Radiation Budget Instrument (RBI)

Contract # NNL14AQ00C

Exhibit B

Contract Data Requirements List/Data Requirements Descriptions

(CDRL/DRD)

Langley Research Center
Hampton, VA

Change History Log

Revision	Effective Date	Description of Changes
Rev -DRFP	04-10-2013	Draft RFP
RBI-PMT-CDRL-0001	06-06-2013	RFP
Same as above	Contract Award Date	Header, add contract number to title page
Rev A (Conformed to Mod 9)	10-27-2014	1. Incorporate Exelis requested delivery schedule updates to PM-03, and PM-13 to synchronize with existing business cycle. 2. Add applicable documents to DRD CV-03 to provide definitions needed to assess TRL levels. 3. Update all GEVS references to GSFC-STD-7000A.
Rev B (Conformed to Mod 10)	05-07-2015	1. SE-12, SE-13, Decoupled RTM and EDU from Milestone reviews 2. Added new text to SE-12 DRD in prep section 5.0 3. CV-02 updated texts and table to correct RSR required wavelength measurement resolution and uncertainty for each channel 4. Changed CV-07 maturity and delivery schedule in CDRL table
Rev C (Conformed to Mod 14)	01-29-2016	Section 1.2 Updated the COR and Government Data Manager Table 1, SE-04 Delivery Schedule Changed 30DP IPRD to 5DP
Rev D (Conformed to Mod X)	04-18-2016	1. Added simulator software to SW-16 and SW-17. Added simulator DRDs SW-18 through SW-23. Updated Government Data Manager. See RBI-CR-026
Rev D (Conformed to Mod 18)	06-15-2016	Administrative edit to change the headers from “Mod X” to “Mod 18” to provide traceability for the contract to establish Mod 18.
Rev E	3-27-2017	Removed “Effective Date” and “Conformed to Mod X” from all headers Table 1: Modified maturity of MA-22 added “Update” for PDR and moved “Final” to CDR. IT-03 & IT-04 corrected typo in “5. Preparation Information” Was “MA-27” should be “MA-26”. See RBI-CR-051
Rev F	10-23-2017	• Section 1.2 Changed COR email • Table 1: Changed Delivery Schd for MA-15, AM-01, AM-02, AM-05, AM-06, AM-14, SW-09, SW-10, SW-11 and SW-15

		• Table 1: Changed Maturity for SW-10 and SW-11 • DRD PM-12 edited section 5. Preparation Information for monthly phased baseline plan; expansion of the reporting categories to break out subcontracts; added section requiring a "Reconciliation of Changes" form for changes from original negotiated baseline and section 6. Additional Distribution Requirements for the Financial Reports to submit via NX • See RBI-CR-076

Table of Contents

List of Tables

1.0 INTRODUCTION

This document contains the Radiation Budget Instrument (RBI) Contract Data Requirements List (CDRL) and Data Requirement Descriptions (DRDs) that define the requirements for data, models, and documentation to be delivered by the Contractor. Section 1 includes definitions and instructions for submission of DRD Items. Table 1 presents the CDRL. Section 2 provides the DRDs which describe each deliverable, how the Government will use the deliverable, the content requirements and other required preparation information.

The CDRL and DRDs are grouped as follows:

PM: Project Management

RE: Reviews

SE: Systems Engineering

MA: Mission Assurance

AM: Analyses and Models

SW: Software

IT: Integration and Test

CV: Calibration / Validation

OO: On-Orbit

Each DRD is uniquely numbered using the two letter group descriptor above followed by a two digit number.

The word “shall” in DRDs indicates required preparation instructions or content for the deliverable. However it is not intended that “shall” statements within DRDs be formally tracked and verified through a rigorous systems engineering process. The Contractor has the responsibility to review each DRD prior to submission to ensure DRD requirements have been met. This includes previously existing data items. Previously existing data items, updated as needed to meet RBI DRD requirements, may be used to fulfill a DRD submission. In the case of previously existing data items, the Contractor has the responsibility to thoroughly review and evaluate the existing data items against RBI requirements and contemporary standards, processes, best practices and analytical approaches, and update the existing data items specifically for RBI prior to submission.

1.1 DEFINITION OF TABLE 1 COLUMNS

1.1.1 DRD NO.

Unique DRD number of each deliverable item or category of items required to be submitted to NASA Langley Research Center (LaRC).

1.1.2 ITEM NAME

Title of the DRD to be submitted.

1.1.3 Statement of Work (SOW) REF

Location where the DRD is referenced in the SOW.

1.1.4 MATURITY

1) Initial: The first submission of an item, which will be revised and resubmitted at a later date.
2) Preliminary: An early submission of an item. Preliminary submittals are written with the best available current information and are resubmitted according to the delivery schedule or when enough additional information has accumulated to make the current version obsolete for its intended use.
3) Final: The complete, thorough submission of an item that, to the best of the Contractor's knowledge and intention, will not require further revision or updates. However, this does not preclude updating if later found to be necessary. Any updates will require the same "approval/review" process as was required for the original submissions.
4) Current: The deliverable is written with the best up-to-date information available at the time.
5) Update: The deliverable is revised with the best up-to-date information available at the time.

