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Space weather Observations at L1 to Advance Readiness Project
Code 493

SOLAR
X-Ray Irradiance Sensor (XRIS)
Contract Deliverables Requirements List (CDRL)

SWO Reviewed – Not Subject to Export Control

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National Aeronautics and Space Administration (NASA)

SOLAR X-Ray Irradiance Sensor (XRIS)
Contract Deliverables Requirements List (CDRL)
Signature/Approval Page

Prepared by:
Paul Markie

Reviewed by:
Charles (Hudson) DeLee
Stephen Husty
Brennan Nowak
John Vollmer
Yaireska Collado Vega
John Panek
Shiva Anand
Thomas Haas
Paul Carr
Edward Glanfield
Ashley Greeley

Approved by:
James (Jim) Morrissey

Preface

This document is under Space weather Observations at L1 to Advance Readiness (SOLAR) configuration management (CM)-controlled document. Changes to this document require prior approval and shall be submitted in the SOLAR project Technical Data Management System (TDMS) via a Configuration Control Request (CCR) or Signature Control Request (SCoRe), along with supportive material justifying the proposed change. Changes to this document will be made via complete revision.

All of the requirements within this document assume the use of the work “shall” unless otherwise stated.

Questions or comments concerning this document should be addressed to:

SOLAR Project Configuration Management Office
Goddard Space Flight Center
Code 493
Greenbelt, MD 20771

Change History Log

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INTRODUCTION

This Space Weather Next (SW Next) Space weather Observation at L1 to Advance Readiness (SOLAR) Instrument Contract Deliverables Requirements List (CDRL) document defines the requirements for deliverable items to be provided by the SOLAR X-Ray Irradiance Sensor (XRIS) contractor. All data **shall** be prepared, maintained/updated, and delivered to the Government in accordance with the requirements specified in the governing contract, delivery order, Statement of Work (SOW), Mission Assurance Requirements (MAR), and this CDRL and its associated Data Item Descriptions (DIDs).

1.1 DEFINITION OF DUE DATES/MATURITY, DEFINITION OF CATEGORIES, AND DELIVERY INSTRUCTIONS

The following definitions apply to the "Delivery" column in Table 2 below.***Error! Reference source not found.***

1.1.1 Due Date

a. Proposal: Items that are provided with the proposal.

b. CDR, PER, etc.: Critical Design Review, Pre-Environmental Review, Pre-Ship Review, etc.

c. As Generated: After each initial edition, revision, addition, etc. Monthly: Monthly by the 15th of each month or as required or as modified by CO

d. Weekly: Weekly status reports by Tuesday close of business or as modified by Contracting Officer (CO)

e. L: Launch Date

f. DACA: Days after contract award

g. MACA: Months after contract award

Unless otherwise noted, the data in the due date column titled "days" are to be interpreted as calendar days.

1.1.2 Maturity

a. Preliminary: The initial submission of an item. To be completed with available information as of the time of preparation for the due date.
b. Update: The best up-to-date information available at the time.
c. Final: The complete thorough submission of an item for approval, review, or information. This does not preclude updating later.

1.1.3 NASA Acceptance Code

A **Approval**: Documents in this category require approval by the Goddard Space Flight Center (GSFC) Contracting Officer's Representative (COR) prior to use by the contractor. Starting when the Government receives the document, the Government Contracting Officer may provide written (electronic) comments within 21 calendar days. When the Government identifies a deficiency, the Contractor **shall** re-submit within 30 calendar days of receiving Government comments (3 days for Instrument-level test and calibration/validation procedures) or provide a plan within 7 calendar days (1 day for test

calibration/ validation procedures), as specified by the Government Contracting Officer, for approval by the Government to close the deficiency. Normally, the requirement for resubmission will be within 30 days of receiving the Government's comments. If the Government does not provide comments in the prescribed time (21 calendar days), the Contractor may proceed with the associated work after notifying the Government of the intention to proceed.

R **Review**: Documents in this category require delivery to the Government prior to use and within the time period specified in the "Due Date" column of this document. They are subject to evaluation by the Government or its designated representatives to determine Contractor effectiveness in meeting contract objectives. Following submission, the Contractor may proceed with the associated work. Starting when the Government receives the document, the Government Contracting Officer may provide written (electronic) comments within 21 calendar days. When the Government identifies a deficiency, the Contractor **shall** re-submit within 30 calendar days of receiving Government comments (3 days for Instrument-level test and calibration/validation procedures) or provide a plan within 7 calendar days (1 day for test calibration/ validation procedures), as specified by the Government Contracting Officer, for approval by the Government to close the deficiency.

I **Information**: Data in this category require delivery to the Government within the time period specified in the "Due Date" column of the XRIS Contract Deliverables Requirements List for the purpose of determining current program status, progress, and future planning requirements. The Government Contracting Officer may provide written (electronic) comments within 21 calendar days to identify errors and omissions, and the Contractor **shall** make the corrections and re-submit as specified by the Government Contracting Officer. The Contractor **shall** address Government comments in the next version delivered, or in a revised version if it is the final delivery

1.2 XRIS CONTRACT DELIVERABLES REQUIREMENTS LIST (CDRL)

Items with an "As Generated" due date that are critical to schedule, performance, or interface **shall** be transmitted to GSFC by within 48 hours of generation.

Any updates to items of "Final" maturity **shall** require the same "approval/review" process as was required for the previous submissions.

All Data items **shall** be delivered in electronic format to a GSFC SOLAR specified web portal unless otherwise noted in the XRIS Contract Deliverables Requirements List.

Individual CDRL items may be combined with other CDRL items to increase documentation efficiency if the content and requirements of the CDRL items are satisfied.

Electronic deliverables **shall** be delivered in the following formats unless otherwise approved by the government:

a. Text Documents: PDF (searchable) or MS Word

b. Presentations: PDF (searchable) or PowerPoint
c. Spreadsheets: Microsoft Excel
d. Database: Delimited ASCII files accompanied with database schema document defining tables and entries.
e. Schedules: MS Project
f. Schematics and Drawings: PDF
g. Photographs: JPEG or current industry standard.
h. Video: Any readily available open standard (e.g., AVI, MPEG)

1.3 DATA ITEM DESCRIPTION (DID) OVERVIEW

Each CDRL item is defined by a corresponding DID. The DID includes the title, number, SOW reference, purpose, applicable documents, and required preparation information.

Much of the required information specified in the DIDs may already exist in the Contractor's documentation. In those cases, existing documents and formats should be used if they meet the intent of the DID requirements. If so, a notation **shall** be supplied in the deliverable which indicates where in the Contractor's document the information that satisfies the requirement can be found.

1.4 DELIVERY INSTRUCTIONS

a. The Contractor **shall** deliver each CDRL item via the media indicated below in accordance with the schedule and any special instructions indicated in Table 2 and/or the corresponding DID, and in accordance with the contract or mission-specific Delivery Order (DO) requirements and provisions.
b. All CDRL items **shall** be delivered electronically (one electronic copy for each CDRL item) to an electronic library designated by the Government. If all or a portion of a CDRL item is not well suited for electronic delivery, the item may be delivered via hard copy upon mutual agreement between the Contractor and the Government.
c. Upon submitting each CDRL item, the Contractor **shall** notify via email the Government Contracting Officer (CO), the CO Representative, and the Data Management Office.

1.5 CDRL ITEMS OVERVIEW

Table 1 provides a list of CDRL item categories as follows:

a. Item # An alpha-numeric identifier for each CDRL item category and its respective DID. The alpha descriptor is based on the subject matter of the deliverable:

Table 1 Alpha-numeric identifiers for each CDRL

PM	Project Management
RM	Resource Management
RVW	Reviews
SE	Systems Engineering
MA	Mission Assurance and Safety

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OPS	Operations
SW	Software
I&T	Integration and Test
FW	FPGA Development Plan

b. Requirements Reference: The reference indicates the section of the SOLAR Instrument SOW, IMAR, and/or Instrument Requirements Specification (SPEC) where the CDRL item is called out.

c. Title (self-explanatory)

d. Delivery: The contract baseline schedule of delivery for the CDRL item. Many of the dates are referenced to reviews or other milestones. Unless stated otherwise, days are calendar days.

e. Flight Model: This column describes if a deliverable is required for the first flight model (FM1), the second flight model (FM2), or both flight models.

f. Purpose: The purpose of the CDRL item submission (i.e., The Government's role following receipt of a CDRL item) is based on the definitions below. The designation for an item applies to all submissions (e.g., preliminary/initial, update, final) of that item unless noted otherwise. UAR indicates Update as Required with the approval letter indicated in the parenthetical. An A, R, or I indicate the delivery is required, with the Government's role following a receipt as indicated.

Table 2 SOLAR XRIS Contract Deliverables Requirements List (CDRL)

CDRL No.	SOW	Title	Delivery	Flight Model	Purpose
PM-1	4.1	Project Management Plan	Preliminary: 30 DACA Final: PDR+14 days	FM-1	R
PM-4	4.4	Engineering Change Proposals, Deviations, and Waivers	As Required	Both	A (Class-I) R (Class-II)
PM-5	4.5.6 4.5.9 4.6	Project Management Status Review Data Package	Bi-monthly	FM-1	I
RM-3	4.2 4.6	Detailed Schedules	Preliminary: 15 DACA Monthly Updates by the 15th of each month Baseline: Submission includes PCM list NLT 90 days after ATP	Both	I I
RVW-1	4.5.4.1-4.5.4.5	Formal Review Data Package	Preliminary: Each Review Dry Run –14 days Update: Each Review – 7 days	Both	I

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CDRL No.	SOW	Title	Delivery	Flight Model	Purpose
RVW-1 (cont.)			Final: NLT Review – 2 days		
SE-3	5	XRIS System Specification	Preliminary: SDR – 14 days Final: SDR	FM-1	I R
SE-4	5.1 6.1 6.3	Detailed Design Specifications	Preliminary: Applicable subsystem PDR Final: Applicable subsystem CDR	FM-1	R R
SE-5	5.3 6.3.2.2	Thermal Math Model and Reports	Preliminary: PDR Update: CDR, FM1 PER, FM1 PSR, and as generated	Both	R R
SE-6	5.3 6.3.2.2	Structural Math Model and Reports	Preliminary: PDR Update: CDR, PER, PSR, and as generated	Both	R Updates: I
SE-7	5.3 6.3.2.2	Solid Math Model	Preliminary: PDR Update: CDR, FM1 PER, FM1 PSR, and as generated	Both	R Updates: I
SE-9	5.1 6.3.2	System Performance Verification Plan	Preliminary: SRR-14 days Final: PDR Update: SDR/SRR	FM-1	R A R
SE-10	5.1 6.3.2	System Performance Verification Report	Preliminary: PSR – 30 days Final: PSR	Both	R R
SE-11	5.1 6.3.2	Performance Verification Procedures	30 Days prior to use	FM-1	R
SE-12	5.1	Environmental Verification Specification	Preliminary: PDR Final: CDR – 14 days Update: As Required	FM-1	I A R
SE-13	5.1	Environmental Verification Reports	Initial assessment: 1 day after test Preliminary: 5 days after test Final: 30 days after Test	FM-1, FM-2 if tested	I I I
SE-14	6.3 8	Digital Image and Video Records	Preliminary: PER Final: PSR Update: As Required	Both	I I I

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CDRL No.	SOW	Title	Delivery	Flight Model	Purpose
SE-15	6.1 6.3	Individual Test Plans	Preliminary: CDR Final: 90 days before Test	FM-1 (FM-2 as applicable)	A
SE-16	5.5 6.3.2.4	Magnetic Control Plan	Preliminary: PDR Final: CDR	FM-1	I R
SE-18	6.3.2.3	EMC/EMI Compatibility Plan	Preliminary: PDR Final: CDR	FM-1	I R
SE-19	7.1.2	Maintenance, Test, and Operations Manual for the XRIS Emulator	Final: With Delivery of XRISE	FM-1	R
SE-20	6.1 6.2	Request for Use of Multi-Mission or Previously Designed, Fabricated, or Flown Hardware	Preliminary: 60 DACA Final: SDR/SRR + 60 days	FM-1	I R
MA 1-1	8	Mission Assurance Requirements Compliance Matrix	Preliminary: With proposal Final: 15 DACA	FM-1	I R
MA 2-1	8	Input to Orbital Debris Assessment Report (ODAR) and End of Mission Plan (EOMP)	Preliminary ODAR: 15 days prior to mission PDR Interim ODAR and Draft EOMP: 60 days prior to mission CDR Final: 90 days prior to Instrument PSR	FM-1	I I I
MA 2-2	MAR 2.2.2	Reporting of MRB Actions	Major MRB: NLT 5 days after MRB action Minor MRB: NLT 5 days after MRB action	FM-1 (FM-2 as applicable)	A R
MA 3-1	8	System Safety Plan (SSP)	Preliminary: SRR Final: 45 days prior to PSR Updates: 30 days prior to implementation	FM-1	I R R
MA 3-2	8	Safety Requirements Compliance Checklist	Preliminary: 45 days prior to PDR Final: 45 days prior to CDR Updates: 45 days prior to Implementation	FM-1	I I I
MA 3-4	8	Instrument Safety Assessment Report (ISAR)	Preliminary: 30 days prior to instrument PDR Intermediate: 30 days prior to instrument CDR Final: 30 days prior to instrument PSR	FM-1	I I I

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CDRL No.	SOW	Title	Delivery	Flight Model	Purpose
MA 4-2	8	Failure Mode, Effects, and Criticality Analysis (FMECA) and Criticality Items List (CIL)	Preliminary: 30 days prior to PDR Update: 30 days prior to CDR and each subsequent milestone review leading to LRR	FM-1	R R
MA 4-5	8	Limited Life Items List	Draft: 30 days prior to PDR Preliminary: 30 days prior to CDR Updates: 30 days of changes	FM-1	I R R
MA 4-6	7.1 8	Parts Stress Analysis	Draft: 30 days prior to PDR Final: 30 days prior to CDR Revisions: 30 after identification	FM-1	R R R
MA 4-7	7.1 8	Worst-case Analyses	30 days prior to CDR Revisions within 30 days after identification	FM-1	R
MA 5-1	8	Software Assurance Plan	Preliminary: 30 days prior to SRR Final: 15 days prior to PDR Updates: 30 days prior to implementation	FM-1	I I I
MA 7-1	7.1 8	EEE Parts Control Plan	30 DACA	FM-1	I
MA 7-2	7.1 8	Master EEE Parts List	EEE parts to the Parts Control Board prior to inclusion Updates prior to inclusion	FM-1 (FM-2 as applicable)	R
MA 7-3	7.1 8	Radiation Effects Mitigation	60 DACA	FM-1	R
MA 7-4	8	Radiation Shielding and Dose Analysis Report	Preliminary: PDR Final: CDR	FM-1	R
MA 7-5	7.1 8	Single Event Effect Fault Management Plan	Preliminary: PDR Final: CDR	FM-1	A
MA 8-2	8	Materials Usage Agreement	30 days prior to CDR New or revised after CDR: 30 days after identification	Both	A
MA 8-3	8	Materials Identification and Usage List (MIUL)	Preliminary: 30 days prior to PDR Final: 30 days prior to CDR	FM-1 (FM-2 as applicable)	R R R R

