contract Core Spacecraft, the heritage instrument name & details need not be provided, only the heritage interfaces and capabilities being offered for a future instrument(s) are required.</p> <p>The spacecraft to instrument interface is defined per the following topics, as a minimum:</p> <ul style="list-style-type: none"> A. <u>Physical Requirements</u> - such as mass properties, footprint, clearance envelope, drill template, alignment, orientation, fields-of-view (optical, thermal, glint, RF), including tolerances. Electrical Connectors - regarding sex, type, orientation, pin assignments. Thermal control coatings, blankets, heat flow and operating limits. Red and green tag items for test and flight. B. <u>Electrical Power and Signals</u> - such as timing clock pulses, data busses, signal (name, type, function), voltage and current limits, frequencies, waveforms, rise and fall time, duration, periodicity, shielding, grounding, formats, line driver/receiver characteristics. Power fusing, voltage, currents, ripple, regulation. C. <u>Software</u> - such as codes, processors, memory storage, application description, uses. D. <u>Payload Environmental</u> - such as vibration, shock, acoustic, EMI/EMC, ESD, thermal, contamination, purges. E. <u>Safety</u> - such as pyrotechnics, energy storage, trip-over, hazardous materials. F. <u>Ground Support Equipment</u> - such as mechanical, electrical, test specific, targets, stimulators. G. <u>Operational Factors</u> – e.g. ground contacts needed per day, data storage capacity and compression, general flight rules and limitations. <p>Show sufficient detail on both sides of each interface to provide a complete definition of the mated interface; e.g. electrical interfaces should be presented to schematic detail (logic elements and piece parts) to the point where impedance and transfer characteristics no longer affect the interface.</p>	

<p><u>Title:</u> Spacecraft Performance Verification Plan</p>	<p><u>DID FOR CDRL #:</u> 3</p>
<p><u>Reference:</u> SOW 4.3.4</p>	
<p><u>Purpose:</u> To identify clearly where, when and how each Core Spacecraft (bus) and Observatory performance requirement is verified in the Spacecraft/Observatory I&T program before launch and where, when, how they are verified in-orbit.</p>	
<p><u>Related Documents:</u> CDRL 4 - Spacecraft/Observatory Integration & Test Plan</p>	
<p><u>Preparation Information:</u> Each spacecraft and observatory performance requirement is to be verified, either by analysis or by test before and after launch.</p> <p>Provide a matrix or an outline narrative indicating where, when, and how (test or analysis) each performance requirement of the Spacecraft and Observatory is verified:</p> <ol style="list-style-type: none"> 1) in the Spacecraft and Observatory I&T flow, and 2) in the Observatory Post-launch activities flow. <p>Identify the test procedure or the analysis that accomplishes the verification of each requirement.</p>	

<p><u>Title:</u> Spacecraft Integration & Test (I&T) Plan</p>	<p><u>DID FOR CDRL #:</u> 4</p>
<p><u>Reference:</u> SOW 4.3.4</p>	
<p><u>Use:</u> To show the Offeror's plans and approach to I&T for the Core Spacecraft (bus) and Observatory</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u></p> <p>The Prime Contractor shall provide definitive test plans for the Core Spacecraft (bus) and Observatory integration and test (I&T) which identify the scope, purpose, sequence (test flow) and success criteria for the activities below. Each occurrence of repeat activities (such as Observatory Full Functional Testing) shall be identified. Plans shall include a final comprehensive performance test.</p> <p>The Prime Contractor shall coordinate all plans and procedures for Instrument Integration with the Instrument representative.</p> <p>The baseline plan shall include at least the following I&T activities:</p> <p>Core Spacecraft Level:</p> <ul style="list-style-type: none"> Integration and Test Comprehensive Performance Test <p>Observatory Level:</p> <ul style="list-style-type: none"> Payload-Instrument Integration <ul style="list-style-type: none"> Mechanical Integration Electrical Integration Instrument Comprehensive Performance Test (To extent feasible) EMI/EMC/ESD Test Optical and Mechanical Alignments Magnetic Survey Attitude Control Subsystem Phasing Solar Array Integration Mass Properties Measurements Vibration Test Acoustic Test Shock Test Solar Array Deployment and Illumination Test Thermal Vacuum Test Including Hot, Cold and Nominal (for Mission) Flight Plateaus Thermal Balance Testing Cleanliness Control and Contamination Monitoring (CDRL 11) End-to-End Full Functional Test Observatory Comprehensive Performance Tests Observatory Launch & Orbit Timeline Simulation Testing 	

<p><u>Title:</u> Telemetry and Command Requirements Documentation</p>	<p><u>DID FOR CDRL #:</u> 5</p>
<p><u>Reference:</u> SOW Section 4.3.2.2</p>	
<p><u>Use:</u> To describe, in detail, the Core Spacecraft, its payload instrument(s) and launch vehicle interfaces telemetry and command features for launch and flight operations.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information</u></p> <p><u>Telemetry Requirements Document contents:</u></p> <ol style="list-style-type: none"> 1. Detailed listing of all telemetry assignments. 2. Key parameters and information necessary for the description and interpretation of the telemetry requirements. 3. Summary of number and type of telemetry assignments, including spares. 4. Description of telemetry interfaces, format, and requirements data. 5. Listing of telemetry assignments that confirm commands. 6. Schematic reference for each telemetry assignment. 7. Transmission or sampling rates. 8. Methods of in-flight or ground-test verification. 9. Engineering units and calibration data, A to D for readout and calibration. <p><u>Command Requirements Document contents:</u></p> <ol style="list-style-type: none"> 1. Detailed listings of all commands that can be applied to the Observatory that can affect a response or change in its configuration in anyway, either in test or in flight. 2. Key parameters necessary for description of commands. 3. Summary of number and type of commands used by each subsystem and the number of spares. 4. Description of command input, verification, rates, and filler commands. 5. Description of command requirements data and information necessary for interpretation. 6. Listing of commands verified by telemetry and resultant telemetry verifications. 7. Schematic reference for each command. 	