1.1.5 DELIVERY SCHEDULE

Defines the deliverable due date. Unless otherwise specified, deadlines are in calendar days.

Delivery schedule acronyms and definitions:

1) ISRR: Instrument Systems Requirements Review
2) IPDR: Instrument Preliminary Design Review
3) ICDR: Instrument Critical Design Review
4) IPER: Instrument Pre-environmental Review
5) ISAR: Instrument Systems Acceptance Review
6) IPSR: Instrument Pre-Ship Review
7) EIDP: End Item Data Package
8) Quarterly: Every three months
9) DACA: Days After Contract Award
10) DP: Days Prior to event. (e.g. 10DP ISRR = 10 calendar days prior to ISRR)
11) DA: Days After event (e.g. 10DA ISRR = 10 calendar days after ISRR)
12) NLT: No Later Than
13) BAT: Bench Acceptance Test
14) As Required:
    a) When a change in law, corporate policy, or Contractor's project implementation approach results in a substantial change that invalidates a prior deliverable, and

development of an updated deliverable is necessary to accurately reflect the present conditions and/or approach.

b) When a body of technical information has been established that renders a prior deliverable obsolete for its intended use, and the Contractor or Government determines that it is technically necessary to produce an updated deliverable that correctly captures the technical information.

Other entries in the "DELIVERY SCHD" column are self-explanatory.

1.1.6 CAT

Designates DRD approval category per the following definitions:

I INFORMATION – DRD Items in this category are provided to the Government for the purpose of determining current program status, progress, and future planning requirements.

R REVIEW – DRD Items in this category are subject to evaluation by the Government or its designated representatives to determine Contractor effectiveness in meeting contract objectives. Upon submission, the Contractor may proceed with associated work while the Government reviews the submission. Within 30 days after confirmation of receipt, for cases where DRD Items are determined by the Government to be inaccurate or non-compliant to DRD requirements, the Government may either (a) reject the submission and require resubmittal of the DRD Item within 30 days or as specified by the CO, or (b) require correction of the error or omission in the next document revision as scheduled per the CDRL. The Government's determination of option (a) or (b) will be based upon the criticality and number of inaccuracies or omissions.

A APPROVAL – DRD Items in this category require approval from the LaRC COR or CO prior to use by the Contractor. For cases when changes are needed before approval of a deliverable, the Contractor shall deliver the updated submission as specified by the LaRC COR or CO. The Contractor shall deliver the updated document for approval within a period of 14 calendar days of receiving comments from the Government unless otherwise specified by the CO. If the Contractor has not received response from LaRC within 30 calendar days of delivery of an Approval-category DRD Item, the Contractor may proceed as if the document has been approved.

1.2 DRD ITEM SUBMISSION

The Contractor shall deliver all DRD Items in electronic format to a LaRC specified, Government-sponsored web-accessible electronic document repository unless otherwise explicitly noted in the DRD. Electronic deliverables shall be delivered in the following formats unless otherwise approved by the Government:

Text Documents:	Microsoft® Word (preferred) or Portable Document Format (PDF) (searchable)
Presentations:	Microsoft® PowerPoint (preferred) or PDF (searchable)
Spreadsheets:	Microsoft® Excel
Database:	Delimited American Standard Code for Information Interchange (ASCII) files accompanied with database schema document defining tables and entries. Note: Alternate native file formats may be acceptable under agreement between the Contractor and the Government
Schedules:	PDF and Microsoft® Project
Schematics and Drawings:	Design Web Format (DWF) and PDF
Photographs:	Joint Photographic Experts Group (JPEG) or any current industry standard.
Video:	Any readily available open standard (e.g., Audio Video Interleave (AVI), Moving Picture Experts Group (MPEG))

The Contractor shall send a notice of DRD Item submittal to the Government via e-mail upon submission of DRD Items. The Government CO or COR will reply with confirmation of DRD Item receipt. When multiple deliverables are transmitted simultaneously, a single notice of submittal that lists all delivery items is acceptable. Distribution of the submittal notification e-mail is as follows:

1) Contracting Officer (CO): C.Snapp@nasa.gov
2) Contracting Officer's Representative (COR): Richard.A.Walker@nasa.gov
3) Government Data Manager: Donna.R.Lewis@nasa.gov

REVIEW PRESENTATION MATERIAL – Presentation material for reviews shall be delivered in electronic and Hardcopy format. The Contractor shall prepare five color hardcopies of presentation materials to be made available at the review site for government representatives.