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CDRL No.	SOW	Title	Delivery	Flight Model	Purpose
			Updates within 30 days after identification As-built MIUL 30 days prior to PSR		
MA 11-1	8	GIDEP Alerts/NASA Advisory Dispositions	Disposition of existing Alerts within 30 days of identification Disposition of new Alerts within 30 days of Alert release	FM-1	R R
MA 11-2	8	Initiating GIDEP Alerts	Within 30 days of identification	FM-1	R
MA 12-1	8	End Item Acceptance Data Package	Preliminary: 30 days prior to PSR Final: 30 days prior to End Item delivery Updates: 30 days after identification	FM-1 (FM-2 as applicable)	R A A
OPS-1	9.1.3	Flight Telemetry and Command Database	Preliminary: PDR Baseline: PER of FM1 Final: PSR Updates: As Required	FM-1	R R R R
OPS-2	9.1.3	Flight Telemetry and Command Handbook	Preliminary: PDR Baseline: PER of FM-1 Final: PSR Updates: As required	FM-1	R R R R
OPS-3	9.1.3	Operations Handbook	Preliminary: PER Final: PSR	FM-1	R A
OPS-4	6.1.3	Ground Processing Algorithms Test and Validation Plan	Preliminary: PDR Final: PSR - 3 months Update: CDR	FM-1	R R R
OPS-5	6.1.3	Ground Processing Algorithm Document	Preliminary: PDR Final: PSR -3 months Update: CDR	FM-1	R R R
OPS-6	6.1.3	Ground Software Acceptance Plan Input	Preliminary: CDR Final: PSR - 6 months	FM-1	R R
OPS-7	6.1.3	Ground Processing Algorithm Code	Preliminary: PDR + 4 months Update: CDR Final: PSR	FM-1	R R R R

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CDRL No.	SOW	Title	Delivery	Flight Model	Purpose
			Update: at major revision releases		
OPS-9	6.3.2.2	Mass Properties and Power Report	Monthly NLT 15th of each month	FM-1	I
OPS-10	7	XRIS Packetized Data	As generated	FM-1	I
OPS-11	9.1.3	Instrument Operations Configurable Items	Preliminary: 30 days prior to launch Updates: As needed	FM-1	R R
SW-1	6.1.2	Software Management Plan	Preliminary: 30 DACA Final: SW Acceptance Review Update: PDR, CDR, TRR	FM-1	R R R
SW-2	9.1.3.1	Software Delivery Packages	Preliminary: PER Final: PSR Updates: At major revision releases	FM-1	R R R
I&T-1	6.4.1	Transportation, Handling Plan and Procedures	Preliminary: PDR Final: CDR	FM-1	R
I&T-2	9.1.3	Post Launch Test Reports	Preliminary: 2 weeks after test Final: 2 months after test	FM-1	R
I&T-3	5.3	Observatory Level Test Procedures	Preliminary: PER Final: PSR	FM-1	R
I&T-4	5.3	Observatory Level Test Report	Observatory PSR	FM-1	R
I&T-5	6.3.3	Calibration Program Plan	Preliminary: SDR/SRR Final: CDR Update: PSR	FM-1	R R R
I&T-6	6.3.3	Calibration Data Books	Final: PSR of each Model	FM-1 (FM-2 as applicable)	R
FW-1	6.2.1	FPGA Development Plan	Preliminary: SRR/SDR Final: 30 days before PDR	FM-1	R R
FW-2	6.2.1	FPGA Design Data Package (FDDP)	Preliminary: 30 days before PDR Updates: As generated Final: 30 days before CDR	FM-1	R R R

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PROGRAM DATA ITEM DESCRIPTIONS

PM-1 PROJECT MANAGEMENT PLAN

Title: Project Management Plan	**DID for CDRL No. PM-1**
Reference: XRIS SOW Section 4.1	
Purpose: Describes how the project is organized and managed. It provides the management structure, its system of operation, responsible lines of communications, and key personnel assignments	

Preparation Information:

1. The Contractor shall prepare and deliver, as prescribed herein, a Project Management Plan organized as follows:
   a. Project Management. Describe the management approach to the implementation of the SOLAR Project Program, including interrelationships of the Contractor's project office with functional and divisional groups. Use flow diagrams, work breakdown structure, logic networks, etc., as necessary to reduce verbal descriptive material. Address interfaces with the Government and subcontractors.
   b. Programmatic Interface with the Government. Describe the process for interfacing with the Government with respect to programmatic and technical status and issues.
   c. Organizational Chart. Provide a chart showing the Contractor's organization for this project, including titles, functions, and lines of authority.
      (1) Authority of the Project Manager relative to other on-going projects and applicable support organizations within the company structure. Discuss the Project Manager's control over essential resources and functions necessary to accomplish the work.
      (2) Process to be followed by the Project Manager in obtaining decisions beyond his/her authority and in resolving conflicts in priority for resources and functions not under the Project Manager's direct control, such as personnel, finances, and facilities.
   d. Implementation approach for the project. Describe in general how the requirements of the project (i.e., Contract, Statement of Work, Mission Assurance Requirements, XRIS Requirements Document, etc.) will be achieved. Identify potential problems related to this work and the planned approach to avoiding problems and/or obtaining solutions. Describe controls to be exercised over subcontractors and suppliers.
   e. Subcontract management. Describe subcontract management practices, approach to establishing clear subcontract requirements, integration of subcontractor work into the project, management of interfaces, subcontractor reporting, plans for review of subcontractor efforts, integration of reported subcontractor risks and issues into the project, acceptance process, and incorporation of mission assurance requirements into subcontracted efforts. Describe how Government insight into subcontractor activities will be enabled.
   f. Management techniques to be employed to minimize risks of violating interface requirements and agreements. Describe how issues will be surfaced in a timely manner and at the proper levels. Identify initial proposed key technical

performance metrics the project will use to monitor and report on interface compliance and resource status, including the continuity of knowledge capture of key personnel through the development lifecycle of the two observatories.

g. Technical Working Groups. Describe the process of establishing and implementing technical working groups such as instrument interfaces, pointing/alignment, thermal, contamination control, environmental test planning, special technical topics, etc. Identify each working group separately along with a general description of its function, members, and planned lifetime. Explain how the Contractor will provide Government technical personnel interfaces and how they will function within the technical working groups. Explain how documentation of the Contractor-led meetings will be maintained and distributed to the Government.

h. Project Facilities. Describe the Contractor facilities to be used for all project activities, including security and Government access to each.

2. Appendix A, Risk Management, shall address risk management as follows:
   a. Define a plan for risk management that describes the process for risk identification, risk analysis, risk mitigation, and risk monitoring. Include the Contractor's process for tracking and reporting risk status and changes. This section shall clearly describe:
      (1) Risk management philosophy
      (2) Risk management organization, to include roles and responsibilities
      (3) Risk Management Review Board, to include members, frequency of meetings, and processes
      (4) Database (use, access, updates, responsibilities, etc.)
   b. Address the management and reporting of risks associated with hardware and software (e.g., technical challenges and risks, new technology qualification), commercial off-the-shelf software, system safety, performance, cost, and schedule (i.e., programmatic risks). Identify which tools, techniques, and attributes (i.e., Likelihood and Consequence) will be used to manage the risks. It is strongly recommended that the Contractor use the Goddard Space Flight Center (GSFC) risk matrix standard scale (5x5) definitions as defined in GPR 7120.4D, Risk Management.
3. Appendix B, Schedule Management, shall address the following:
   a. Describe the scheduling system, including details of management control methods and techniques. Include an approach for obtaining adequate insight into schedules for subcontracted efforts and integrating subcontractors schedule information in the system schedule. Include a description of schedule level detail (i.e., Level 1, Level 2, etc.) and use of each level of detail for management of the project.
   b. Describes the process for preparation, delivery, and maintenance of a schedule that meets the requirements of CDRL RM-3, Detailed Schedules and provides the primary and secondary critical paths.
4. Appendix C, Spare Parts Plan, describes sparing strategy and includes a list that identifies spare items by name, quantity, integration level of spare, applicable subsystem, and a qualitative and quantitative description of the schedule risk being mitigated by each spare.
5. Appendix D, Configuration Management Plan, describes the Contractor's hardware

and software Configuration Management (CM) system (including a description of the Contractor's CM policies and procedures) that will be implemented for this project.

a. Describe the approach, methodology, and application of CM principles and practices, including the following:
   (1) CM activities and procedures for each of the following CM functions:
      (a) Configuration planning and management
      (b) Configuration identification
      (c) Configuration change management
      (d) Configuration status accounting
      (e) Configuration verification and audit
      (f) CM of digital data
   (2) Change management, including methods of obtaining customer approvals and the role of the Government resident office
   (3) Configuration Item Identification List and the Computer Software Configuration Items and Hardware Configuration Items

6. Appendix E of the Project Management Plan shall include a Work Breakdown Structure (WBS) and WBS Dictionary with information provided down to the Level 3 WBS.
   a. Depict the WBS as a logical, hierarchical display of the subdivision of all project work to be completed and include the approved element title and element number.
   b. Arrange the WBS Dictionary in the same order as the contract WBS. Include in the WBS Dictionary the following for each WBS element:
      (1) WBS element title
      (2) WBS element code
      (3) WBS element code description, including quantities, work content and relevant efforts associated with each element (e.g., design, development, manufacturing), and contract end items where applicable
      (4) Specification title and number associated with the WBS element, if applicable

PM-4 ENGINEERING CHANGE PROPOSALS, DEVIATIONS, AND WAIVERS

Title: CONFIGURATION CHANGE REQUESTS (CCR) CLASS I	**DID for CDRL No. PM-4**
Reference: XRIS SOW Section 4.4	
Purpose: ECPs, Deviations, and Waivers facilitate the configuration control of system design changes	
Preparation Information: 1. The Contractor shall prepare and submit, as prescribed herein, Class I ECPs, waivers, and/or deviations using SAE-EIA-649, Configuration Management Standard, as a guideline. 2. All ECPs shall contain, in addition to the change description, sufficient information in the form of attachments, drawings, test results, etc., to allow the Government to evaluate the total impact of the proposed change.	

3. For the purposes of this DID, a Class I ECP is a change that:
    a. Affects a contract specification, mission requirement, or interface requirement
    b. Affects schedules of end-item deliverables to the Government
    c. Impacts Government-furnished equipment
    d. Affects configuration to the extent that changes would be required to prior deliverables in order to maintain specified performance

4. The Government may direct the Contractor to prepare ECPs under the "Changes" clause of the contract.

5. The Contractor shall allow the Government access to Class II changes.

6. Requests for Waivers and Deviations shall:
    a. Describe the requirements that apply to the item, subsystem, or system needing the waiver or deviation and provide specific information regarding the nature of the noncompliance.
    b. Describe the effect of the proposed noncompliance on item, subsystem, and system performance at higher levels of assembly.
    c. Describe the cost or schedule impact of non-approval of the waiver or deviation.

Note: Safety-related waivers and deviations are submitted in accordance with CDRL MA3- 2, Safety Requirements Compliance Checklist, MAR section 3.3.7.

Note: Waivers and deviations related to Material Review Board actions are submitted in accordance with the XRIS MAR.

PM-5 PROJECT MANAGEMENT STATUS REVIEW DATA PACKAGE

Title: PROJECT MANAGEMENT STATUS REVIEW DATA PACKAGE	**DID for CDRL No.** **PM-5**
Reference: XRIS SOW Section 4.5.6, 4.5.9, and 4.6	
Purpose: To summarize the progress since the previous Project Management Status Review.	
Preparation Information:	

The Project Management Status Review Data Package **shall** include the following items:

1. Accomplishments since last review, including 20 milestone events depicting critical items of project status for the succeeding two months with a report on the previous two months milestone events
2. Schedule
3. Technical issues and concerns, including summaries of technical progress and descriptions of the current technical issues and concerns
4. Business issues and concerns, including personnel changes

5. Open contract items
6. Open action items
7. Planned effort for next review period
8. Reliability and quality assurance information
9. Mass properties and power summary
10. Software metrics for each Class A, B or C Computer Software Configuration Item (CSCI) including:
    a. Number of software requirements and their change status
    b. Number of software change requests and problem reports and their status
    c. Resource utilization estimates and measurements of memory, CPU and I/O Bandwidth
11. Summary of progress towards Payment Milestones
12. Subcontractor status including:
    a. Efforts under contract
    b. Efforts waiting contract award
    c. Changes to first tier and sub-tier contractors
    d. Change orders, problems, issues
    e. Pending subcontractor consent packages
    f. Supply chain performance will be tracked using the table below, updated bi-monthly. This includes items 12. a. through 12. e. for subcontracts.

Part Description	Supplier	Leadtime	Original Date (on contract)	Delivery Date	Need date	Slack (days)	Affected Constraint		
							Technical	Schedule	Contract

13. A list of actions requested of GSFC management
14. Update of corporate changes, for example: early warning of
    a. Restructuring activities (including internal reorganizations)
    b. Indirect/direct rate changes
15. Risk assessment including approach for mitigation

16. Any additional data requested by GSFC (For example, a few slides of detailed technical progress or issues)

RESOURCE MANAGEMENT

RM-3 DETAILED SCHEDULES

Title: DETAILED SCHEDULES	**DID for CDRL No. RM-3**
Reference: XRIS SOW Section 4.2 and 4.6	

Purpose:

For understanding and mapping out in detail the most efficient way of melding together all elements necessary for providing the project deliverables by their required delivery times.

Preparation Information:

1. The schedule **shall** encompass all phases of the project indicating critical path and schedule slack and reserve.
2. The contractor **shall** establish, implement, and maintain an instrument schedule. Each Flight Model (FM) development and delivery **shall** be tracked in the schedule.
3. Phase 1 schedules **shall** include the instrument and GSE design, the Project Reviews, fabrication and test of the Engineering Development Unit (EDU) and GSE.
4. Phase 2 schedules **shall** include the fabrication, test, calibration, and delivery of the Flight Model (FM) instrument and its integration to the SOLAR spacecraft.
5. Design schedules **shall** be detailed by task with expected start and completion dates.
6. Procurement schedules **shall** be detailed by major items, assembly, or definable subassembly.
7. Procurement schedules **shall** be subdivided into standard electrical parts, integrated circuits, etc.
8. Fabrication schedules **shall** be detailed to the mechanical subassembly level and to the electronic board level, and show the expected start and completion dates, as well as substantive in-process milestones.
9. Detailed schedules **shall** indicate critical paths.
10. Detailed schedules **shall** indicate slack and reserve.

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REVIEW DATA ITEM DESCRIPTIONS

RVW-1 FORMAL REVIEW DATA PACKAGE

Title: FORMAL REVIEW DATA PACKAGE	**DID for CDRL No.** **RVW-1**
Reference: XRIS SOW Section 4.5.4.1 – 4.5.4.5	
Purpose: To demonstrate the instrument meets the entrance and exit criteria of NPR 7123.1D Appendix G.	
Preparation Information: Each formal review data package shall provide sufficient information to meet entrance and exit criteria as required by NPR 7123.1D Appendix G. For reference, GSFC-STD-1001A provides guidelines and criteria in support of planning and implementing the project reviews.	

SYSTEMS ENGINEERING DATA ITEM DESCRIPTIONS

SE-3 XRIS SYSTEM SPECIFICATION

Title: XRIS SYSTEM SPECIFICATION	**DID for CDRL No.** **SE-3**
Reference: XRIS SOW Section 5	
Purpose: The System Specification defines the contractor's software and hardware requirements for the Instrument and Ground Support Equipment in order to assure that the contractor is performing in accordance with the XRIS Requirements Specification	
Preparation Information: 1. The XRIS System Specification **shall** include derived requirements from the XRIS Requirements Specification and if contractor identifies other contractual requirements that should be included. 2. The XRIS System Specification **shall** be delivered in an Excel formatted file or in the ReqIF (Requirements Interchange Format). 3. The XRIS System Specification **shall** include a Requirements Traceability Matrix. 4. The Requirements Traceability Matrix **shall** include an impacts field identifying all systems and subsystems that may be affected by a proposed change to this requirement. 5. The Requirements Traceability Matrix **shall** include an interface impacts field identifying all systems and subsystems that may be affected by a proposed change to this requirement due to an interface association. 6. The Requirements Traceability Matrix **shall** include identification of the parent requirement.	

SE-4 DETAILED DESIGN SPECIFICATIONS

Title: DETAILED DESIGN SPECIFICATIONS	**DID for CDRL No.** **SE-4**
Reference: XRIS SOW Section 5.1, 6.1, and 6.3	
Purpose: To evaluate the contractor's flow down of design requirements from the system level to subassembly and CSU level.	
Preparation Information: 1. The Detailed Design Specifications **shall** provide the hardware and software specifications to be used by the contractor to direct the development of the Instrument and ground support equipment.	