<p><u>Title:</u> External Interfaces, Models and Analysis</p>	<p>DID FOR CDRL #:6</p>
<p><u>Reference:</u> SOW Section 4.3.2.2</p>	
<p><u>Use:</u> To provide the instrument and ground system teams with spacecraft interface data, models, and analysis needed to assist them in their designs and preparations to support the Observatory for launch and mission operations.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information</u></p> <p>The offeror shall provide to the instrument developer and ground system team the required external interface information (data, models, and analysis) for the development of the instrument or ground system. This shall include as a minimum:</p> <ul style="list-style-type: none"> A. Core Spacecraft and Observatory reduced finite element models B. Structural interface analyses C. Pointing and alignment budgets D. Core Spacecraft and Observatory thermal models analyses E. Ground system protocols and data rates compatibility analyses F. Data contact scenarios and optimization including contacts versus data recorder size trade study. G. Flight dynamics and orbital maintenance analysis. 	

<p><u>Title:</u> Flight Operations Ground System Interface Documentation</p>	<p><u>DID FOR CDRL #:</u> 7</p>
<p><u>Reference:</u> SOW Section 4.3.2.2.2</p>	
<p><u>Use:</u> To document and define requirements and control all aspects of the interface between the Observatory and the Flight Operations ground systems to insure efficient integration and promote successful mission operations.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information</u></p> <ul style="list-style-type: none"> A. Data formats, communications protocols, data rates. B. Compression algorithms, Error Detection and Correction schemes. C. Antenna patterns, Equivalent Isotropically Radiated Power (EIRP), Gain to Temperature Ratio (G/T), Beam width, Frequency, Polarization, and Link Margins. D. Command and Telemetry formats. E. Spacecraft contact scenarios for data transmission, operations, and maintenance. 	

<p><u>Title:</u> Launch Vehicle Documentation</p>	<p><u>DID FOR CDRL #:</u> 8</p>
<p><u>Reference:</u> SOW Section 4.3.2.2.3</p>	
<p><u>Use:</u> To document and define requirements of the interface between the Observatory and the launch vehicle to insure efficient integration and promote successful pre-launch operations and the launch to the mission orbit.</p>	
<p><u>Related Documents:</u> Launch Vehicle User Planners Guide External Interfaces, Models and Analysis (CDRL 6) Observatory Launch Site Operations and Test Plan (CDRL 14) Launch Site Operations and Test Procedures List (CDRL 15)</p>	
<p><u>Preparation Information</u> In addition to the Observatory Launch Site Operations and Test Plan (CDRL 14) and the Launch Site Operations and Test Procedures List (CDRL 15) this deliverable set of data defines the requirements of the Observatory for the launch vehicle provider and is to include the following as a minimum:</p> <ul style="list-style-type: none"> A. Spacecraft Questionnaire B. Spacecraft Mathematical Model for Dynamic Analysis C. Spacecraft Environmental Test documents D. Missile System Pre-Launch Safety Package (MSPSP) inputs E. Payload/Launch System Interface Specification (electrical, mechanical, data) F. Mission Operations and Support Requirements G. Payload Requirements Documents (PRD) H. Payload Compatibility Drawings I. Electrical Wiring Requirements J. Fairing Requirements, including spacecraft environment controls K. Launch Site Test Plan L. Spacecraft Integrated Test Procedure Inputs M. Mission Analysis Requirements N. Launch Intervals (Launch Windows) O. Radio Frequency Applications P. Post-Launch Orbit Confirmation Data 	

<p><u>Title:</u> As Built Parts List (ABPL)</p>	<p>DID For CDRL# 9</p>
<p><u>Reference:</u> SOW 4.3.3.1</p>	
<p><u>Use:</u> Provide a list of all EEE parts that are used in the flight hardware.</p>	
<p><u>Related Documents</u></p>	
<p><u>Preparation Information:</u></p> <p>The As Built Parts List (ABPL) shall contain the following information:</p> <ul style="list-style-type: none"> - Assembly Name/Number - Next Level of Assembly - Need Quantity - Reference Designator(s) and - Parts List Item Number (if applicable) - Assembly serial number; - Next Level of Assembly serial number; - Lot/Date/Batch/Manufacturing Code, as applicable; - Manufacturer's Commercial and Government Entity (CAGE) Code (specific plant location preferred); - Distributor/supplier, if applicable; and - Part serial number, if applicable. 	

<p><u>Title:</u> Failure Mode and Effects Analysis (FMEA) and Critical Items List (CIL)</p>	<p>DID For CDRL #10</p>
<p><u>Reference:</u> SOW 4.3.3.2</p>	
<p><u>Use:</u> Used to evaluate design against requirements, to identify single point failures and hazards, and to identify modes of failure within a system design for the early mitigation of potential safety critical functions.</p>	
<p><u>Related Documents</u></p> <ul style="list-style-type: none"> - GSFC Flight Assurance Procedure (FAP) P-322-208, Performing a Failure Mode and Effects Analysis - NPR 8705.4, Risk Classification for NASA Payloads 	
<p><u>Delivery:</u></p> <ul style="list-style-type: none"> - Submit all deliveries 30 calendar days prior to the related Spacecraft Systems Review. 	
<p><u>Preparation Information:</u></p> <p>The FMEA Report shall include the following:</p> <ul style="list-style-type: none"> - A discussion of the approach of the analysis, methodologies, assumptions, results, conclusions, and recommendations. - Objectives. - Level of the analysis. - Ground rules. - Functional description. - Functional block diagrams. - Reliability block diagrams. - Equipment analyzed. - Data sources used. - Problems identified. - Single-point failure analysis, to include the root cause, mitigation, and retention rationale for those with severity categories 1, 1R, or 1S. - Corrective actions. - Work sheets identifying failure modes, causes, severity category, and effects at the item, next higher level, and mission level, detection methods, and mitigating provisions. - CIL for severity categories 1, 1R, and 1S including item identification, cross-reference to FMEA line items, and retention rationale. Appropriate retention rationale may include design features, historical performance, acceptance testing, manufacturing product assurance, elimination of undesirable failure modes, and failure detection methods. 	

<p><u>Title:</u> Contamination/Cleanliness Control Plan and Data</p>	<p><u>DID for CDRL#:</u>11</p>
<p><u>Reference:</u> SOW 4.3.3.4</p>	
<p><u>Use:</u> To evaluate for sources of potential contamination to the mission, establish allowances and determine methods for monitoring and controlling contamination and recording and presenting verification results.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Delivery:</u></p> <ul style="list-style-type: none"> - In compliance with CDRL Table 1. - The status of contamination control measures and contamination monitoring and/or updates to the contamination control plans shall be reported with each systems review. - Measured contamination beyond requirements shall be reported immediately. - A Certificate of Cleanliness shall be submitted with the End Item Acceptance Data Package in compliance with the Observatory Acceptance Review (OAR) requirements. 	
<p><u>Preparation Information:</u></p> <p>The Contractor shall provide: material properties data; design features; test data; system tolerance of degraded performance; and methods of detection and preventing degradation relating to contamination.</p> <p>The items below shall be addressed in the plan:</p> <ul style="list-style-type: none"> - Beginning of life and end of life contamination requirements for contamination sensitive surfaces or subsystems. - Methods and procedures used to measure and maintain the levels of cleanliness required during each of the various phases of the item’s lifetime (e.g., protective covers, environmental constraints, purges, cleaning/monitoring procedures, thermal-vacuum bake-out of parts and assemblies) before and after payload-instrument integration - Materials: <ul style="list-style-type: none"> - Outgassing as a function of temperature and time and pressure; - Nature of outgassing chemistry; and - Areas, weight, location, view factors of critical surfaces and outgas pathways. <p>(Continued on next page)</p>	

CDRL DID 11 – Acceptance Data Package (cont'd)

- Venting: size, location and relation to external surfaces.
- Thermal vacuum test contamination monitoring plan, to include vacuum test data, QCM location and temperature, pressure data, system temperature profile, and shroud temperature.
- On-orbit spacecraft and instrument performance as affected by contamination deposits.
 - Contamination effect monitors;
 - Methods to prevent and recover from contamination in orbit;
 - Evaluation of on-orbit degradation
 - Photo-polymerization of outgassing products on critical surfaces;
 - Space debris risks and protection; and
 - Atomic oxygen erosion and re-deposition.
- Analysis of contamination impact on the satellite on-orbit performance.
- In orbit contamination impact from other sources such as Launch Vehicle and adjacent payload-instruments.
- Ground/Test support equipment controls to prevent contamination of flight item(s).
- Facility controls and processes to maintain hardware integrity (protection and avoidance).
- Training.

<p><u>Title:</u> Engineering Change Proposals (ECPs) (Deviations and Waivers)</p>	<p><u>DID for CDRL #:</u> 12</p>
<p><u>Reference:</u> SOW Section 4.3.1.5</p>	
<p><u>Use:</u></p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u></p> <p>The Contractor shall prepare and submit Class I Engineering Change Proposals (ECPs) (Deviations and Waivers) for Government Approval. All ECP's shall contain, in addition to the change description, sufficient information in the form of attachments, drawings, test results, etc., to allow NASA's to evaluate the total impact of the proposed change.</p> <p>For the purposes of this DID, a Class I ECP is a change that:</p> <ul style="list-style-type: none"> A. affects any NASA Contract specification, mission requirement or interface requirement; B. affects schedules of end item deliverables to the Project; or C. impacts Government Furnished Equipment <p>The Contractor shall allow access to the Government to all Class II changes.</p> <p>The Government may direct the Contractor to prepare other ECPs under the "Changes" clause of the contract.</p> <p>All safety related waivers and deviations and use-as-is and use-as-repaired Material Review Board (MRB) actions shall also be submitted to the Government for Review.</p>	

<p><u>Title:</u> Storage, Shipping and Handling Plan</p>	<p><u>DID FOR CDRL #:</u> 13</p>
<p><u>Reference:</u> SOW Section 4.3.4.5 & 4.3.4.6</p>	
<p><u>Use:</u> To understand the Offeror’s role, responsibility and plans to store and ship the integrated Observatory with flight instrument(s), along with the supporting equipment, from the Contractor’s integration and test facility to the launch site.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information</u></p> <p>The data provided in the plan should address the following as a minimum:</p> <ul style="list-style-type: none"> A. Definition of storage related activities including: locations; methods; GSE; environmental controls and monitoring; and pre-, post-, or intermittent storage testing required. B. Description of shipping container C. Methods of transporting the Observatory and ground support equipment (GSE) D. Bagging and purging requirements E. Environmental controls and monitoring equipment F. Expected roles and responsibilities of the Offeror and the Government. G. Who provides ground transportation at launch site H. Shipping crew support, convoy support I. Off-loading of Observatory at the launch site J. Movement between facilities at the launch site K. Fueling GSE L. Lifting slings M. Electrical and mechanical support equipment general description. 	