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2. The Detailed Design Specifications **shall** consist of separate specifications as appropriate.
3. The Detailed Design Specifications **shall** include engineering requirements down to the subassembly level and as needed to the part level.
4. The Detailed Design Specifications **shall** include interface requirements internal and external to XRIS. (Separate Interface Requirements Specifications should be used where appropriate.)
5. The Detailed Design Specifications **shall** include operational parameters and requirements.
6. The Detailed Design Specifications **shall** include safety and assurance requirements.
7. The Detailed Design Specifications **shall** include software requirements to the CSU level.
8. The Detailed Design Specifications **shall** include unique identifiers for each requirement.
9. The Detailed Design Specifications **shall** include traceability matrices identifying parent requirements and any requirements impacted by a change in the requirement.

SE-5 THERMAL MATH MODEL AND REPORTS

Title:	**DID for CDRL No.**
THERMAL MATH MODELS AND REPORTS	**SE-5**

Reference:
XRIS SOW Section 5.3 and 6.3.2.5

Purpose:
Establish the thermal analytical model of the XRIS for the SOLAR mission, to provide review of these analytical tools which form the basis and analytical validation of the thermal design, and which constitute an accurate representation of the instrument thermal performance in orbit. Reduced thermal analytical models are required for integrated mission thermal analyses. A report will be created to evaluate the adequacy of the thermal design to meet requirements, both explicit and derived, under worst-case hot and cold environments for all mission phases and operating modes

Preparation Information:

1. The Thermal Math Model **shall** include:
    a. A Detailed Thermal Model of the instruments and options
    b. A Reduced Thermal Model of the instrument
2. Both the Detail Thermal Model and the Reduced Thermal Model **shall** include geometric math models (GMM), which calculate radiation couplings and environmental heat fluxes, and a thermal math models (TMM), or nodal models which calculate the heat transfer and resultant temperatures.
3. The Detailed and Reduced GMM **shall** be in Thermal Desktop format.

4. The Detailed and Reduced TMMs **shall** be in The Systems Improved Numerical Differencing Analyzer 85 (SINDA85) format.
5. Thermal Math Models **shall** support both steady-state and transient solutions.
6. Thermal Math Models **shall** represent all flight environments and mission modes from pre- launch through the entire mission life, as well as model the environments of the thermal balance and thermal vacuum tests.
7. Thermal Math Models Report **shall** include the files and description of any special analytical routines or techniques, e.g., for representing heater or other temperature control features.
8. Any nodes or surfaces using adiabatic surfaces or arithmetic nodes (zero mass nodes) **shall** be noted.
9. Thermal Math Models Report **shall** include figures showing at least the overall layout of the instrument with dimensions, and with significant features of the thermal control system identified (e.g., radiators, insulation, apertures).
10. Thermal Math Models Report **shall** include figures or sketches showing how nodes and surfaces correspond to instrument components.
11. Thermal Math Models Report **shall** include results of sample run (of the hot case, EOL).
12.

SE-6 STRUCTURAL MATH MODEL AND REPORTS

Title: STRUCTURAL MATH MODEL AND REPORTS	**DID for CDRL No.** **SE-6**
Reference: XRIS SOW Section 5.3 and 6.3.2.2	
Purpose: To provide instrument interface information for coupled loads analysis by spacecraft contractor for both launch loads and on orbit jitter.	

Preparation Information:

1. The structural math model **shall** include a full order structural math model.
2. The full order structural math model **shall** be MSC/NASTRAN compatible.
3. The structural math models **shall** provide models of the instrument in launch configuration.
4. The Structural Math Model Reports **shall** document the math models with the following information:
    a. Configuration version
    b. Identification of the documents and drawings used to generate the model
    c. Model mass properties

d. Boundary conditions
e. Figures showing the components modeled
f. References used for mechanical properties
g. A summary of output results including modal frequencies, deflections and critical stresses.
h. Undeformed and deformed plots of the FEM

SE-7 SOLID MATH MODEL

Title: SOLID MATH MODEL	**DID for CDRL No.** **SE-7**
Reference: XRIS SOW Section 5.3 and 6.3.2.2	
Purpose: Used by the spacecraft contractor to check envelope and field-of-view constraints. Government will use for independent verification of constraints.	
Preparation Information: 1. Solid math model **shall** be delivered in its native and Standard for the Exchange of Product (STEP) format.	

SE-9 SYSTEM PERFORMANCE VERIFICATION PLAN

Title: SYSTEM PERFORMANCE VERIFICATION PLAN	**DID for CDRL No.** **SE-9**
Reference: XRIS SOW Section 5.1 and 6.3.2	
Purpose: Provides a description of the XRIS performance and verification test program and describes the specific tests and/or analysis that will collectively demonstrate that the hardware/software complies with the performance and environmental requirements.	
Preparation Information: 1. The Performance Verification Plan **shall** describe the approach (test, analysis, etc.) that will be used to verify the hardware/software complies with requirements. 2. The Performance Verification Plan **shall** address the environmental verification program either as a separate section or as a separate stand-alone document. 3. The environmental verification section of the Performance Verification Plan **shall** describe the contractor's approach for qualification and acceptance testing. It is intended to provide general test philosophy and an overview of the system-level environmental testing to be performed to demonstrate adequacy of the instrument for flight (e.g., vibration, shock, thermal vacuum, etc.). 4. If performance or environmental verification is performed at level of assembly other than instrument, the Performance Verification plan **shall** describe the relationship of the test and analysis to instrument level verification. 5. The Performance Verification Plan **shall** address any limitations in the ability to verify any performance or environmental requirement along with a risk assessment of the inability to verify the requirement. 6. Where requirements are verified by analysis, the Performance Verification Plan **shall** include objectives, a description of the mathematical model, assumptions on which	

the models will be based, required output, criteria for assessing the acceptability of the results, the interaction with related test activity, if any, and requirements for reports.

7. The Performance Verification Plan **shall** contain detailed test flow sequence charts showing sequence of development and instrument level testing, including integration and qualification/acceptance test activities for the instrument and instrument assemblies.
8. The Performance Verification **shall** indicate in the test flows where Comprehensive and Limited Performance Tests will be conducted.
9. The Performance Verification Plan **shall** provide descriptions of the tests and activities that will be performed at the contractor's facility, spacecraft contractor's facility and at the launch base (descriptions include: level of assembly, configuration of item, objectives, facilities, instrumentation, safety consideration, necessary functional operations, and requirements for procedures and reports).
10. The Performance Verification Plan **shall** include a description of when and how frequently all redundant parts and cross-strapped paths will be tested during each test activity.
11. The Performance Verification Plan **shall** address the plan for the verification of all previously flown and qualified hardware, including identification of additional verification testing that is required.
12. The Performance Verification Plan **shall** include a recommended post-launch test plan.
13. The Performance Verification Plan **shall** provide a description of all ground support facilities and equipment planned along with plan for certification of any lifting equipment.
14. The Performance Verification Plan **shall** include a description of the operational methodology for controlling, documenting, and approving activities not part of the approved test procedure.
15. The Performance Verification Plan **shall** address the controls to prevent accidents that could damage or contaminate hardware or facilities or cause personal injury.
16. The Performance Verification Plan **shall** address the controls for real-time decision-making mechanisms for continuation or suspension of testing after malfunction, and a method for determining retest requirements, including the assessment of the validity of previous tests.
17. The System Performance Verification Plan **shall** contain a Performance Verification Matrix that maps performance and design requirements/parameters against the test verification methods to prove compliance with the specification requirements.
18. The System Performance Verification Matrix **shall** include columns of information to identify and/or describe the following minimum information:

    a) Parameter description

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b) Specification requirement (Requirements Spec or other contractual requirements contractor identifies))

c) Contractor's Design Specification or Instrument ICD paragraph number

d) Method of compliance verification (test, life test, demonstration, analysis, inspection)

e) Level of Assembly where compliance will be verified (instrument, unit, assembly, etc.)

f) Identification of design phase and integration level at which verification is performed.

g) System Performance Verification Test Plan number

h) Test Procedure number or identifier

i) Test Report Number

19. The environmental verification section of the System Performance Verification Plan **shall** contain an Environmental Test Matrix compatible with the matrix in Figure 2.1-1 of the GSFC General Environmental Verification Specification.
20. The System Performance Verification Plan **shall** also include a description of the plans for using software to conduct system level testing. The plan should provide an overview of system level software testing.
21. The System Performance Verification Matrix **shall** include the Software Requirements Verification Matrix.

SE-10 SYSTEM PERFORMANCE VERIFICATION REPORT

Title: SYSTEM PERFORMANCE VERIFICATION REPORT	**DID for CDRL No.** **SE-10**
Reference: XRIS SOW Section 5.1 and 6.3.2	
Purpose: Summarize compliance with system specification requirements and/or provide a summary of testing and analysis results, including conformance, nonconformance, and trend data.	
Preparation Information: 1. The System Performance Verification Report **shall** compare hardware/software specification requirements with the verified values (whether measured or computed) for each instrument.	

SE-11 PERFORMANCE VERIFICATION PROCEDURES

Title: PERFORMANCE VERIFICATION PROCEDURES	**DID for CDRL No.** **SE-11**
Reference: XRIS SOW Section 5.1 and 6.3.2	
Purpose:	

Provide detailed procedures required to perform subsystem, system, and calibration tests.

Preparation Information:

1. Performance Verification Procedures **shall** document the detailed procedure for conducting the test to verify that the system meets the performance requirement.
2. Performance Verification Procedures **shall** include:
    a. Title of the test
    b. Contractor's name and address
    c. Contract number
    d. Test description and conditions
    e. Test objective(s)
3. Performance Verification Procedures **shall** include complete identification of the item tested including the following:
    a. Name
    b. Model number, part number and serial number
    c. Type of item, for example: engineering model, prototype, proto-flight or flight
    d. Applicable engineering changes
    e. Date of manufacture
    f. Configuration
4. Performance Verification Procedures **shall** include identification of objective and criteria established for test by the applicable test plan including:
    a. Required test parameters
    b. Performance requirements
    c. Acceptance or compliance limits
    d. Environmental criteria
5. Performance Verification Procedures **shall** include identification of each item of test equipment used in the test including the following:
    a. Name
    b. Model number
    c. Serial number
    d. Manufacturer
    e. Calibration status and coefficients
    f. Accuracy data
6. Performance Verification Procedures **shall** include a description of the physical set up used to conduct the test including the following:

a. Location and orientation of the test item.
b. Location, identification, orientation and settings of test equipment and instrumentation
c. Location and orientation of interconnections and cables
d. Facility location and requirements
e. Grounding scheme

7. Performance Verification Procedures **shall** include detailed step-by-step descriptions of test procedure including:
    a. Test set up
    b. Test item operating limits and test conditions
    c. Measurements required
    d. Operations required to obtain the data
    e. Test break down
8. Performance Verification Procedures **shall** include any special support requirements including:
    a. Use of special facilities or test ranges
    b. Personnel requirements
    c. Unusual electrical, hydraulic or pneumatic requirements
    d. Support equipment
9. Performance Verification Procedures **shall** include:
    a. Hazardous situations, operations and abort conditions
    b. Responsibilities and chain of command
    c. Contamination control procedures
    d. Quality assurance provisions
    e. Safety requirements
    f. Pass fail criteria
    g. List of references
    h. List of acronyms and abbreviations
10. Performance Verification Procedures **shall** also include system level software test procedures/descriptions with the following items
    a. Test preparations, including hardware and software
    b. Test descriptions, including:
        i. Test identifier
        ii. System requirements addressed by the test case
        iii. Prerequisite conditions

iv. Test input
v. Instructions for conducting procedure
vi. Expected test results, including criteria for evaluating results, and assumptions and constraints
vii. Criteria for evaluating results

c. Requirements traceability
d. Identification of test configuration

SE-12 ENVIRONMENTAL VERIFICATION SPECIFICATION

Title: ENVIRONMENTAL VERIFICATION SPECIFICATION	**DID for CDRL No. SE-12**
Reference: XRIS SOW Section 5.1	
Purpose: To specify technical approach for demonstrating hardware complies with the performance requirements.	
Preparation Information:	

1. The Environmental Verification Specification **shall** include:
   a) Standard conditions for all test areas, i.e., temperature, humidity and cleanliness.
   b) Qualification and acceptance test temperatures, including uncertainties.
   c) Shock test requirements.
   d) Radiation levels.
   e) Acoustic excitation levels.
   f) Qualification and acceptance vibration test levels.
   g) Electromagnetic test levels.
   h) Measurement tolerances for weight, center-of-gravity and moments of inertia.
   i) Thermal and thermal vacuum test profiles for all assemblies and instruments.
   j) The instrument system level thermal test profiles should be illustrated and described. The estimated time for each event, i.e., hot and cold soak, hot and cold exposures, transitions, etc. should be identified.

SE-13 ENVIRONMENTAL VERIFICATION REPORTS

Title: ENVIRONMENTAL VERIFICATION REPORTS	**DID for CDRL No. SE-13**

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Reference:
XRIS SOW Section 5.1

Purpose:
Reports compliance with system specification requirements and/or provides a summary of testing and analysis results, including conformance, nonconformance, and trend data.

Preparation Information:

1. Verification Reports **shall** include test objective(s).
2. Verification Reports **shall** include complete identification of the item tested including the following:
    a. Name
    b. Model number, part number, serial number
    c. Type of item for example engineering model, prototype, proto-flight or flight
    d. Applicable engineering changes
    e. Date of manufacture
    f. Configuration
3. Verification Reports **shall** include identification of the test requirements correlated to contractual requirements including required test parameters, performance requirements, acceptance or compliance limits, and environmental criteria.
4. Verification Reports **shall** include a report summary including the following:
    a. Brief discussion of the significant test results, observations, conclusions and recommendations covered in greater detail in the report.
    b. Proposed corrective actions and schedules for any failures or problems encountered.
    c. Identification of deviations, departures or limitations encountered relative to the contract requirements.
5. Verification Reports **shall** include tables, graphs, illustrations and/or charts to simplify the summary data.
6. Verification Reports **shall** include identification of documents referenced.
7. Verification Reports **shall** include identification of each item of test equipment used in the test including the following:
    a. Name
    b. Model number
    c. Serial number
    d. Manufacturer
    e. Calibration status and coefficients
    f. Accuracy data

8. Verification Reports **shall** include description of the physical set-up used in conducting the test including the following:
    a. Location and orientation of the test item.
    b. Location, orientation and settings of test equipment and instrumentation.
    c. Location and orientation of interconnections and cables.
    d. Facility location and requirement.
9. Verification Reports **shall** include summarized sequence of testing steps including how the item was operated during the test and any control conditions imposed.
10. Verification Reports **shall** include test results and analysis including:
    a. Recorded data.
    b. Data reduction from test results to verifiable requirements including sample calculations.
    c. Tables comparing test results against requirements and predicts.
    d. Discussion of results.
    e. Discussion of anomalies, deviations, discrepancies or failures. Also, address discrepancies between design requirements and the tested configuration.
    f. Trends in performance.
11. Verification Reports **shall** include conclusions distinguished between objective and subjective to include the following:
    a. The effectiveness of the test procedures
    b. The success or failure of the test item
    c. Any need to repeat, additional or alternative tests.
    d. Any need for item redesign or development
    e. Any need for improved test procedures, techniques or facilities
    f. The adequacy and completeness of the test requirements
12. Verification Reports **shall** include a certification the test was performed in accordance with the test plans and procedures, that the results are true and accurate, and that the item tested either passed or failed the item's requirements.
13. The certification **shall** include the signature of the contractor personnel that performed the test, and an authorized contractor representative authorized to make certifications, and any government witnesses.
14. For thermal testing, Test Reports **shall** include tabulation of test target and chamber temperatures and recorded test temperatures for all equipment and assemblies.
15. For thermal balance testing, Test Reports **shall** include a tabulation of test prediction and actual temperatures and a tabulation of other pertinent targeted parameters vs. their

actual test values, including dissipations (directly measured or inferred), heater power, and absorbed radiant energy flux.

16. For thermal balance testing, Test Reports **shall** include an assessment of proximity to theoretic steady state run to infinite time.

SE-14 DIGITAL IMAGE AND VIDEO RECORDS

Title: DIGITAL IMAGERY AND VIDEO RECORDS	**DID for CDRL No.** **SE-14**
Reference: XRIS SOW Section 6.3 and 8	
Purpose: Capture visual history of the instrument build and test. The purpose of this DID is to describe how digital images and video records that are captured should be delivered when necessary.	

Preparation Information:

1. The contractor **shall** prepare and deliver digital color still photographs and digital color video to serve as the visual history of the assembly, test, integration, and as-delivered configuration of the instrument hardware. Contractor may determine when and how many photographs are required to capture the visual history.

   Metadata should accompany each photo/video record to clearly and accurately describe that record within a context of time, place and purpose.

SE-15 INDIVIDUAL TEST PLANS

Title: INDIVIDUAL TEST PLANS	**DID for CDRL No.** **SE-15**
Reference: XRIS SOW Section 6.1 and 6.3	
Purpose: Define a test plan for each test.	

Preparation Information:

1. The Test Plans **shall** document the contractor's plan for conducting the test and analyzing the test results to verify that the system meets the performance requirement.
2. The Test Plans **shall** include the following:
   a) Title of the test
   b) Contractor’s name
   c) Contract number
   d) Test description and conditions
   e) Test objectives(s)

f) Description of the hardware under test including:
   1) Name
   2) Model number, part number
   3) Type of item for example engineering model, prototype, proto-flight or flight.
   4) Configuration

g) Required test support equipment, government furnished equipment and ground support equipment including description

h) Test facilities

i) Contamination control approach

j) Quality assurance provisions

k) Safety requirements

l) Pretest analysis

m) Test approach, test levels and sequence of test runs

n) Instrumentation list including description and figures

o) Required data recording, reduction including sample calculations, analysis and data output from the test

p) Pass/Fail criteria

q) Documentation requirements

r) List of references

s) List of acronyms and abbreviations

SE-16 MAGNETIC CONTROL PLAN

Title: MAGNETIC CONTROL PLAN	**DID for CDRL No.** **SE-16**
Reference: XRIS SOW Section 5.5 and 6.3.2.4	
Purpose: To ensure that no instrument steady or time-varying magnetic field interferes with the magnetometer sensor system on the spacecraft.	
Preparation Information: 1. The Magnetic Control Plan **shall** provide identification and characterization of all magnetic materials used in fabrication of the instrument flight hardware with the objective of minimizing the use of, and impact of, permanent and soft magnetic materials. Special attention should be given to any parts which move in the spacecraft frame of reference.	

2. The Magnetic Control Plan **shall** consist of design procedures and design review requirements which will ensure that stray magnetic fields arising from current loops in the interconnection harnessing are minimized. Special attention is required for all elements of power generation and distribution, heaters, and communications assemblies whose status changes frequently. A correction scheme (algorithm) must be delivered to the government that can be used in real-time data processing to correct for any magnetic signature(s) that exceeds magnetometer specification limits.
3. The Magnetic Control Plan **shall** consist of a magnetic screening/test program to ensure that all flight equipment used in the vicinity of the magnetic sensors meets stringent limitations on hard and soft permanent magnetic materials.
4. The Magnetic Control Plan **shall** consist of guidelines issued on materials and tools used in the vicinity of the flight instruments.
5. The Magnetic Control Plan **shall** consist of an instrument magnetic field model which includes dipole moment, position and orientation for each instrument known to possess significant magnetic material. The model will be used to predict the worst-case magnetic signature from the spacecraft body at the flight sensor assembly as well as to estimate the worst-case spacecraft attitude perturbations caused by magnetic torque.

SE-18 EMC/EMI COMPATIBILITY PLAN

Title: EMC/EMI COMPATIBILITY PLAN	**DID for CDRL No.** **SE-18**
Reference: XRIS SOW Section 6.3.2.3	
Purpose: The document will be used to evaluate the design and test verification methods that will be used to ensure that the instrument will be compatible with the performance requirements.	
Preparation Information:	

1. The EMC/EMI Compatibility Plan **shall** contain the following minimum information:
    a) Description of how the instruments will be designed to ensure electromagnetic compatibility between the instrument and spacecraft subsystems and launch vehicle.
    b) Describe the test plans that will be used at the assembly and instrument system level of assembly.
    c) Describe the test plan(s) that will be used to demonstrate that the instrument will be electromagnetically compatible with the spacecraft subsystems and launch vehicle.
    d) If Electro-Static Discharge (ESD) testing is not planned, provide the ESD Analysis Report used to drive the design requirements that will protect the electronics from damage/upset from an ESD event.
    e) Describe the proposed accept/reject test criteria that will be used at the assembly and instrument system level of assembly.
    f) Describe the proposed design guidelines that will be employed to ensure that the EMC/EMI requirements will be met, such as bonding, grounding and isolation, wiring harness design, circuits, shielding, etc.

SE-19 MAINTENANCE, TEST, AND OPERATIONS MANUAL FOR THE XRIS EMULATOR

Title: MAINTENANCE, TEST AND OPERATIONS MANUAL FOR THE XRIS EMULATOR	**DID for CDRL No.** **SE-19**
Reference: XRIS SOW Section 7.1.2	
Purpose: To provide information necessary to install, troubleshoot, and maintain the XRIS Emulator.	
Preparation Information:	

1. The Maintenance, Test and Operations Manual for the XRIS Emulator (XRISE) **shall** include detailed vendor and custom equipment description, including a list of parts/devices.
2. The Maintenance, Test and Operations Manual for the XRISE **shall** include configuration of the final design including a set of reduced electrical schematics and top assembly mechanical drawings supporting the design and function description.
3. The Maintenance, Test and Operations Manual for the XRISE **shall** include installation procedures.
4. The Maintenance, Test and Operations Manual for the XRISE **shall** include hardware maintenance resources.
5. The Maintenance, Test and Operations Manual for the XRISE **shall** include operations and test procedures.
6. The Maintenance, Test and Operations Manual for the XRISE **shall** include corrective maintenance procedures.
7. The Maintenance, Test and Operations Manual for the XRISE **shall** include preventive maintenance procedures.
8. The Maintenance, Test and Operations Manual for the XRISE **shall** include troubleshooting guide and error message descriptions.
9. The Maintenance, Test and Operations Manual for the XRISE **shall** include a detailed test and certification procedure for certifying XRISE performance.

SE-20 REQUEST FOR USE OF MULTI-MISSION OR PREVIOUSLY DESIGNED, FABRICATED, OR FLOWN HARDWARE

Title: REQUEST FOR USE OF INHERITED, BUILD-TO-PRINT, OR MODIFIED HERITAGE ITEMS	**DID for CDRL No.** **SE-20**
Reference: XRIS SOW Section 6.1 and 6.2	
Purpose: This process is an alternative approach to accepting heritage flight items in lieu of pursuing waivers to mission assurance requirements. The process establishes a potential risk and consequence for using the item and may avoid routine waiver processing, based on the established prior history, the change in the design, environment, or operations, and the information provided about the processes used to develop the product. The risk determined **shall** be primarily based on prior usage, changes, and the approach to changes in standard products.	
Preparation Information: 1. Inherited components **should** demonstrate at least 50 hours of failure-free testing for each year of required operation on orbit to mitigate infant mortality concerns. 2. The Request **shall** include as a minimum:	

a. List of inherited products and statement of approach to use – rebuild, modification of previous build, or use of existing product.

b. Summary results of qualification, acceptance, and/or prototype/proto-flight testing completed, or comparison of current qualification/proto-qualification requirements and what was performed/realized on the inherited design, including environments, required design margins, and life.

c. Flight history of the products and specific attributes for each flight, including environments (compare previous environment to current, including duty cycle and general concept of operations).

d. Ground and on-orbit anomaly and failure history including the determination of root causes or information that root cause was not determined. Ground anomalies may be restricted to major anomalies, where component performance requirements were violated.

e. Reliability analyses performed for the most recent version of the product.

f. Identification of significant changes in manufacturing from qualified product to current product (facility, process, sub-tier supplier, testing changes, company change of ownership, etc.), and any changes in design or materials, including electronic parts, printed circuit boards, and standards used (changing from an older revision of a standard to the latest revision need not be discussed). Highlight changes from the previous spacecraft build(s)

3. The Request should provide the following supplemental information as available to further reduce the risk to NASA:

a. Deviations of each product from original design (white wires, cut traces, splices, etc., if not objectively clear to be part of the design) and reasons for each deviation. If the design has been qualified on a previous GSFC project in the same environment and same risk posture, then the deviations may be declared relative to the previously qualified design.

b. Specifications and/or standards used to develop the products (e.g., IPC, J-STD, NASA, or GSFC requirements, including fastener integrity approach, or company standards). For products with minimal prior flight history, company standards or detailed synopses of such should be provided, if such are used to develop the product.

c. Previous as-built parts list, including lot date codes, and the differences for new inherited items. This should include evidence that Government Industry Data Exchange Program (GIDEP) alerts and advisories have been properly dispositioned if the parts have already been procured. Note that GIDEP should always be used as an aid in procuring new parts or pulling parts from inventory. Reference to prior project deliveries to GSFC is acceptable, in which case, an amendment may be delivered to indicate any changes.

d. Known obsolete parts that will be supplied from existing inventory, including the quantity required and the quantity available. If available, include the sparing plan (quantity required, quantity available, and sparing philosophy).

e. Materials list and approved Material Usage Agreements (MUAs). Materials list includes lot date codes and evidence that GIDEP alerts and advisories have been properly dispositioned, if the materials have already been procured. Such evidence should be encompassed in GIDEP closure records for each of the items that have impacts. Reference to prior project deliveries to GSFC is acceptable, in which case, an amendment may be delivered to indicate any changes.

f. List of major electrical and mechanical analyses completed and summary of results.

MISSION ASSURANCE AND SAFETY DATA ITEM DESCRIPTIONS

MA 1-1 MISSION ASSURANCE REQUIREMENTS COMPLIANCE MATRIX

Title: MISSION ASSURANCE REQUIREMENTS COMPLIANCE MATRIX	**DID for CDRL No.** **MA 1-1**
Reference: XRIS SOW Section 8 IMAR Section 1.1, GEN_02	
Purpose: The Mission Assurance Requirements Compliance Matrix documents the contractor's compliance with the contractual system safety and mission assurance requirements. This includes identification of requirements for which relief is requested via the Inherited Item Risk Assessment process.	
Preparation Information: 1. The Mission Assurance Compliance Matrix **shall** address the contractual system safety and mission assurance requirements as applied to: a. All flight hardware and software that is designed, built, or provided by the developer and its subcontractors, or furnished by the government, from project initiation through launch and mission operations b. The ground support equipment (GSE) that interfaces with flight equipment to the extent necessary to assure integrity and safety to flight items	

MA 2-1 INPUT TO ORBITAL DEBRIS ASSESSMENT REPORT and End of Mission Plan (EOMP)

Title: INPUT TO ORBITAL DEBRIS ASSESSMENT REPORT (ODAR) AND END OF MISSION PLAN (EOMP)	**DID for CDRL No.** **MA 2-1**
Reference: XRIS SOW Section 8 IMAR Section 2.3, QMS_22 NASA-STD-8719.14 Process for Limiting Orbital Debris	
Purpose: Ensure NASA requirements for post-mission orbital debris control and end of mission planning are met.	
Preparation Information: 1. The contractor **shall** provide input to the ODAR per NASA-STD-8719.14 Appendix A. 2. The contractor **shall** provide input to the EOMP per NASA-STD-8719.14 Appendix B.	

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3. After the initial delivery of this CDRL, the Instrument Contractor can provide a summary of mass by material type for future updates to this CDRL.

MA 2-2 REPORTING OF MRB ACTIONS

Title:	**DID for CDRL No.:**
MA 2-2 Reporting of MRB Actions	**MA 2-2**
Reference: XRIS MAR Section 2.2.2	
Purpose: Report MRB actions to the project office	
Applicable Documents: None	
Preparation Information: 1. The Contractor shall document the MRB action per the Contractor's MRB system form, which shall contain at a minimum: a. MRB Classification (major/minor) b. Dates (opened, closed, etc.) c. Condition Observed d. Cause e. Corrective Action Taken f. Preventive Action	

MA 3-1 SYSTEM SAFETY PLAN (SSP)

Title:	**DID for CDRL No.**
SYSTEM SAFETY PLAN (SSP)	**MA 3-1**
Reference: XRIS SOW Section 8 IMAR Section 3.3.1, SAF_10	
Purpose: The System Safety Plan (SSP) describes the tasks and activities of system safety management and engineering required to identify, evaluate, and eliminate or control hazards to the hardware, software, and system design by reducing the associated risk to an acceptable level throughout the system life cycle, including launch range safety requirements.	
Preparation Information: 1. The contractor **shall** prepare a SSP that describes the development and implementation of a system safety program that complies with the requirements of NPR 8715.7, the launch service provider, and launch range safety. 2. The contractor **shall**: a. Define the roles and responsibilities of personnel	

b. Define the required documentation, applicable requirements documents, and completion schedules for analyses, reviews, and safety packages

c. Address support for Safety Reviews, Safety Working Group Meetings and TIMs

d. Provide for early identification and control of hazards to personnel, facilities, support equipment, and the flight system during product development, including design, fabrication, test, transportation, and ground activities.

e. Address compliance with the launch range safety requirements

f. Address compliance with safety requirements imposed by NASA and OSHA, address design and operational safety requirements, and address contractually imposed mission unique obligations.

MA 3-2 SAFETY REQUIREMENTS COMPLIANCE CHECKLIST

Title: SAFETY REQUIREMENTS COMPLIANCE CHECKLIST	**DID for CDRL No.** **MA 3-2**

Reference:

XRIS SOW Section 8

IMAR Section 3.3.2, SAF_11

NASA-STD 8719.24 (with Annex), NASA Expendable Launch Vehicle Payload Safety Requirements.

Purpose:

The contractor **shall** document and implement a Safety Requirements Compliance Checklist to demonstrate that the payload complies with NASA and range safety requirements.

Preparation Information:

1. The contractor **shall** prepare a compliance checklist of all design, test, analysis, and data submittal requirements.
2. The checklist **shall** include the following:
    a. Criteria and requirement.
    b. System
    c. Indication of compliance, noncompliance, or not applicable
    d. Rationale for indications other than compliant
    e. Resolution
    f. Reference
    g. Copies of Range Safety and NASA approved non-compliances, including waivers and equivalent levels of safety certifications
3. Note: the developer **shall** submit safety waivers for non-compliant design elements

MA 3-4 INSTRUMENT SAFETY ASSESSMENT REPORT

Title: INSTRUMENT SAFETY ASSESSMENT REPORT	**DID for CDRL No.** **MA 3-4**

Reference: XRIS SOW Section 8 IMAR Section 3.3.3, 3.3.4, and 3.3.6, SAF_17, SAF_21, SAF_22, SAF_26	
Purpose: Provide a detailed description of the payload design sufficient to support hazard analysis results, hazard analysis methods, and other applicable safety related information.	
Preparation Information: 1. The developer **shall** generate an Instrument Safety Assessment Report (ISAR) to document the comprehensive evaluation of the risk being assumed prior to the testing or operation of an instrument. The spacecraft developer will use the ISAR as an input to the Safety Data Package (SDP). 2. The ISAR **shall** identify safety features of the hardware, software, and system design as well as procedural, hardware, and software related hazards that are present in the instruments. This includes specific procedural controls and precautions that **shall** be followed. 3. The ISAR **shall** include the following information: a. The safety criteria and methodology used to classify and rank hazards, including assumptions upon which the criteria or methodologies were based or derived b. The results of hazard analyses and tests used to identify hazards in the system including: c. Those hazards that still have a residual risk and the actions that have been taken to reduce the associated risk to a level contractually specified as acceptable d. Results of tests conducted to validate safety criteria, requirements, and analyses e. Hazard reports documenting the results of the hazard analyses to include a list of all significant hazards along with specific safety recommendations or precautions required to ensure safety of personnel, property, or the environment. NOTE: Identify whether or not the risks may be expected under normal or abnormal operating conditions. 4. The contractor **shall** submit with the Final ISAR a signed statement that: a) Hazards have been closed out through elimination or through risk mitigations that are contractually specified as acceptable b) Identifies hazards that have not been eliminated or controlled at the time of submission c) The instrument is ready to test, operate, or proceed to the next phase.	