<p><u>Title:</u> Observatory Launch Site Operations and Test Plan</p>	<p><u>DID FOR CDRL #:</u>14</p>
<p><u>Reference:</u> SOW Section 4.3.2.2.3</p>	
<p><u>Use:</u> (1) To provide a detailed understanding of the launch site activities, operations and testing planned for a particular mission, (2) to support requirements of the Missile System Prelaunch Safety Package (MSPSP) and (3) to obtain launch site procedure approvals.</p>	
<p><u>Related Documents:</u> Launch Vehicle Payload Planner’s Guides (as applicable) AFSPCMAN 91-710, “Range Safety User Requirements Manual” Eastern/Western Range Safety Requirements, EWR 127-1 Missile System Prelaunch Safety Package (MSPSP) (Ref. CDRL 8)</p>	
<p><u>Preparation Information</u> Describe all aspects of the activities at the launch site beginning with arrival of the Observatory, including final testing and preparations, fueling, transportation between buildings and the launch vehicle, launch vehicle integration and testing, and removal of systems after launch. The data shall be originated to support launch site “test and inspection plans” requirements and the “ground operations plan” requirements of the associated launch range requirements.</p> <ul style="list-style-type: none"> A. Layout a schedule and timeline of proposed activities B. Specify what facilities and facility resources are needed C. Show equipment placement and personnel area requirements D. Fully explain staffing plan E. Explain schedule and personnel contingency methods F. Describe roles and responsibilities and the other equipment needed at each step of the plan G. Describe fueling methods, crew training, SCAPE (Self Contained Air breathing Protective Equipment) operations, fuel storage locations H. Address cleanness methods, purge gasses and lines, garments I. Identify special test equipment needed on the launch tower or in the blockhouse <p>Identify specific communication links needed between locations at the launch site to perform Observatory end-to-end testing and to support the Observatory on the launch vehicle up to the point of launch.</p>	

<p><u>Title:</u> Observatory Launch Site Operations and Test Procedures</p>	<p><u>DID for CDRL #:</u> 15</p>
<p><u>Reference:</u> SOW Section 4.3.2.2.3</p>	
<p><u>Use:</u> To document the complete understanding of how the planned activities are to be carried out at the launch site to meet requirements of: 1) MSPSP; 2) the ground operations plan; 3) test and inspection plans, and 4) procedure approval specified in AFSPCMAN 91-710.</p>	
<p><u>Related Documents:</u> AFSPCMAN 91-710, “Range Safety User Requirements Manual” Missile System Prelaunch Safety Package (MSPSP) (Ref. CDRL 8) Launch Vehicle Payload Planner’s Guides (as applicable)</p>	
<p><u>Preparation Information</u> For all of the activities at the launch site, most of which are identified in the referenced Observatory Launch Site Operations and Test Plan (CDRL 14), detailed procedures are to be prepared, reviewed, and approved before use.</p> <p>Specify in the procedures: the test objectives, personnel and equipment requirements, environmental and handling needs for Spacecraft and payload instrument(s), and electrical tests and operations to be performed, including, as applicable, conditioning of batteries, special calibrations, end-to-end type testing, red tags, green tags, load cells, and optical alignment equipment and other information as may apply to the DO effort.</p> <p>Particular interest will be paid to the period of time that the Observatory is mated to the launch vehicle (Integrated Procedures) to assure safety, smooth interaction between the Observatory and launch vehicle activities and a successful launch.</p> <p>Hazardous activities shall be identified and included in the MSPSP.</p> <p>All launch range safety related (i.e. “hazardous”) procedures shall be provided to the Government sixty (60) days prior to first use, for Approval, prior to their submission to the Launch Range organization. They shall be provided to the Launch Range Safety organization twenty-one (21) days prior to first use.</p>	

<p><u>Title:</u> Flight Operations Support Plan</p>	<p><u>DID FOR CDRL #:</u> 16</p>
<p><u>Reference:</u> SOW Section 4.3.2.2.2 & 4.3.6.1</p>	
<p><u>Use:</u> To describe the contractor’s plan for supporting the flight operations of the Observatory starting at integration and test, through launch, and throughout the life of the mission. Included is how the offeror intends to provide anomaly resolution support to the end of the mission, and how Flight Software will be supported through the mission life cycle.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information</u></p> <ul style="list-style-type: none"> A. Description of roles and responsibilities and plans of how the offeror will support the operations of the spacecraft during test, launch, and on-orbit operations for the life of the mission. B. Description and designation of ground systems and responsibilities needed for spacecraft operations. C. Plan for anomaly identification, investigation, and resolution process. D. Plan for periodic performance assessments to determine spacecraft viability. E. Description of complement of skills needed to provide this support and how the offeror will provide these resources. F. Description of the Flight Software standards and practices through development, integration and Test, and in-orbit checkout. Describe the documentation system, how source and executable code is generated and used, and the method(s) of maintaining equipment. G. Description of the governments right to Flight Software source and executable code, and discuss how software maintenance and future mission modifications can be performed. Describe configuration control methods and safeguards, how emulators are accessed or dedicated, and how software corrections or changes are verified before uploading to the on-orbit Observatory. 	