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MA 4-2 FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS, AND CRITICALITY ITEMS LIST

Title: FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS (FMECA) AND CRITICAL ITEMS LIST (CIL)	**DID for CDRL No. MA 4-2**
Reference: XRIS SOW Section 8 IMAR Section 4.2.1, REL_11 NPR 8705.4 Risk Classification for NASA Payloads GPR 7120.4D Risk Management	

Purpose:

The FMECA addresses flight hardware and software and ground support equipment that interfaces with flight systems that are being designed, built, or provided from project initiation through launch and mission operations.

Preparation Information:

1. The contractor **shall** perform and maintain Failure Modes and Effects Criticality Analyses (FMECA) that address flight hardware and software and ground support equipment that interfaces with flight systems that are being designed, built, or provided from project initiation through launch and mission operations.
2. The contractor **shall** include likelihood, cause, detection and mitigation, and the effects of each failure mode at the local, subsystem, and system or mission levels, to the interface level for existing systems and to the box or functional level for modified or new systems.
3. The FMECA Report **shall** explain the approach of the analysis, methodologies, assumptions, results, conclusions, and recommendations.
4. The FMECA Report **shall** include the following:
    a. Objectives
    b. Level of the analysis
    c. Ground rules
    d. Functional description
    e. Functional block diagrams
    f. Reliability block diagrams to illustrate any redundancies
    g. Equipment analyzed
    h. Data sources used
    i. Problems identified
    j. Corrective actions

k. Work sheets identifying, item functions failure modes, causes, severity category, likelihood and consequence category, and effects at the item, next higher level, and mission level, detection methods, and mitigating provisions.

l. Critical Items List (CIL) for severity categories 1SC, 1, 1R, 1S, and 2, including item identification, cross-reference to FMECA line items, and retention rationale. Appropriate retention rationale may include design features, historical performance, acceptance testing, manufacturing product assurance, corrective action recommendation/elimination of undesirable failure modes, proper design controls, and failure detection methods. The rationale also will contain data that describes operational constraints caused by occurrence of the failure and any measures that can be taken to restore the function on orbit where known.

m. Single Point Failure (SPF) list for failure modes resulting in category 1 and 1SC severities (See IMAR Table 4.1)

MA 4-5 LIMITED LIFE ITEMS LIST

Title: LIMITED LIFE ITEMS LIST	**DID for CDRL No.** MA 4-5

Reference:
XRIS SOW Section 8
IMAR Section 4.3, REL_22

Purpose:

Defines and tracks the selection, application and wear of limited-life items, and the predicted impact on mission operations.

Preparation Information:

1. The developer **shall** prepare and maintain a list of limited life items and their predicted impact on mission operations. The list **shall** include expected life, required life, duty cycle, and rationale for selecting and using the items for which the expected life is less than twice the required life. See sample content and format below:

Example Limited Life Items List

Item	Life-Limiting Mechanism	Expected Life	Required Life	Compliance & Life Ratio	Data Sources & Notes
Mirror Coating	Degradation of optical properties	10 years	5 years	Complies 2.0	Expected Life: Vendor datasheet Required Life: Requirement Doc 98765

MA 4-6 PARTS STRESS ANALYSIS

Title: PARTS STRESS ANALYSIS	**DID for CDRL No.** MA 4-6

Reference:
XRIS SOW Section 7.1 and 8
IMAR Section 4.4, REL_26
GSFC EEE-INST-002 Instruction for EEE Parts Selection, Screening, Qualification, and Derating

Purpose:

Provides EEE parts stress analyses for verifying circuit design conformance to derating requirements; demonstrates that environmental operational stresses on parts comply with project derating requirements

Preparation Information:

1. The contractor **shall** perform parts stress and derating analyses for electrical, electronic, and electromechanical (EEE) parts in accordance with GSFC EEE-INST-002 Instruction for EEE Parts Selection, Screening, Qualification, and Derating or the developer's own established standard, unless specifically relieved of this requirement by the GSFC Inherited Items Risk Assessment process (See IMAR Section 1.9).
2. The Parts Stress Analysis Report **shall** contain analysis worksheets that include:
    a. Identification of derating standard used
    b. Part identification (traceable to circuit diagrams)
    c. Rated stress
    d. Applied stress (consider all significant operating parameter stresses at the extremes of anticipated environments)
    e. Ratio of applied-to-rated stress

MA 4-7 WORST-CASE ANALYSES

Title:	**DID for CDRL No.**
WORST-CASE ANALYSES	**MA 4-7**

Reference:
XRIS SOW Section 7.1 and 8
IMAR Section 4.5, REL_30

Purpose:

Demonstrate design margins in electronic and electrical circuits, optics, and electromechanical and mechanical items

Preparation Information:

1. The developer **shall** perform worst-case analyses (WCA) for circuit designs that are new or significantly modified and identified as critical through analysis of the design (See Section 4.2)
2. The Worst-Case Analysis Report **shall** include the following:
    a. Identification of worst-case conditions considered for each component.
    b. Consideration of critical parameters at maximum and minimum limits.

c. The effect of environmental stresses on the operational parameters being evaluated.

MA 5-1 SOFTWARE ASSURANCE PLAN

Title: SOFTWARE ASSURANCE PLAN (SAP)	**DID for CDRL No.** **MA 5-1**
Reference: XRIS SOW Section 8 IMAR Section 5.1, SWA_04	

Purpose:

Documents the contractor's Software Assurance roles and responsibilities and surveillance activities.

Preparation Information:

1. The Software Assurance Plans **shall** be written per NASA-STD-8739.8, NASA Software Assurance Standard.
2. The Software Assurance Plan (SAP) **shall** address the following:
    a. Purpose
    b. Scope
    c. Reference documents and definitions
    d. Assurance Organization and Management
    e. Assurance Activities by discipline
        i. Software Quality (process and product)
        ii. Software Safety
        iii. Software Reliability
        iv. Software Verification and Validation
        v. Independent Verification and Validation (if applicable)
    f. Assurance Activities for Complex Programmable Logic Devices
    g. Assurance tools, techniques, and methodologies
    h. Software Assurance Program Metrics
    i. Problem Reporting and Corrective Action
    j. Assurance records, collection, maintenance, and retention
    k. Training
    l. Risk Management
    m. Requirements Compliance Matrix (NASA-STD-8739.8 Appendix C)
    n. SAP Change procedure and history

MA 7-1 EEE PARTS CONTROL PLAN

Title:	**DID for CDRL No.**
EEE PARTS CONTROL PLAN	**MA 7-1**

Reference:
XRIS SOW Section 7.1 and 8
IMAR Section 7.1, EEE_02

Purpose:

Description of contractor's approach and methodology for implementing Parts Control Program, including flow-down of applicable requirements to subcontractors.

Preparation Information:

1. The Contractor **shall** document and implement a Parts Control Plan (PCP) per Level 3 requirements of GSFC EEE-INST-002 Instruction for EEE Parts Selection, Screening, Qualification, and De-rating.
2. The Parts Control Plan **shall** address the following for EEE parts:
    a. Parts control program organization and management
    b. EEE Parts control per GSFC EEE-INST-002 Instructions for EEE Parts Selection, Screening, Qualification, and Derating
    c. Shelf life control plan
    d. Supplier and manufacturer surveillance
    e. Procedures regarding application specific integrated circuits, gate arrays, system-on-chip, and custom integrated circuits
    f. Incoming inspection and test
    g. Sparing policies
    h. Destructive physical analysis per S-311-M-70 Specification for Destructive Physical Analysis
    i. Defective parts controls program.
    j. Handling, preservation, and packing
    k. Contamination control
    l. Alternate quality conformance inspection and small lot sampling
    m. Traceability and lot control
    n. Failure analysis
    o. Counterfeit parts control plan per AS5553 Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition
    p. Radiation hardness assurance program, which **shall** address: total ionizing dose; displacement damage (total non-ionizing dose); destructive and non-destructive single-event effects; single-event effect rates; proton hardness/tolerance

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q. Parts Control Board Operations
   i. Organization and membership
   ii. Meeting schedule and notices
   iii. Distribution of meeting agenda, notes, and minutes
   iv. Review and approval responsibilities and processes
   v. Documentation and records

MA 7-2 MASTER EEE PARTS LIST

Title: MASTER EEE PARTS LIST	**DID for CDRL No.** **MA 7-2**
Reference: XRIS SOW Section 7.1 and 8 IMAR Section 7.4, EEE_16	

Purpose:

Listing of all parts intended for use in space flight hardware, including EEE parts.

Preparation Information:

1. The contractor **shall** maintain the Master EEE Parts List Information in a searchable electronic format. The GSFC Project Parts Engineer **shall** have access to the list.
2. The Contractor **shall** generate and maintain a Master EEE Parts List with the minimum information listed below for the various stages throughout the project's lifecycle:
   a. For EEE parts that are identified for potential flight use, the list **shall** include the following information:
      i. Flight component identity to the circuit board level
      ii. Complete part number (i.e., Defense Supply Center Columbus part number, Specification Control Drawing part number, with all suffixes)
      iii. Manufacturer's Generic Part number
      iv. Manufacturer (not distributor)
      v. Part Description (please include meaningful detail)
      vi. Federal Supply Class
      vii. Procurement Specification
      viii. Comments and clarifications, as appropriate
      ix. Estimated quantity required (for procurement forecasting)
   b. For EEE parts that are approved for flight use the list **shall** include the following information:

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i. Procurement Part Number
ii. Flight Part Number, if different from the procurement part number
iii. Package Style/Designation
iv. PCB Status
v. PCB Approval Date
vi. PCB Required Testing/Evaluations

c. For EEE parts that are approved for as-designed use the list **shall** include the following information:
   i. Assembly Name/Number
   ii. Next Level of Assembly
   iii. Need Quantity
   iv. Reference Designator(s)
   v. Item number, if applicable

d. For EEE parts in flight hardware the list **shall** include the following information:
   i. Assembly serial number
   ii. Item revision
   iii. Next Level of Assembly serial number
   iv. Lot/Date/Batch/Heat/Manufacturing Code, as applicable
   v. Manufacturer's CAGE Code (specific plant location when relevant)
   vi. Distributor/supplier, if applicable
   vii. Part number
   viii. Part serial number, (if applicable)

MA 7-3 RADIATION EFFECTS MITIGATION

Title: RADIATION EFFECTS MITIGATION	**DID for CDRL No.** **MA 7-3**
Reference: XRIS SOW Section 6.3.3 and 8 IMAR Section 7.5, EEE_19	
Purpose: Provide a radiation plan.	
Preparation Information: 1. The contractor **shall** provide a plan for approval, for how radiation will be addressed	

2. Provide the overall plan for mitigating the effects of radiation, including one or more of the following approaches, as applicable:
    a. Avoidance: dormancy of sensitive electronic elements in high stress regions such as SAA or Van Allen Belts
    b. RHBD: Proven rad-hard by design approach, applied to circuits and/or parts
    c. Traditional parts-centric: Use of RHA parts with radiation-tolerant design to accommodate high stress region operation
    d. Modern parts-centric: Use of familiar sensitive parts[1] along with proven circuit designs in comparable environment
    e. Radiation-tolerant design: Use radiation-tolerant circuit design techniques including features such as MOSFET protection and overcurrent detection with reset capability, resettable processors, EDAC, derating beyond EEE-INST-002 recommendations, etc.
    f. Risk-based approach combining past on-orbit experiences in similar stressing environments.
    g. System fault-tolerance (including redundancy): This may include new, unproven approaches, with backup proven systems.
3. Note: [1] Sensitive parts include memory, processors, CMOS devices, MOSFETs, etc.

MA 7-4 RADIATION SHIELDING AND DOSE ANALYSIS REPORT

Title: RADIATION SHIELDING AND DOSE ANALYSIS REPORT	**DID for CDRL No.** **MA 7-4**

Reference:
XRIS SOW Section 8
IMAR Section 7.5, EEE_20

Purpose:

Provide a radiation and shielding analysis to ensure that all instrument parts will be compatible with the expected space radiation environment for the required mission life.

To determine whether the instrument radiation shielding is adequate to protect the instrument electrical and optical parts from excessive degradation due to radiation over the instrument life.

Preparation Information:

1. The Radiation and Shielding and Dose Analysis Report **shall** include a description of the model used to generate radiation dose predictions, including:
    a) Description of the shielding analysis software.
    b) Description of the instrument shield geometry and composition, as modeled.
    c) List of assumptions and approximations.
    d) Estimate of model prediction accuracy.

2. The Radiation and Shielding and Dose Analysis Report **shall** include a tabular listing of predicted ionizing dose at end-of-spacecraft life for each instrument unit and optical parts of the instrument.
3. The Radiation and Shielding and Dose Analysis Report **shall** define the proposed parts that will require additional shielding to be compatible with the required instrument mission life.

MA 7-5 SINGLE EVENT FAULT MANAGEMENT PLAN

Title:	**DID for CDRL No.**
SINGLE EVENT FAULT MANAGEMENT PLAN	**MA 7-5**

Reference:
XRIS SOW Section 7.1 and 8

Purpose:

Provide a plan to address error-vulnerable and error-critical faults and failures impacting key performance parameter (KPP) data products and critical functionality in the instrument. To determine whether the instrument electronic hardware and software systems design and operation are fault-tolerant enough to meet availability performance requirements.

Preparation Information:

1. The Single Event Effect Fault Management Plan **shall** include a Single Event Effect Criticality Analysis (SEECA) including a tabular listing of the EEEE piece-parts, the SEEs to which the piece-parts are sensitive, a classification of Error-Functional, Error-Vulnerable, or Error-Critical for each SEE, and a justification for each classification – such as mitigation.
2. The Single Event Effect Fault Management Plan **shall** include a plan for managing SEE faults and failures in hardware and software systems, including:
    a. A list of Error-Vulnerable or Error-Critical single event effect (SEE) hazards that could lead to a fault or failure and the rate for the underlying SEE.
    b. Means to detect each Error-Vulnerable or Error-Critical SEE fault or failure, if any, and definition of nominal performance of the critical function or KPP data product.
    c. Description of the impact of each Error-Vulnerable or Error-Critical SEE fault or failure including the component in which the SEE originates, the components to which the SEE propagates and the critical functionality or the KPP data product impacted.
    d. List of operational steps required to return to a known state if the system enters an unknown state.
    e. List of operational steps required to return to an operational state in which critical functionality or KPP data product availability is restored.
    f. If recovery is autonomous, an estimate of the maximum amount of time to autonomous recovery.
    g. Definition of anomalous fault or failure conditions.

h. Roll-up of Error-Vulnerable and Error-Critical rates and expected availability performance in background and worst-case environmental conditions.

MA 8-2 MATERIALS USAGE AGREEMENT

Title: MATERIALS USAGE AGREEMENT EVALUATION FORM	**DID for CDRL No. MA 8-2**
Reference: XRIS SOW Section 8 IMAR Section 8.2, MAP_03	
Purpose: Establishes the process for submitting a Materials Usage Agreement (MUA).	
Preparation Information: 1. The MUA documentation approach, per NASA-STD-6016C, Section 4.1.6, **shall** be defined in the Materials and Processes Selection, Control, and Implementation Plan (see MA 8-1). 2. The MUA package **shall** include the technical information required to justify the application. MUAs for stress corrosion **shall** include a Stress Corrosion Cracking Evaluation Form per MSFC-STD-3029A (see NASA-STD-6016C) and a stress analysis.	

MA 8-3 MATERIALS IDENTIFICATION AND USAGE LIST

Title: MATERIALS IDENTIFICATION AND USAGE LIST (MIUL)	**DID for CDRL No. MA 8-3**
Reference: XRIS SOW Section 8 IMAR Section 8.3, MAP_04, Section 9.2, CON_03	
Purpose: Establishes the Materials Identification and Usage List (MIUL).	
Preparation Information: 1. The MIUL documentation approach, per NASA-STD-6016C, Section 4.1.5, **shall** be defined in the Materials and Processes Selection, Control, and Implementation Plan. 2. Additions and Prescribed Changes to NASA-STD-6016C MIUL requirements: a. The MIUL **shall** identify all unique materials and processes used in the construction of the deliverable hardware. b. With approval from the GSFC MPE, for NASA-STD-6016C, Section 4.1.5, the developer **may** use GFSC forms or the developer's equivalent forms in lieu of the MAPTIS format. c. The MIUL **shall** include Thermal Vacuum Stability data, when appropriate, per NASA-STD-6016C, Section 4.2.3.6.	

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d. The MIUL **shall** include the vacuum bake-out schedule for materials that fail outgassing requirements or provide a separate MUA (see DID 8-2).

e. The developer **may** use the GSFC outgassing database (URL http://outgassing.nasa.gov) in addition to MAPTIS (URL http://maptis.nasa.gov).

f. The MIUL **shall** document, when appropriate, compliance to MSFC-STD-3029A

g. The MIUL **shall** clearly identify all materials that do not meet the requirements of NASA-STD-6016C and require an MUA per Section 8.2 and DID-8-2 of this MAR.

h. The MIUL **shall** include soldering flux and solvents used for cleaning flight electronic assemblies, other than isopropyl alcohol or deionized water.

MA 11-1 GIDEP ALERTS/NASA ADVISORY DISPOSITIONS

Title: GIDEP ALERT/NASA ADVISORY DISPOSITIONS	**DID for CDRL No.** **MA 11-1**
Reference: XRIS SOW Section 8 IMAR Section 11.1, GID_01, Section 11.4, GID_07	
Purpose: To document the Contractor's disposition of GIDEP Alerts; GIDEP Safe-Alerts; GIDEP Problem Advisories; GIDEP Agency Action Notices and NASA Advisories, hereinafter referred to collectively as "Alerts" with respect to parts and materials, equipment, and software used in NASA products.	
Preparation Information: 1. The contractor **shall** submit a completed GSFC Form 4-37, "Problem Impact Statement Parts, Materials, and Software", or equivalent Contractor form, spreadsheet or database containing the same information, for each Alert. 2. Note: Use-as-is dispositions for parts, materials, equipment, or software directly impacted by an Alert require thorough documentation, including documented concurrence from discipline areas contributing to the response and supporting objective evidence, such as thermal, or worst-case circuit stress, or environmental stress analyses.	

MA 11-2 INITIATING GIDEP ALERTS

Title: INITIATING GIDEP ALERTS	**DID for CDRL No.** **MA 11-2**
Reference: XRIS SOW Section 8 IMAR Section 11.3, GID_06	
Purpose:	

To document the contractor's identification of significant parts, material, and safety problems and the contractor's actions as required by the GIDEP manual regarding the decision to prepare an Alert, including the type of Alert that is applicable.
Preparation Information: 1. The contractor **shall** submit relevant information (e.g., failure analyses, test reports, root cause and corrective action evaluations).

MA 12-1 END ITEM ACCEPTANCE DATA PACKAGE

Title:	**DID for CDRL No.**
END ITEM ACCEPTANCE DATA PACKAGE (EIDP)	**MA 12-1**
Reference: XRIS SOW Section 8 IMAR Section 12, EIA_1	
Purpose: The End Item Acceptance Data Package documents the design, fabrication, assembly, test, and integration of the hardware and software being delivered and is included with the end item delivery.	
Preparation Information: 1. The contractor prepares the End Item Acceptance Data Package as part of design development and implementation such that it is completed prior to delivery. 2. The following items **shall** be included (as specified by requirement): a. The deliverable item name, serial number, part number, and classification status (e.g., flight, non-flight, ground support, etc.) b. Appropriate approval signatures (e.g., Contractor's quality representative, product design lead, government Representative, etc.) c. List of shortages or open items at the time of acceptance with supporting rationale d. As-built serialization e. As-built configuration f. In-process Work Orders (available for review at Contractor's--not a deliverable) g. Final assembly and test Work Order h. Major MRB actions i. Major anomaly reports j. Acceptance testing procedures and report(s), including environmental testing k. Trend data l. Anomaly/problem failure reports with root cause and corrective action dispositions	

m. Master EEE parts list
n. As-built materials
o. Chronological history, including:
    i. Total operating hours and failure-free hours of operation
    ii. Total number of mechanical cycles and remaining cycle life
p. Limited life items, including data regarding the life used and remaining
q. As-built final assembly drawings
r. PCB coupon results
s. Photographic documentation of hardware (pre- and post-conformal coating for printed wiring assemblies, box or unit, subsystem, system, harness, structure, etc.)
t. Delivery of XRIS flight harness required to integrate onto the Spacecraft providers procured deployable boom two years before launch
u. Waivers
v. Certificate of Compliance, which is signed by management

OPERATIONS DATA ITEM DESCRIPTIONS

OPS-1 FLIGHT TELEMETRY AND COMMAND DATABASE

Title: FLIGHT TELEMETRY AND COMMAND DATABASE	**DID for CDRL No.** **OPS-1**
Reference: XRIS SOW Section 6.5.3	
Purpose: Allow integration of the instrument telemetry and command database with the satellite database for spacecraft integration & test.	
Preparation Information: 1. The Telemetry and Command Database **shall** include all parameters necessary to operate the instrument during ground test and all phases of on orbit operations, including values for yellow and red limits on critical telemetry 2. The Telemetry and Command Database **shall** be in a format and schema negotiated with the spacecraft contractor and approved by the Government	

OPS-2 FLIGHT TELEMETRY AND COMMAND HANDBOOK

Title: FLIGHT TELEMETRY AND COMMAND HANDBOOK	**DID for CDRL No.** **OPS-2**
Reference: XRIS SOW Section 6.5.3	

Check the SOLAR CM tool Server at https://ipdtdms.gsfc.nasa.gov/ to verify that this is the correct version prior to use.

Purpose:
Provide usable list of telemetry and commands, and packet content definitions along with description and parameters.
Preparation Information:
1. The Flight Telemetry and Command Handbook **shall** provide an itemized identification of all telemetry and commands to and from the instrument. 2. The Flight Telemetry and Command Handbook **shall** contain a Data Format Control section defining the contents of all telemetry packets, including sensor data, metadata, calibration data, ancillary data, engineering data, health and safety data, and commands. 3. All command and telemetry Source Packet content definitions **shall** list all APIDs, secondary header flags, packet length including headers, and data zone contents. 4. The command description **shall** contain a complete list of instrument commands for all instrument modes of operation and sequence testing with a description of their effects. 5. The Command List **shall** include the command number, title of command, description, telemetry verifier (if any), and subsystem commanded. 6. The Command List **shall** also identify any critical commands which may damage the instrument in certain situations. 7. The Telemetry Listing **shall** contain the telemetry position in the source packet, telemetry point size in bytes, description of the telemetry point, indication whether analog or digital, range of parameter, accuracy of telemetry point, and default sample rate. 8. The Telemetry Listing **shall** contain a complete list of housekeeping telemetry data coming from the instrument, including telemetry calibrations, and levels which require alerts or immediate actions, for each instrument. 9. All the content related to the Telemetry listing **shall** be in a separate appendix to the Flight Telemetry and Command Handbook, so that this content can be shared separately with our foreign ground station partners. Exported-controlled items within the Telemetry Listing Appendix **shall** be clearly identified.

OPS-3 OPERATIONS HANDBOOK

Title: OPERATIONS HANDBOOK	**DID for CDRL No.** **OPS-3**
Reference: XRIS SOW Section 6.5.3	
Purpose: To provide information necessary for the operation of the XRIS, and to provide the information necessary to understand instrument functions and normal operation.	
Preparation Information:	

Check the SOLAR CM tool Server at https://ipdtdms.gsfc.nasa.gov/ to verify that this is the correct version prior to use.

1. The Operations Handbook **shall** contain a description of the instrument and its subsystems, including functional operation, block diagrams, schematics and timing diagrams.
2. The Operations Handbook, in conjunction with the detailed drawings, **shall** provide all the information needed for operating the XRIS, interpreting all housekeeping data, and taking corrective action as necessary.
3. As a minimum, the Operations Handbook **shall** include the following:
    a) Part I - Instrument Description
        i. Include an exploded view drawing of the instrument, block diagrams, schematics, timing diagrams, etc.
        ii. Include the location of all heaters, thermistors, and sensors used to control thermostatic heaters and the descriptions of sensors used for telemetry data. Provide temperature set points for the active control heaters and set points for the survival heaters.
        iii. A set of logic and timing flow diagrams describing the operations of the software and firmware, including the principles of operation of command timing, the modules of the software and firmware design, and the interfaces of the software and firmware with the spacecraft command and telemetry subsystem.
    b) Part II - Transfer Orbit Operations
        i. Launch Configuration
        ii. Transfer Orbit Heater Configuration
    c) Part III – On-Orbit Operations
        i. Operational Constraints
        ii. Initial On-orbit Turn-on and Checkout - include details such as the contents of operational control tables, start-up command sequences, etc.
        iv. Heater usage during on-orbit mode
        v. Initial on-orbit outgassing requirements. (i.e., minimum time post-launch before instrument or instrument functions can be started.
        vi. Instrument diagnostic procedures
        vii. Periodic Operations e.g., on-board memory tests and corrective upload procedures
        iii. Storage Mode Operation
        viii. Standby Mode Configuration and Operation
        ix. Eclipse procedures
        x. Recovery procedures from safe mode

Check the SOLAR CM tool Server at https://ipdtdms.gsfc.nasa.gov/ to verify that this is the correct version prior to use.

xi. Corrective actions required for error conditions

xii. Software operating, diagnostics, and patching procedures

d) Part IV - Transfer Orbit and On-orbit Contingency Plans

i. Plans for recovery from instrument anomalies.

e) Part V - Telemetry and Command

i. Itemized identification of all telemetry signals from and commands to the instruments.

ii. A description of the data format, including packet size, headers, addresses and data location.

iii. Red and Yellow limit tables for all housekeeping telemetry for ground testing and all on-orbit operational modes

iv. A Complete list of instrument commands for all instrument modes of operation and sequence testing with a description of their effects. The Command List should include the command number, title of command, description, telemetry verifier (if any), and subsystem commanded It should also identify any critical commands which may damage the instrument in certain situations.

4. The operations handbook **will** provide Recommended (standard) and Contingency Operating Procedures (ROPs and COPs) for the instrument that will provide the following details:

a) Operational Constraints / Flight Rules for Instrument

b) Operations description: Include "Day in the life" *for each mission phase* (e.g., activation, cruise, orbit raising, normal ops, maneuver cadence/station-keeping, calibrations, other special activities/maintenance, etc.)

c) Configurations for each Instrument state and mode of operation

d) Recommended Operating Procedures (ROPs):

i. For each Instrument: Activation, Nominal Ops, Special Activity, De-orbit, (calibration, test/checkout, etc.), and Contingency/Recovery / Fault Management

ii. For each procedure, provide:

1. Short description of the procedure, including any state or mode changes induced by the procedure

2. Whether the command is designated a SAFETY or HAZARDOUS command

3. Planned use (phase/mode/configuration as applicable) [Include SC configuration/mode if applicable]

4. Applicable Constraints/Flight Rules

5. Initial Conditions or other dependencies
6. Command sequence, timing, and TLM validation

e) For each command sequence provide:
   i. Step by step operation (including references to other imbedded procedures if applicable)
   ii. Timing (if applicable)
   iii. State change (if applicable)
   iv. CMD mnemonics including parameters/options
   v. TLM response for each command

f) When applicable, provide drawings to illustrate state/mode changes (e.g., changes to comm command/housekeeping/mission data path selections)

5. The ROPs and COPS **will** use the same template provided in Appendix A.

OPS-4 GROUND PROCESSING ALGORITHMS TEST AND VALIDATION PLAN

Title: GROUND PROCESSING ALGORITHMS TEST AND VALIDATION PLAN	**DID for CDRL No.** **OPS-4**
Reference: XRIS SOW Section 6.1.3	
Purpose: Provide test plan to be used by contractor to verify algorithms.	
Preparation Information: 1. The Ground Processing Algorithms Test and Validation Plan **shall** document the Contractor's plan for acceptance tests of the ground processing algorithms, including acceptance test input and expected results. These tests **shall** test all functions of the ground processing algorithms. 2. The Ground Processing Algorithms Test and Validation Plan **shall** provide an outline of Acceptance Test Procedures. 3. The Ground Processing Algorithms Test and Validation Plan **shall** describe how the Ground Processing Development System will be used to provide a real-time demonstration of the generation of XRIS data products.	

OPS-5 GROUND PROCESSING ALGORITHM DOCUMENT

Title: GROUND PROCESSING ALGORITHM DOCUMENT	**DID for CDRL No.** **OPS-5**
Reference: XRIS SOW Section 6.1.3	

Purpose:

Completely describes the Ground Processing Algorithms (GPAs) that process raw sensor data into processed data products that meet the requirements specified in the Instrument Requirements Specification.

Preparation Information:

1. The Ground Processing Algorithm Document **shall** be complete and detailedsuch that a third party can generate executable code that correctly implements the algorithms. Visual flowcharts and descriptions in for example Unified Modeling Language are helpful for understanding and implementing the algorithms.
2. The Ground Processing Algorithm Document **shall** include a written component that mirrors the intended structure of the delivered computer source code, including use of pseudocode where applicable.
3. The Ground Processing Algorithm Document **shall** include narrative descriptions of each routine and **shall** include equations, scientific units, figures, and other supporting information where appropriate, in order to clearly convey the intent, flow, and context of the processing.
4. The Ground Processing Algorithm Document **shall** include specifications, data interface definitions, external dependencies, flow charts, input and output variable lists, software and/or pseudocode for each algorithm.
5. The Ground Processing Algorithm Document **shall** include structural information such as hierarchy charts and data flow diagrams.
6. The Ground Processing Algorithm Document **shall** document any algorithm that performs spatial, temporal, or spectral resampling required to meet performance requirements.
7. The Ground Processing Algorithm Document **shall** include error budgets estimating the uncertainty (including all systematic error and random errors) associated with each observed data point. These error budgets include but are not identical to the error budgets documented in the Calibration Program Plan (I&T-5) since some errors are introduced by sources external to the instrument, for example, spacecraft attitude error.
8. The Ground Processing Algorithm Document **shall** include cross-references to the Flight Telemetry and Command Handbook (OPS-2) for all instrument data used by the algorithms.
9. The Ground Processing Algorithm Document **shall** include an itemization of all external (to the instrument) data used by the algorithm, along with any assumptions about source, cadence, accuracy, precision, and data format. Assumptions **shall** be substantiated as reasonable based on past performance or identified as a driver of the performance of some other part of the flight or ground segment.
10. The Ground Processing Algorithm Document **shall** provide a complete description of all required datasets internal to the algorithm (e.g., initial gain and bias terms, detector maps, look-up tables, other calibration parameters) in Extensible Markup Language (XML).