<p><u>Title:</u> Spacecraft Operations Description Manual</p>	<p><u>DID FOR CDRL #:</u> 17</p>
<p><u>Reference:</u> SOW Section 4.3.2.2.2 & 4.3.7.2</p>	
<p><u>Use:</u> Provides a description of the operation of the Spacecraft to be used by the operations organization to develop detailed operations procedures.</p>	
<p><u>Related Documents:</u> Flight Operations Support Plan (CDRL 16) Flight Operations Ground System Interface Documentation (CDRL 7) Telemetry and Command Requirements Document (CDRL 5)</p>	
<p><u>Preparation Information:</u> Operations Description Manual contents:</p> <ul style="list-style-type: none"> A. Overview and discussion of operations concept B. Description of unique factors associated with the operation of the Observatory C. Overview of internal and external Observatory interfaces D. Unique ground system logistics, software, software maintenance, and sustaining engineering required for sustained Observatory operations E. Sample operational scenarios F. Operation of the Observatory and all Spacecraft subsystems G. Contingency scenarios and procedures H. Redundancy management I. State of health maintenance J. Listing of operations limits, cautions, and constraints. <p>Note: The Government will provide the payload-instrument sections.</p>	

<p><u>Title:</u> End Item Acceptance Data Package</p>	<p><u>DID for CDRL #:</u> 18</p>
<p><u>Reference:</u> SOW 4.3.1.2 and 4.3.7.3</p>	
<p><u>Use:</u> The End Item Acceptance Data Package documents the design, fabrication, assembly, test, and integration of the hardware and software being delivered and is provided in support of the Observatory Acceptance Review (OAR)</p>	
<p><u>Related Documents:</u> CDRL 20G - Observatory Acceptance Review (OAR) Information Requirements</p>	
<p><u>Delivery/Purpose:</u> Updated versions should be provided at the Pre-Environment (PER) and Pre-Ship (PSR) reviews. Final Delivery to the Project thirty (30) days prior to the OAR, for Approval.</p>	
<p><u>Preparation Information:</u></p> <p>The Contractor prepares the End Item Acceptance Data Package as part of design development and implementation such that it is completed prior to delivery. The following items shall be included:</p> <ul style="list-style-type: none"> - The deliverable item name, serial number, part number, and classification status (e.g. flight, non-flight, ground support). - Appropriate approval signatures (e.g. Contractors quality representative, product design lead, Government Representative). - List of shortages or open items at the time of acceptance with supporting rationale. - As-built serialization. - As-built configuration. - In-process work orders (available for review at Contractors--not a deliverable). - Final assembly and test work order. - Non-conformance reports. - Acceptance testing procedures and report(s), including environmental testing. - Trend data. - Anomaly/problem failure reports with root cause and corrective action dispositions. - As-built EEE parts list. (CDRL 9) - As-built materials list. - Chronological history, including: <ul style="list-style-type: none"> - Total operating hours and failure-free hours of operation; and - Total number of mechanical cycles and remaining cycle life. <p>(Continued on next page)</p>	

CDRL DID 18 – End Item Acceptance Data Package (cont'd)

Preparation Information (cont'd)

- Limited life items, including data regarding the life used and remaining.
- As-built final assembly drawings.
- PWB coupon results.
- Photographic documentation of hardware (pre and post-conformal coating for printed wiring assemblies, box or unit, subsystem, system, harness, structure, etc.).
- Waivers.
- Certificate of Contamination Compliance (Ref. CDRL 11)
- Certificate of Compliance (signed by management)

RAPID IV RFP # 80GSFC19R0016 Rev 4

Title: Orbital Debris Assessment	<u>DID for CDRL#</u> : 19
Reference: SOW 4.3.3.5	
Use: Ensure NASA requirements for mission orbital debris control are met.	
Related Documents: <ul style="list-style-type: none">- NPR 8715.6B, NASA Procedural Requirements for Limiting Orbital Debris and Evaluating the Meteoroid and Orbital Debris Environments.- NASA-STD-8719.14, Process for Limiting Orbital Debris	
<u>Preparation Information:</u> <ul style="list-style-type: none">- The assessment shall be done in accordance with NPR 8715.6B NASA Procedural Requirements for Limiting Orbital Debris and Evaluating the Meteoroid and Orbital Debris Environments, and NASA-STD-8719.14 Process for Limiting Orbital Debris. <p>The preliminary assessment is conducted to identify areas where the project may contribute debris and to assess this contribution relative to the guidelines. The final assessment conducted shall include comments on changes made since the preliminary assessment. The detail shall be consistent with the available information of design and operations. The Contractor shall submit updates to the final assessment for design changes after CDR that impact the potential for debris generation.</p> <p>NOTE: Orbital Debris Assessment Software (DAS version 2.1.1) is available for download via NASA ARES (Astro Research & Exploration Science) website at https://orbitaldebris.jsc.nasa.gov/mitigation/das.html</p>	

<p><u>Title:</u> Spacecraft Systems Requirements and Systems Definition Reviews (SSR/SDR) Information Requirements</p>	<p><u>DID FOR CDRL #: 20A</u></p>
<p><u>Reference:</u> SOW Section 4.3.1.4.2</p>	
<p><u>Use:</u> To define the purpose and required information content of the SSR/SDR.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Purpose:</u> The purpose of the SSR/SDR is to verify that the Spacecraft/Observatory functional, interface and performance requirements are defined and understood, to ensure the requirements are satisfied by the designated concept, and to justify proceeding with design definition and flow-down of requirements to the system and subsystem elements.</p>	
<p><u>Preparation Information:</u> The contractor shall provide at a minimum, the following information:</p> <ol style="list-style-type: none"> 1. Mission and spacecraft requirements overview showing a mature understanding of the mission objectives, requirements, and constraints including mission operations and instrument-payload requirements. 2. Mission performance requirements allocation flow-down to the spacecraft and spacecraft subsystems. 3. The approaches that will be used to carry out the mission with definition of organizational roles and responsibilities. 4. Plans for future activities showing that the spacecraft/observatory design concept will accommodate the interfaces, constraints and successfully accomplish the mission. 5. The top level design by means of block diagrams that depict system interfaces with external supporting systems, as well as depicting internal interfaces between independent system elements 6. Available modeling and analyses results. <p>Completion will be determined by the Government per SOW Section 4.3.1.4.2.</p>	

<p><u>Title:</u> Spacecraft Preliminary Design Review (PDR) Information Requirements</p>	<p><u>DID FOR CDRL #:</u> 20B</p>
<p><u>Reference:</u> SOW Section 4.3.1.4.2</p>	
<p><u>Use:</u> To define the required information content of the PDR.</p>	
<p><u>Purpose:</u> The purpose of this review is to show the ability of the preliminary spacecraft/observatory design to meet all requirements including critical interface compliance with acceptable risk, to show verification methods with supporting analyses and show readiness to proceed with the detailed design and ability to complete the project within constraints.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u> It is expected that the requirements and preliminary designs for all systems, subsystems and components have been completed and that peer reviewed PDRs on these elements have been completed prior to the Spacecraft PDR. For Spacecraft System Level:</p> <ol style="list-style-type: none"> 1. Mission and spacecraft requirements overview showing a mature understanding of the mission objectives and the approaches that will be used to carry out the mission with definition of roles and responsibilities. 2. Mission performance requirements and allocation to the spacecraft and subsystem flow-down. 3. Resources allocations and margins for system and subsystem capability (e.g. telemetry, command, electrical power, weight, data storage, processor capability) 4. ICDs for the payload/instrument, flight operations ground system and launch vehicle are ready for review. 5. The plan and rationale for performance verification and test sequence. 6. Core Spacecraft integration and test (I&T) sequence and rationale 7. The plans and status for spacecraft electrical and mechanical ground support equipment (GSE) and associated I&T software requirements, description, and development 8. Initial Observatory I&T sequence and rationale. 9. Initial QA and Safety program plans 10. Orbit parameters, maintenance and flight dynamics analysis 11. Status of long lead parts and assembly procurements. 12. Readiness to proceed with the detailed final designs. <p>(continued on next page)</p>	

**CDRL DID 20B - Spacecraft Preliminary Design Review (PDR) Information Requirements
(cont'd)**

For Subsystem level (including flight software):

1. Status of the subsystem and component PDRs and any remaining open issues.
2. The flow down of requirements to specifications of each subsystem
3. Subsystem components preliminary design details and development plans
4. Performance verification and validation plans
5. GSE description and development plans and status
6. Supporting analyses and design performance margins.

Completion will be determined by the Government per SOW Section 4.3.1.4.2.

<p><u>Title:</u> S/C Critical Design Review (CDR) Information Requirements</p>	<p><u>DID FOR CDRL #:</u> 20C</p>
<p><u>Reference:</u> SOW Section 4.3.1.4.2</p>	
<p><u>Use:</u> To define the purpose of and required information content of the CDR.</p>	
<p><u>Related Documents:</u> .</p>	
<p><u>Purpose:</u> At the CDR the Prime Contractor discloses the complete mission observatory design and demonstrates the maturity of the design and development effort and justifies proceeding with full scale procurement and fabrication activities, assembly, integration and test</p>	
<p><u>Preparation Information:</u> It is expected that prior to the Spacecraft CDR the final requirements and design drawings for all systems, subsystems and components have been completed and that peer reviewed CDRs on these elements shall have been completed and all ICDs (e.g. Instrument, Launch Vehicle, and Mission Operations) are ready for signature. The contractor shall provide, at a minimum, the following information for the CDR: For Spacecraft System Level:</p> <ol style="list-style-type: none"> 1. Mission and spacecraft requirements overview showing a mature understanding of the mission objectives and the approaches that will be used to carry out the mission with definition of roles and responsibilities. 2. Mission performance requirements and allocation to the spacecraft and subsystem flow-down. 3. The complete design, showing the design and critical interfaces meet all requirements with acceptable risk by means of block diagrams, power flow diagrams, signal flow diagrams, interface circuits, software logic flow and timing diagrams, appropriate modeling results and breadboard and engineering model test results 4. Adequate technical and programmatic margins and resources exist to complete the development within schedule constraints. 5. Resources allocations and margins for system and subsystem capability (e.g. telemetry, command, electrical power, weight, data storage, processor capability) 6. The plan and rationale for performance verification and test sequence. 7. Core Spacecraft integration and test (I&T) sequence and rationale 	

CDRL DID 20C - S/C Critical Design Review (CDR) Information Requirements (cont'd)

8. The plans and status for spacecraft electrical and mechanical ground support equipment (GSE) and associated I&T software requirements, description, and development
9. Initial Observatory I&T sequence and rationale.
10. Initial QA and Safety program plans
11. Orbit parameters, maintenance and flight dynamics analysis
12. Justification for proceeding with full scale procurement & fabrication activities, assembly, and integration and test.