11. The Ground Processing Algorithm Document shall define the time-dependent functions for calibration factors that may change on-orbit
12. The Ground Processing Algorithm Document **shall** provide a detailed description of the content and format of the algorithm output data files, with sufficient detail to enable verification and validation.
13. The Ground Processing Algorithm Document **shall** describe the Ground Processing Development System (GPDS) used to test the algorithm, its hardware and configuration, the test input and output data used, and the measured performance of the algorithms on the GPDS (e.g., CPU and memory utilization, latency).
14. The Ground Processing Algorithm Document **shall** describe the ground processing necessary for analysis of on-orbit calibration campaigns and how to appropriately update the processing pipelines based on the results.
15. The Ground Processing Algorithm Document **shall** not be uniformly stamped proprietary, ITAR or otherwise restricted. Any components therein that are restricted must be specifically labeled such that the label does not apply to the entire document
16. The GPA and descriptive document **shall** define provide a L1a products before L1b that is fully calibrated in units of detector counts instead of physical units, and L1b products in physical (irradiance) units. (product definitions are described in Appendix C)
17. The GPA **shall** include detailed descriptions of data quality flags and auxilliary flags.
18. The GPA **shall** include descriptions of time-dependent functions of parameters that may trend with time (e.g., dark counts).

OPS-6 GROUND SOFTWARE ACCEPTANCE PLAN INPUT

Title: GROUND SOFTWARE ACCEPTANCE PLAN INPUT	**DID for CDRL No.** **OPS-6**
Reference: XRIS SOW Section 6.1.3	
Purpose: Provide test plan to be used by contractor to verify algorithms.	
Preparation Information: 1. The Contractor's Ground Processing Algorithms Test and Validation Plan may be used as the Ground Software Acceptance Plan Input if tests are applicable to the Operational Ground System. 2. The Ground Software Acceptance Plan Input **shall** include recommended acceptance tests for the ground processing algorithms, along with acceptance test input and expected results data, including acceptance criteria.	

3. The acceptance test input and output data used to test all functions of the ground processing algorithms **shall** be delivered in a machine-readable, self-documenting file format as part of the Ground Software Acceptance Plan Input.

OPS-7 GROUND PROCESSING ALGORITHMS CODE

Title: GROUND PROCESSING ALGORITHMS CODE	**DID for CDRL No.** **OPS-4**

Reference:
XRIS SOW Section 6.1.3

Purpose:

Provide the Ground Processing Algorithms (GPA) source code. This CDRL is separate to capture the delivery of the GPA source code but refers to CDRL OPS-6 and CDRL SW-2 for instructions.

Preparation Information:

1. The Contractor **shall** provide a copy of the GPA source code, both "as-run," and as-updated, for validation.
2. The GPA source code **shall** be configuration controlled in accordance with the Contractor's software management plan.
3. The Contractor **shall** provide updated source code when new versions are released. It is strongly recommended that the source code should be in a language on NOAA's operational baseline (e.g., Python is strongly preferred)
4. The GPA source code **shall** written as described in the Ground Processing Algorithm Document (CDRL OPS-6).
5. The GPA source code **shall** be provided with build instructions, revision history, any special operating procedures, and anomaly reports.
6. Software Delivery Media
    i. The software delivery will be delivered on media as agreed to by the contractor and the Government.
    ii. The software product deliverable for each baseline Build should include, but not be limited to, the following:
        1. Source Code
        2. Object Code
        3. Data
        4. Executable Image
7.

OPS-9 MASS PROPERTIES AND POWER REPORT

Title: MASS PROPERTIES AND POWER REPORT	**DID for CDRL No.** **OPS-9**

Reference: XRIS SOW Section 6.3.2.2
Purpose: Track mass and power margin during development. Provide spacecraft contractor up to date mass properties and power usage.
Preparation Information: 1. The Mass Properties and Power report **shall** provide latest information on instrument mass, center of mass location, and moments of inertia. 2. The Mass Properties and Power report **shall** provide power profiles indicating the elements that are individually controlled by command or automatic program, duty cycles, peaks such as turn- on transients, and average and peak power budget requirements during launch operational modes. 3. The Mass Properties and Power Report **shall** differentiate between calculated, estimated, or actual values for mass and power. 4. The Mass Properties and Power Report **shall** report values to at least the major assembly level of the subsystems, e.g., mechanism, power supplies, heaters, cabling, etc. 5. The Mass Properties and Power Report **shall** identify the accuracy of the values provided.

OPS-10 XRIS PACKETIZED DATA

Title:	**DID for CDRL No.**
XRIS PACKETIZED DATA	**OPS-10**
Reference: XRIS SOW Section 7	
Purpose: Provide input for observatory and NOAA ground system testing and debugging ingest and analysis capabilities.	
Preparation Information: 1. The XRIS packetized data **shall** include all XRIS data from government specified tests. 2. The XRIS packetized data **shall** be delivered on digital media.	

OPS-11 INSTRUMENT OPERATIONS CONFIGURABLE ITEMS

Title: INSTRUMENT OPERATIONS CONFIGURABLE ITEMS	**DID for CDRL No. OPS-11**
Reference: XRIS SOW Section 6.5.3	

Purpose:

To provide instrument configurable items stored and used in the instrument (e.g., tables, files, parameters, software patches) necessary to operate the instrument during pre-launch testing, Mission Rehearsal, and on-orbit phases.

Preparation Information:

1. Instrument Operations Configurable Items **shall** contain files in format compatible with SOLAR ground system for command input to be received by the instrument.
2. Instrument Operations Configurable Items preliminary delivery **shall** contain all the data stored in the instrument (i.e., non-executable portion of flight software) at the time of launch.
3. Instrument Operations Configurable Items delivery **shall** contain a “Read Me” file identifying the file name, version number, upload instructions, any command parameters needed for upload (e.g., CRC, checksum, number of segments, etc.), and telemetry indication of successful upload operation.
4. Instrument Operations Configurable Items **shall**, if applicable, contain human readable listings of the values that comprise the binary files.

SOFTWARE DATA ITEM DESCRIPTIONS

SW-1 SOFTWARE MANAGEMENT PLAN

Title: SOFTWARE MANAGEMENT PLAN	**DID for CDRL No. SW-1**
Reference: XRIS SOW Section 6.1.2	

Purpose:

To define the contractor's systematic approach to, and processes used in, the management, development, testing (verification, validation, and qualification), documentation, configuration management, and quality assurance of the XRIS software.

Preparation Information:

1. The Software Management Plan **shall** apply to all software developed by the contractor for the SOLAR Project, including any software used to conduct system testing and GSE software used to validate ground processing algorithms.
2. The Software Management Plan **shall** include:
    a. A description of practices, tasks, and activities performed as a basis for contractor effort and schedule determination.
    b. A table indicating the criticality classification and justification for each CSCI, in accordance with the definitions for Class A, B, C, D, E, F, G and H software in Appendix D of NPR 7150.2.
    c. A table mapping applicable software processes and/or SMP sections to show compliance with NPR 7150.2. Include a justification for any areas where a gap exists. Note: In the event of a conflict, XRIS CDRL DIDs supersede NPR 7150.2 document content requirements in Section 5.1.
    d. The plans for acquiring software and/or firmware, which will be an integral part of instrument subsystems. Include a description of all subcontractor management and monitoring.
    e. The definition of the software decomposition criteria.
    f. A discussion of the peer review/inspection process of software work products. Include a discussion of how both the informal and formal software reviews fit into the software development lifecycle, the instrument design reviews, and instrument development lifecycle. Indicate NASA, DCMA, and contractor SQA participation in reviews where applicable.
    g. An identification of any deviations from the standard life cycle necessary to accommodate the integration of commercially acquired software. Specifically include justification for less than thorough testing of COTS software.
    h. A table containing a mapping of applicable SW Lifecycle Process activities/reviews/milestones to at least the CSCI level.

i. A description of all selected software languages(s) along with the selection justification.

j. A description of software protection against vandalism, viruses, unauthorized access, and disaster risks.

k. The software lifecycle model, including a description of software integration and hardware/software integration processes, software delivery, and maintenance. Include a description of the methodologies used in performing software requirements analysis and interface control, and software design and implementation. Describe the techniques used to transition between the two methodologies.

l. A Risk Management section describing the processes and methods by which technical, cost, and schedule risks will be identified, evaluated, and minimized.

m. A Software Configuration Management Plan section describing the configuration management process for the software and its associated products. Clearly define the relationship between the software configuration management approach and that employed by the remainder of the program. The Software Configuration Management (SCM) Plan should include:

    i. SCM Management Overview - Organization, responsibilities, and interfaces and relationships to software life cycle;

    ii. Software Configuration Management Activities:

        1. Configuration Identification

        2. Configuration Control

        3. Status Accounting

        4. Configuration Audits and Reviews

    iii. Schedule information, which establishes the sequence and coordination for the identified activities and for all events affecting the Plan's implementation.

    iv. Software Configuration Management Resources - tools, techniques, equipment, personnel, and training;

    v. Software Release management & delivery;

    vi. Maintenance information, which identifies the activities and responsibilities necessary to ensure continued planning during the life cycle of the program.

n. An identification of the constraints to which the development process is subject (e.g., methodologies, resource limitation, hardware processors, external dependencies, reuse of existing software). Include an identification of any modifications to the standard Software Acquisition Life Cycle to accommodate the integration of existing or planned reuse software.

o. A description of software build definition and planning rationale and methodology used.

p. Provide an overall view of the software test program, detailing validation/verification approach, test philosophy objectives, and rationale for all software testing activities planned for the program. Include a discussion of the approach for providing independent performance verification/validation by qualified testers that are independent of the SW designers and contractors.

q. A description of the software development system and software testbed facility required to develop, test, evaluate and demonstrate that the software is in compliance with specifications. Describe any software development effort necessary for the integration, operation or use of these systems.

r. A discussion of software metrics collected and their use.

s. A Software Reliability Plan which documents the activities to be undertaken to achieve the software reliability requirements, as well as describe the activities to be undertaken to demonstrate that the software reliability requirements have been verified.

t. A description of the software safety program approach, which documents the activities to be undertaken to achieve the software safety requirements, as well as describe the activities to be undertaken to demonstrate that the software safety requirements have been verified.

u. A Software Maintenance Plan which provides insight into the method, approach, responsibility, and processes to be followed for maintenance of software and its associated documentation. Describe the specific standards, methods, tools, actions, procedures, and responsibilities associated with the software maintenance process. Include the approach for the scheduling, implementation, and tracking of software upgrades.

SW-2 SOFTWARE DELIVERY PACKAGES

Title: SOFTWARE DELIVERY PACKAGES	**DID for CDRL No.** **SW-2**
Reference: XRIS SOW Section 6.5.3.1	
Purpose: A software delivery package is required with submittal of each software release of flight software, FSDE software and/or XRISE (XRIS Emulator) software for GSFC acceptance. There are three items comprising the software delivery package. The first item is the delivery letter describing what is being delivered. The second item is the software on appropriate media. The third item is accompanying documentation.	
Preparation Information:	

1. A software delivery package is required prior to submittal of each software release for GSFC acceptance. The software delivery package **shall** include the following information with appropriate approvals:
    a. Software Delivery Letter, one page in length, which defines briefly what is being delivered, contains in its attachments the details of the delivery, and identifies a point of contact for resolution of questions/misunderstandings/problems involving the delivery. Attachments which support the delivery letter are described in items (i) through (x) below:
        i. Description of Delivery Contents - Identify the delivery in terms of subsystem, release number(s), configuration ID(s), media type(s) (tapes, diskettes, other) and number of copies.
        ii. Build Instructions - Provide instructions to be used in building the delivered software, including the version number of system or vendor-supplied software required to build the system. The supplier should provide evidence that these instructions have been executed prior to delivery and that the software has been built successfully using them (As Built Configuration).
        iii. Special Operating Instructions - Indicate any special instructions that test or operations personnel need to know in using the software. These may include, for example, the use of special simulators, changes to operational procedures, the addition of new files, file format changes, operating constraints/limitations, workaround resolutions to documented problems, operational software version numbers, and associated database version numbers.
        iv. List of Resolved Anomaly Reports and Change Requests
        v. List of Unresolved Anomaly Reports and Change Requests
        vi. Copy of Resolved Anomaly Reports and Change Requests
        vii. Copy of Unresolved Anomaly Reports and Change Requests
        viii. Matrix of requirements addressed by this release (may be done by reference to mapping of requirements identified in requirements specification document)
        ix. Release History Summary Matrix
        x. Inventory of the Delivered Media - Produce the inventory from the media themselves.
    b. Software Delivery Media
        i. The software delivery will be delivered on media as agreed to by the contractor and the Government.
        ii. The software product deliverable for each baseline Build should include, but not be limited to, the following:

1. Source Code
2. Object Code
3. Data
4. Executable Image

c. Accompanying Documentation

i. The third and final item included in the software package is the documentation that describes the delivered software. Provide copies of the following:

1. Software User Manual, as appropriate
2. Software Version Description Document
3. Final Requirement(s) Document
4. Final Design Document
5. Data Definitions
6. Test Results as appropriate

INTEGRATION AND TEST DATA ITEM DESCRIPTIONS

I&T-1 TRANSPORTATION, HANDLING PLAN AND PROCEDURES

Title: TRANSPORTATION, HANDLING PLAN AND PROCEDURES	**DID for CDRL No.** **I&T-1**
Reference: XRIS SOW Section 6.4.1	
Purpose: Provide the instructions and procedures for safe and effective packaging, handling, storage, and transporting of XRIS and associated GSE throughout the mission contract.	
Preparation Information: 1. The Transportation Handling Plan and Procedures **shall** discuss the plan and all of the step-by- step procedures for the packaging, handling, and transporting of XRIS, spares, and GSE. 2. The documentation **shall** include: a. Nomenclature of all supportive equipment b. Calibration and load-tested data c. Identification of special environmental conditions, such as cleanliness, temperature, humidity, etc., and the controls to be implemented to maintain those conditions d. Format for recording QA stamp, deviations and approval columns e. Requirements for special tools, equipment, special handling fixture and containers f. Method of transportation and carrier g. Procedures to comply with local, state and federal safety requirements h. Procedures for maintaining contact with the transported item (where applicable)	

I&T-2 POST LAUNCH TEST REPORTS

Title: POST-LAUNCH TEST REPORTS	**DID for CDRL No.** **I&T-2**
Reference: XRIS SOW Section 6.5.3 and 6.5.5	
Purpose: To provide a summary of the on-orbit testing and analysis results, including conformance with expected results, nonconformance, and trend data.	
Preparation Information: 1. The Post Launch Test Reports **shall** include test objective(s). 2. The Post Launch Test Reports **shall** include overview of test results	

Check the SOLAR CM tool Server at https://ipdtdms.gsfc.nasa.gov/ to verify that this is the correct version prior to use.

3. The Post Launch Test Reports **shall** identify any anomalies, incidents, departures or deviations from expected execution and results.
4. The Post Launch Test Reports **shall** include identification of the item tested including:
    a. Name
    b. Configuration at time of test (e.g., side, mode, deployable state).
5. The Post Launch Test Reports **shall** include details describing test execution and data analysis (including as applicable: timeline of test, data plots, figures, and tables) as defined in the Post Launch Test Procedure.
6. The Post Launch Test Reports **shall** include conclusions and lessons learned with highlights of the analysis and any other information that might be useful for future operations.

I&T-3 OBSERVATORY LEVEL TEST PROCEDURES

Title: OBSERVATORY LEVEL TEST PROCEDURES	**DID for CDRL No.** **I&T-3**
Reference: XRIS SOW Section 5.3	
Purpose: To provide the instrument test procedures that the observatory contractor will incorporate into all observatory level test procedures.	
Preparation Information: 1. The Observatory Level Test Procedures **shall** include all tests that the instrument contractor and the Government want performed during all segments of observatory testing. 2. The Observatory Level Test Procedures **shall** include a test description, command mnemonics and timing, telemetry response for observatory console monitoring, yellow and red limit tables, specific use of calibration sources, etc. 3. The Observatory Level Test Procedures **shall** be written such that they can be interleaved with other instrument and observatory commanding.	