For Subsystem level (including flight software):

1. Status of the subsystem and component CDRs.
2. The flow down of requirements to specifications of each subsystem
3. Subsystem components preliminary design details and development plans
4. Performance verification and validation plan
5. GSE description and development plans and status
6. Status of completion of engineering model evaluations and breadboard development and tests
7. Status of long lead items procurements

Specific Analysis and Margins:

1. Stress and dynamics
2. Loads determination
3. Communication links
4. Thermal flight predictions
5. Power balance and end-of-life performance
6. Battery performance and charge control
7. Worst case analysis
8. Data flows and in-flight storage and loading
9. Pointing budgets and attitude control simulation results
10. Flight dynamics, orbit insertion, maintenance, disposal
11. Radiation, EMC, ESD, magnetics
12. Failure mode and effects update.

Completion will be determined by the Government per SOW Section 4.3.1.4.2.

<p><u>Title:</u> Instrument Integration Readiness Review (IIRR) Information Requirements</p>	<p><u>DID FOR CDRL #:</u> 20D</p>
<p><u>Reference:</u> SOW Section 4.3.1.4.2</p>	
<p><u>Use:</u> To define the required information content (and success criteria) of the IIRR.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u> The Contractor shall present at the IIRR:</p> <ol style="list-style-type: none"> 1. The summary of results of Core Spacecraft Integration and Test in preparation for payload. 2. A complete and comprehensive status of the observatory with emphasis on changes to the design and or requirements since the CDR. 3. Resource allocations and margins (telemetry, commands, power, weight, data storage, processor capability, etc.) 4. A resolution plan for all failures, anomalies, and malfunctions encountered during system testing 5. Any remaining open integration and test issues and their proposed resolution 6. The readiness to perform Instrument integration (e.g. staffing, facilities, GSE, procedures, resources, etc.) 7. Plans to proceed to the Pre-Environmental Review (PER) (tests, activities, facilities, resources, schedule, flow) 8. I&T software readiness and verification status 9. Flight software development and verification status <p>Completion of the IIRR will be determined by the Government per SOW Section 4.3.1.4.2.</p>	

<p><u>Title:</u> Observatory Pre-Environmental Review (PER) Information Requirements</p>	<p><u>DID FOR CDRL #:</u> 20E</p>
<p><u>Reference:</u> SOW Section 4.3.1.4.2</p>	
<p><u>Use:</u> To define the required information content for the PER.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u> The contractor shall present at the PER:</p> <ol style="list-style-type: none"> 1. The results of Instrument Integration and status of the overall Observatory and readiness to proceed with environmental testing. 2. A resolution plan for all failures, anomalies, and malfunctions encountered during instrument integration & test. 3. A review of all environmental test plans and procedures, plus readiness and availability of environmental test facilities. 4. Detailed thermal-vacuum and thermal balance test plans showing observatory in the chamber, hot and cold plates and shrouds, optical or thermal targets, RF coupling, star camera, earth and sun sensor stimulators, QCMs, cold finger, planned test profile, cleaning and outgassing plan, temperature control equipment. 5. The structural qualification/acceptance plan, showing the final modal analyses and analyses of results from the coupled loads analysis (performed by the launch service provider). 6. Define the predicted test limits for the components of the core spacecraft and instrument-payload for vibration, thermal-vacuum, and thermal balance. 7. Provide justification that the planned test environments adequately demonstrate the Observatory performance requirements without presenting a hazard, and without degrading Observatory performance or lifetime. 8. Present the plans to proceed to the PSR (e.g. tests, activities, facilities, staffing resources, schedule, flow) <p>Completion of the PER will be determined by the Government per SOW Section 4.3.1.4.2.</p>	

<p><u>Title:</u> Observatory Pre-Shipment Review (PSR) Information Requirements</p>	<p><u>DID FOR CDRL #:</u> 20F</p>
<p><u>Reference:</u> SOW Section 4.3.1.4.2</p>	
<p><u>Use:</u> To define the required information content of the PSR.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u> The contractor shall conduct a PSR to verify and document that the spacecraft and flight software and spacecraft GSE equipment are performing in accordance with the Mission Spacecraft Performance Specification (CDRL 1) and Integration and Test Plan (CDRL 4). The contractor shall present the following at the PSR:</p> <ol style="list-style-type: none"> 1. Results of all environmental tests, end-to-end tests and the latest observatory comprehensive performance test and comparison against requirements. 2. A review of all failures, anomalies, and waivers and a resolution plan for all that remain open. 3. The results of all flight software verification and validation efforts. 4. List of all open work under the delivery order and plans for completion. 5. Shipping plans and documentation status (e.g. shipping lists, manifests, containers handling, transport, environmental controls and monitoring, etc.) 6. Observatory documentation status (e.g. final configuration lists, trend data, test reports, mass properties, system safety plan, life-limited items, equipment logs) 7. Cleanliness certification (Ref. CDRL 11) 8. Receiving point plans (e.g. arrival time, place, storage, handling, points-of-contact, logistics, mechanical and electrical test plans and procedures. 9. Detailed plans of the launch support (e.g. activities, facilities, staffing, resources, schedule, and processing flow). (Ref. CDRL 14) 10. Readiness of flight operations procedures and personnel. (Ref. CDRL 15) 11. Operations Ground Network compatibility and RF test results. 12. Show that existing residual risks and other open issues have been assessed as acceptable for moving forward with plans for closure. 13. Overview of mission and launch simulation plans. 	

**CDRL DID # 20F - Observatory Pre-Shipment Review (PSR) Information Requirements
(cont'd)**

14. Overview of mission and launch simulation plans.
15. All system acceptance criteria are met the Acceptance Data Package (CDRL 18) is up to date
16. All safety and hazard assessments in all areas are complete.
17. If the contractor is responsible for Orbit Operations, the review will cover the contractor's readiness to support launch and post launch operations of the spacecraft, include training and preparedness of the flight team.

Completion of the PSR will be determined by the Government per SOW Section 4.3.1.4.2.

<p><u>Title:</u> Observatory Acceptance Review (OAR) Information Requirements</p>	<p><u>DID FOR CDRL #:</u> 20G</p>
<p><u>Reference:</u> SOW Section 4.3.1.4.2 & 4.3.7.3</p>	
<p><u>Use:</u> Define the required content for the OAR.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u> The Contractor shall present the following at the OAR:</p> <ol style="list-style-type: none"> 1. The OAR shall be in a presentation format and include, for each slide, facing page text detailed information 2. A timeline summary of all events following liftoff of the launch vehicle through the completion of on-orbit performance verification and readiness for handover to the operations team shall be included. The indicated performance of the Observatory in response to those events in comparison to the predicted performance. 3. A summary of the operating performance of each subsystem and component of the Observatory. 4. A summary of all performance discrepancies and their closure status. All issues potentially affecting mission success through the required mission lifetime shall be addressed. The more significant issues shall be discussed in the greatest detail. <ol style="list-style-type: none"> 1. A summary of the status of all deliverables including all required documentation. Delivery of an acceptable Acceptance Data Package (CDRL18) is required for successful completion of the OAR. <p>Completion will be determined by the Government per SOW Section 4.3.1.4.2</p>	

<p><u>Title:</u> Project Management Plan</p>	<p><u>DID FOR CDRL #:</u> 21</p>
<p><u>Reference:</u> SOW Section 4.3.1</p>	
<p><u>Use:</u> To describe the Contractor’s program for managing spacecraft project implementation activities.</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u></p> <p>Describe your project management activities in enough detail to provide an understanding of how the implementation effort, specific to the propose Core Spacecraft, will be controlled and monitored, how resources are assigned and managed, and how progress is measured and reported. The description shall include the following at a minimum:</p> <ul style="list-style-type: none"> • <i>Project Management Organization, Authority, and Responsibilities;</i> • <i>Scheduling and Project Control</i> • <i>Documentation Systems</i> • <i>Reviews and Audits</i> • <i>Government Insight</i> • <i>Contract Management</i> • <i>Risk Management</i> • <i>Resource Management (Staffing, Facilities, etc.)</i> <p>The Contractor may provide previously developed internal Project Management Plan document(s) in response to this CDRL provided a matrix is provided showing linkage to the above topics.</p> <p>Provide an Implementation Schedule denoting the following program phases: Systems Engineering & Design; Fabrication, Assembly & Test; Core Spacecraft Integration & Test; Observatory Integration & Test; Shipment & Launch Site Support; Launch & Flight Operations Support including Spacecraft Checkout. Include in the schedule the contractually required and additional proposed payment milestones.</p> <p>Also provide information on how Delivery Orders for Studies of potential mission spacecraft will be managed.</p>	

<u>Title:</u> Systems Engineering Plan	<u>DID FOR CDRL #:</u> 22
<u>Reference:</u> SOW Section 4.3.2	
<u>Use:</u> To describe the Contractor's program for managing systems engineering activities.	
<u>Related Documents:</u>	
<u>Preparation Information:</u> Describe how you will accomplish the following systems engineering activities with enough detail to provide an understanding of how requirements will be defined and allocated, how interfaces will be defined and maintained, and your approach toward specialty areas such as reliability, safety and configuration control will be managed: <ul style="list-style-type: none">• Requirements Analysis, Mission Design and Sub-Systems Allocations• Interface Definition and Maintenance• Instrument, Launch Vehicle and Mission Operations Requirements Accommodations• Configuration Management• Reliability• Safety <p>The Contractor may provide previously developed internal Systems Engineering Management Plan document(s) in response to this CDRL provided a matrix is provided showing linkage to the above topics.</p>	

<p><u>Title:</u> Systems Assurance Plan</p>	<p><u>DID FOR CDRL #:</u> 23</p>
<p><u>Reference:</u> SOW Section 4.3.3</p>	
<p><u>Use:</u> To describe how the Contractor implements their Quality Management System</p>	
<p><u>Related Documents:</u></p>	
<p><u>Preparation Information:</u></p> <p>Describe how your Quality Management System for the spacecraft development and associated services comply SAE AS 9100D or ISO 9001 requirements including how you will control and maintain your processes to provide repeatable quality products. Systems assurance topics to be covered include are:</p> <ul style="list-style-type: none"> • <i>Management Responsibility</i> • <i>Quality System</i> • <i>Contract Review</i> • <i>Design Control</i> • <i>Document and Data Control</i> • <i>Purchasing</i> • <i>Control of Customer Supplied Product</i> • <i>Product Identification and Traceability</i> • <i>Process Control</i> • <i>Inspection and Testing</i> • <i>Control of Inspection, Measuring, and Test Equipment</i> • <i>Inspection and Test Status</i> • <i>Control of Nonconforming Product</i> • <i>Preventive and Corrective Action Process</i> • <i>Handling, Storage, Packaging, Preservation, and Delivery</i> • <i>Control of Quality Records</i> • <i>Internal Quality Audits</i> • <i>Training</i> • <i>Servicing</i> • <i>Statistical Techniques</i> <p>The Contractor may provide previously developed internal Quality Management Plan document(s) in response to this CDRL provided a matrix is provided showing linkage to the above topics.</p>	

(End of CDRL DIDs)