I&T-4 OBSERVATORY LEVEL TEST REPORT

Title: Observatory Level Test Report	**DID for CDRL No.** **I&T-4**
Reference: XRIS SOW Section 5.3	
Purpose: To provide a summary of all instrument observatory level testing from first power ON through final testing before the observatory Pre-Ship Review.	
Preparation Information: 1. Observatory Level Test Report **shall** provide a time history of all instrument observatory level testing.	

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2. The Observatory Level Test Report **shall** provide the total instrument operating time since integration and total operating hours since last failure.
3. The Observatory Level Test Report **shall** address all anomalies or failures and their resolution.
4. The Observatory Level Test Report **shall** include references to other documents such as non- conformance reports or failure reports.
5. The Observatory Level Test Report **shall** demonstrate that the instrument is ready for launch.

I&T-5 CALIBRATION PROGRAM PLAN

Title: CALIBRATION PROGRAM PLAN	**DID for CDRL No. I&T-5**
Reference: XRIS SOW Section 6.3.3	
Purpose: Provide understanding of proposed calibrations and activities required to achieve calibrations.	

Preparation Information:

1. The Calibration Program Plan **shall** describe the complete calibration process in detail, including those measurements performed outside the contractor's facilities.
2. The Calibration Program Plan **shall** describe the prelaunch calibration methodology and characterization approach.
3. The Calibration Program Plan **shall** summarize directed and derived calibration requirements.
4. The Calibration Program Plan **shall** address error sources, budgets, and predicted accuracies.
5. The Calibration Program Plan **shall** describe the facilities and equipment required for each prelaunch calibration and the availability of such equipment.
6. The Calibration Program Plan **shall** illustrate and discuss the prelaunch calibration set-up.
7. The Calibration Program Plan **shall** address the calibration sources to be used for each calibration.
8. The Calibration Program Plan **shall** describe any on-board calibration methodologies.
9. The Contractor **shall** establish a calibration lifetime for ground storage of the instrument flight models.
10. The Contractor **shall** define a recalibration plan for the instrument including plans for the instrument to be recalibrated in the event than storage longer than expected.

I&T-6 CALIBRATION DATA BOOKS

Title: CALIBRATION DATA BOOKS	**DID for CDRL No.** **I&T-6**
Reference: XRIS SOW Section 6.3.3	
Purpose: To provide the calibration data and other measurements necessary for full interpretation of the orbital data, and for the generation of NOAA data products (definitions of levels is in Appendix A).	

Preparation Information:

1. The Calibration Data Book **shall** provide a record of all pertinent test and calibration data, including all raw data from which graphs, curves, calibration coefficients, etc., have been generated.
2. The Calibration Data Book **shall** include a summary section for each measurement, which contains functional equations and charts pertinent to the data contained therein.
    a. The summaries **shall** depict all information pertinent to the calibration requirements, the final calibration and required subsystem data.
3. The Calibration Data Books **shall** provide calibration coefficients for the critical temperature sensors.
4. The Calibration Data Books **shall** provide calibration coefficients for the critical housekeeping data, including temperature, voltage and current sensors.
5. The Calibration Data Books **shall** provide the temperature dependence of calibration curves and coefficients.
6. The Calibration Data Books **shall** provide the full responses of the instrument in the wavelength, frequency, energy, angular, and/or angular domains, as relevant. For XRIS, the relevant domain is the electromagnetic frequency domain.
7. The Calibration Data Books **shall** include a machine-readable file in a self-documenting format (e.g., netCDF4, HDF5) containing all the calibration parameters used by the GPA (CDRL OPS-5), and all calibration parameters used to convert housekeeping telemetry (e.g., temperatures) into engineering units. This machine-readable file **shall** include metadata documenting the units of these parameters and their source, for traceability.

FPGA DATA ITEM DELIVERABLE

FW-1 FPGA DEVELOPMENT PLAN

Title: FPGA Development Plan	**DID for CDRL No.** **FW-1**
Reference: XRIS SOW Section 6.2.1	
Purpose: Document the Contractor's systematic approach to, and processes used in, the management, design, development, testing (verification, validation, and qualification), documentation, configuration management, review, and quality assurance of any Field Programmable Gate Arrays (FPGAs).	

Preparation Information:

1. The FPGA Development Plan **shall** apply to all FPGAs used by the Contractor for the SOLAR Project
2. The FPGA Development Plan **shall** address:
    a. Required documentation (requirements, specification)
    b. FPGA development flow diagram
    c. Test and flight FPGA part types selection, justification and usage
    d. Use of 3rd party or government developed FPGA designs (design-reuse) and/or intellectual property code (includes core selection, management, and verification)
    e. FPGA design capture process
    f. FPGA verification plan, including:
        i. Simulation
        ii. Any other analysis methods
        iii. Non-flight hardware test configuration(s)
        iv. Flight test configuration(s)
    g. FPGA computer-aided engineering (CAE) tools including version number
    h. FPGA utilization/margin guidelines at specified stages of development for I/O, combinatorial logic, sequential logic, RAMs, cores, etc. as well as internal and interface timing
    i. Design Review process – Reviews specified may be combined with in-house FPGA reviews
    j. Quality Assurance involvement/monitoring/oversight/audit of FPGA development processes
    k. Revision control, configuration management, daily backups and archive processes used at specified stages of development

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FW-2 FPGA DESIGN DATA PACKAGE

Title:	**DID for CDRL No.**
FPGA Design Data Package	**FW-2**

Reference:
XRIS SOW Section 6.2.1

Purpose:

An FPGA Data Design Package (FDDP) is required for each FPGA (and similar logic devices like ASICs, PLDs, etc.,) design to allow independent government review of Contractor designs. An FDDP **shall** be submitted for each design used by the Contractor for the SOLAR Project. If a design is revised after its data package was delivered, then an update **shall** be delivered so that each final design data package reflects the flight design.

Preparation Information:

1. The FDDP **shall** include:
    a. Placed and routed database file(s) and folder(s)
    b. Synthesis report files
    c. PDF of the circuit board schematics containing this FPGA
    d. Circuit board netlist(s) (any ASCII format such as PADS, Mentor Graphics (MGC), Allegro)
    e. Requirements, specifications, and verification document(s) as well as any supporting material (e.g., block diagrams, presentation material) relevant to the Gate Array
    f. Source code (e.g., VHDL, Verilog, state machines, state tables PDF of schematics) including any 3rd party intellectual property code and/or cores
    g. Responses to the 500-PG-8700-2.7 (Design of Space Flight Field Programmable Gate Arrays) checklist or equivalent including:
        i. Timing analyses for external inputs and outputs, internal domain(s), etc.
        ii. Disposition of all clock domain crossings
        iii. Simulation analysis summary (e.g., functional coverage, code coverage) and simulation testbench/script code
        iv. Signal integrity analyses relevant to this Gate Array
        v. Power integrity analyses relevant to this Gate Array
    h. To facilitate reviewing the FPGA design, the developer may include:
        i. System, box, and circuit board requirements, specifications, presentations, and/or verification document(s) relevant to the Gate Array and its role in the system, box, and circuit board
        ii. Board part list (any ASCII or common spreadsheet format)
        iii. PDF of the board layout, such as an assembly drawing

iv. Any other files relevant to the review of the Gate Array

XRIS HARDWARE/SOFTWARE DELIVERABLE ITEMS

Table 3 defines the hardware end item deliverables, the quantities required for each Flight Model, and the associated due dates.

Table 3 SOLAR XRIS Hardware/Software Deliverables Flight Model 1

Item	Description	Quantity	Delivery Date	Acceptance Location(s)	SOW Section
1	SOLAR XRIS Flight Instrument Suite 1 (FM1) (with associated acceptance documentation including incoming inspection and post ship CPT results at Spacecraft Contractor's facility (Boulder, CO))	1	Pre-ship/Pre-storage Review No Later Than One Month Before Shipment Ship to Spacecraft Contractor (Boulder, CO) (following closure of any PSR RFA's) No Later Than November 2029	Ship In Place Final acceptance at Spacecraft Contractor's facility following successful post ship incoming inspection and CPT	4.5.4.5
1a	SOLAR XRIS Flight Instrument Suite 2 (FM2) (with associated acceptance documentation including incoming inspection and post ship CPT results at Spacecraft Contractor's facility)	1 Lot	Pre-ship/Pre-storage Review No Later Than at least one month prior to shipment and storage Ship to Goddard Space Flight Center (following closure of any PSR RFA's) No Later Than May 2030	Final acceptance at Goddard Space Flight Center	4.5.4.5
1b	SOLAR XRIS Flight Model 1 Component Spares	1 Lot	November 2029	Ship in place at Instrument Contractor facility	6.2
1c	SOLAR XRIS Flight Model 2 Component Spares	1 Lot	May 2030	Ship in place at Instrument Contractor facility	
2	SOLAR XRIS Engineering Development Unit Instrument (EDU)	1	December 2027 (TBR)	Instrument Contractor's facility	6.1.1
3	Reserved				
4	Ground Processing Algorithms (GPA) Software Development System	1	December	Instrument contractor's facility	6.1.3

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Item	Description	Quantity	Delivery Date	Acceptance Location(s)	SOW Section
5	Ground Processing Algorithms (GPA) (Code) (OPS-7)	AR	See OPS-7 Delivery	Deliver in place (with copies to NOAA)	6.1.3
6	Spacecraft Flight non-typical connectors and contacts for Flight Model 1 (for S/C Contractor to fabricate S/C to instrument flight harness with)	1 Lot (per XRIS S/C ICD)	May 2028	Ship in place then transfer to Spacecraft Contractor's facility (Boulder, CO)	7.1.3
6a	Spacecraft Flight non-typical connectors and contacts for Flight Model 2 (for S/C Contractor to fabricate S/C to instrument flight harness with)	1 Lot (per XRIS S/C ICD)	September 2028	Ship in place	7.1.3
7	Electrical System Test Equipment (ESTE)	2	With Flight Instrument Delivery	Instrument contractor's facility (one unit will ship with the flight instrument to support the incoming testing at the Spacecraft Contractor facility (Boulder, CO))	7.1.1
8	XRIS Emulator (and user manual)	4	December 2027(first unit to Instrument Contractor's facility) December 2027 (second unit to Spacecraft Contractor's facility (Boulder, CO)) Remaining two units to Spacecraft Contractor's facility (Boulder, CO) as required by March 2028	Instrument Contractor's facility (qty. 1) Spacecraft Contractor's facility (Boulder, CO)(qty. 3)	7.1.2

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Appendix A Abbreviations and Acronyms

AM	Additively Manufactured
AMCP	Additive Manufacturing Control Plan
AMR	Additive Manufacturing Requirement
AMRR	Additive Manufacturing Readiness Review
ANSI	American National Standards Institute
CCR	Configuration Change Request
CDR	Critical Design Review
CDRL	Contract Deliverables Requirements List
CIL	Criticality Items List
CO	Contracting Officer
COTS	Commercial off-the-shelf
COR	Contracting Officer's Representative
CSCI	Computer Software Configuration Item
CSU	Computer Software Unit
DACA	Days After Contract Award
DID	Data Item Description
EAR	Engineering Analysis Report
EDU	Engineering Development Unit
EEE	Electrical, Electronic, and Electromechanical
EIDP	End Item Acceptance Data Package
EMC	Electromagnetic Compatibility / Electromagnetic Interference
EOL	End of Life
ESD	Electrostatic Discharge
ESTE	Electrical System Test Equipment
FEM	Finite Element Model
FM	Flight Model
FMEA	Failure Modes Effects Analysis
FMECA	Failure Modes, Effects, and Criticality Analysis
FOD	Foreign Object Debris
FPGA	Field Programmable Gate Array
FSDE	Flight Software Development Environment
FTA	Fault Tree Analysis
GIDEP	Government-Industry Data Exchange Program
GFE	Government Furnished Equipment
GFP	Government Furnished Property
GMM	Geometric Math Model
GPA	Ground Processing Algorithm
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
HVTL	Hazard Verification Tracking Log
I&T	Integration and Test
ICD	Interface Control Document
IDD	Instrument Description Document
IMAR	Instrument Mission Assurance Requirements Document

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ISAR	Instrument Safety Assessment Report
L	Launch
L1	Lagrange 1
MACA	Months After Contract Award
MIUL	Materials Identification and Usage List
MUA	Materials Usage Agreement
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
ODAR	Orbital Debris Assessment Report
OHA	Operations Hazard Analysis
PCB	Printed Circuit Board
PDR	Preliminary Design Review
PER	Pre-Environmental Review
ReqIF	Requirements Interchange Format
RFA	Request for Actions
SAP	Software Assurance Plan
SCM	Software Configuration Management
SDR	System Definition Review
SINDA	System Improved Numerical Differencing Analyzer
SOLAR	Space weather Observations at L1 to Advance Readiness
SOW	Statement of Work
SSPP	System Safety Program Plan
STEP	Standard for the Exchange of Product
TMM	Thermal Math Model
TRR	Test Readiness Review
XML	Extensible Markup Language
XRIS	X-Ray Irradiance Sensor
XRISE	X-Ray Irradiance Sensor Emulator
WBS	Work Breakdown Structure

Appendix B Recommended Operating Procedures (ROPS) Template

L1 Series Instruments ROP Template

ROP ID (Inst/SC-N/C-Sys/Subsys-##)
ROP Name
Rev/Date
additional products applicable to this procedure

Revision Summary		
Rev	Date	Change

Purpose of procedure:
1 -2 sentence purpose. Indicate whether N-Nominal or C-Contingency (see ROP ID above)

Operational Constraints/Flight Rules:
1._____
2. _____

Description/ Planned Use:
Brief summary of the procedure

Pre-Conditions:
1._____
2. _____

Mission Phase: On-orbit, cruise, etc.

Initial Configuration:
States, Modes, Description, Diagram, etc.

Estimated Duration:

Initial Configuration:

Reference Products:
States, Modes, Description, Diagram, etc.

Command/Parameters/Telemetry List:
(annotate any commands that call Safety Critical or Hazardous commands)

Command List			
Command	**Params**	**TLM Verif**	**Safety/Hazardous**

PROCEDURE:

STEP #	DESCRIPTION/ACTION	DETAILS (TLM VERIF/CMD PARARMS)	RESULTS/REMARKS
1			
2			
3			
4			
5			

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Appendix C Space Weather Product Level Definitions

Product Level	Definition
Raw	Raw digital telemetry stream containing spacecraft and instrument data as received at the ground antenna. Data may overlap and/or contain communication artifacts.
Level 0 Sub-level definitions are useful for algorithm development.	Reconstructed, unprocessed spacecraft and instrument data stream at full resolution. Communication artifacts and duplicate data are removed. Data are time-sequenced and may include data gaps to be backfilled as necessary. Level 0a: Single file will have single APID decoded Level 0 Level 0b: Multi-APID decoded Level 0 (File contains all instrument and spacecraft APIDs needed to produce Level 1 data types). Level 0c: Calibration or other available and relevant information necessary for downstream data product calculation are appended.
Level 1a	Fully decommutated, but not fully calibrated, space weather instrument data file: • In sensor or scientific units. • In a local (spacecraft or instrument) reference frame. • At full resolution (per telemetered data). • Includes all supplemental information needed in subsequent processing.
Level 1b	Fully decommutated and fully calibrated space weather data file: • In final units (typically scientific units, but sometimes sensor). • In a standard fixed coordinate frame. • At full resolution (per telemetered data). • Includes all supplemental information needed in subsequent processing.
Level 1c	This includes data that is averaged, binned, or integrated but is still in scientific (final) units. Additional/alternative geophysical reference frames, for example rotations or resampling onto a fixed grid, allowed if they do not change the scientific units. Lower resolutions (e.g., temporal averages/down-samples) allowed except in cases that require more advanced analysis before (e.g., backgrounds that must have events removed)
Level 2	Environmental variable derived from the Level 1 source, which may involve modeling or inversion.
Level 3	Environmental variable or model output that is predictive