Table 1: Contract Data Requirements List (CDRL)

Project Management (PM)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
PM-01	Project Management Plan	SOW-1.1-02	Final	60 DACA	R
			Update	As Required	R
PM-02	Contract Work Breakdown Structure Package	SOW-1.1-05	Final	30 DACA	A
			Update	As required; revised pages shall be submitted 10 working DA changes	A
PM-03	Integrated Schedule Package	SOW-1.1-08 SOW-1.1-11 SOW-1.2-09	Preliminary	60 DACA	I
			Update	IMS File NLT 5 Working Days following End of Month PM-03 report Monthly NLT 10 Working Days following End of Month	I
PM-04	Earned Value Management Plan	SOW-1.1-13	Final	60 DACA	R
			Update	As required, or if EVMS Architecture Changes	R
PM-05	Integrated Baseline Review Materials	SOW-1.1-16	Final	NLT three weeks prior to the applicable IBR	R
PM-06	Risk Management Plan	SOW-1.1-18	Final	45 DACA	R
			Update	As Required	I
PM-07	Risk Assessment and Mitigations Report	SOW-1.1-20	Initial	45 DACA	R
			Update	Monthly	I
PM-08	Configuration and Data Management Plan	SOW-1.1-23	Final	45 DACA	R
			Update	As Required	I

Project Management (PM)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
PM-09	Configuration Item Identification List (CIIL)	SOW-1.1-27	Initial	90 DACA	R
			Update	As updates are made	I
			Final	With EIDP	I
PM-10	Project Management Reports	SOW-1.2-09	Current	Monthly (upload materials by the day of the monthly Project Management Review)	I
PM-11	Technical Progress Reports	SOW-1.2-09	Current	Monthly (upload materials by the day of the monthly Project Management Review)	I
PM-12	Contractor 533 Financial Management Reports	SOW-1.2-09	Initial	533Q: NLT 30 DACA 533M: NLT 10 working DA the close of Contractor's first monthly accounting period incurring cost	R
			Current	533Q: NLT 15th working day of the month proceeding the quarter being projected in columns 8a, 8b, and 8c. 533M NLT 10 working DA the close of Contractor's monthly accounting period.	R
PM-13	Contract Performance Reports	SOW-1.2-09	Initial	90 DACA	R
			Current Draft	Monthly by the 6th working day following the close of the prior month accounting period. Format 5 not required in draft.	R
			Current Final	Monthly by the 12th working day following the close of the prior month accounting period.	R

Project Management (PM)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
PM-14	Contract Final Report	SOW-1.2-09	Final	60 DA Instrument Delivery	A
PM-15	Material Inspection and Receiving Reports	SOW-1.2-09	Current	As Generated	A
PM-16	New Technology Reports	SOW-1.2-09	Current	Annual after anniversary date of contract award	A
			Final	3 months after completion of contract work	A
PM-17	Invention Disclosure Reports	SOW-1.2-09	Current	As Generated	I
PM-18	NASA Property in Custody of Contractor Reports	SOW-1.2-09	Current	Annual NLT October 15th for the period October 1 through September 30 of the previous year	I
			Final	Within 30 DA disposition of all property when contract performance is complete	I
PM-19	Federal Contractor Veterans Employment Reports	SOW-1.2-09	Current	Annually; NLT Sept. 30 Each Year, followed by notification to CO of submittal	I
PM-20	Subcontracting Reports	SOW-1.2-09	Current	Semi-annually during performance periods ending Mar 31 and Sep 30. Reports are due w/in 30 days after close of each performance period: No Later Than April 30th and October 30th of each year	I
			Final	30 Days Prior to Contract Closeout	I

Project Management (PM)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
PM-21	Evidence of Insurance	SOW-1.2-19	Initial	Prior to Performance under this contract	R
			Update	As Required	R
PM-22	IT Security Management Plan	SOW-1.2-19	Final	30 DACA	R
			Update	As Required	R
PM-23	Conflicts of Interest Avoidance Plan	SOW-1.2-19	Final	30 DACA	R
			Update	As Required	R
PM-24	Safety and Health Plan Revisions	SOW-1.2-19	Update	As Required	R

Reviews (RE)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
RE-01	Instrument Systems Requirements Review (ISRR)	SOW-1.3-05	Preliminary	Presentation Material: 15 DP Review	R
			Final	Data Package: 15 DP Review	R
			Final	Presentation Material: At Review	R
RE-02	Instrument Preliminary Design Review (IPDR)	SOW-1.3-05	Preliminary	Presentation Material: 15 DP Review	R
			Final	Data Package: 15 DP Review	R
			Final	Presentation Material: At Review	R

Reviews (RE)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
RE-03	Instrument Critical Design Review (ICDR)	SOW-1.3-05	Preliminary	Presentation Material: 15 DP Review	R
			Final	Data Package: 15 DP Review	R
			Final	Presentation Material: At Review	R
RE-04	Instrument Pre-Environmental Review (IPER)	SOW-1.3-05	Preliminary	Presentation Material: 15 DP Review	R
			Final	Data Package: 15 DP Review	R
			Final	Presentation Material: At Review	R
RE-05	Instrument System Acceptance Review (ISAR)	SOW-1.1-03 SOW-1.3-05	Preliminary	Presentation Material: 15 DP Review	R
			Final	Data Package: 15 DP Review	R
			Final	Presentation Material: At Review	R
RE-06	Instrument Pre-Ship Review (IPSR)	SOW-1.3-05	Preliminary	Presentation Material: 15 DP Review	R
			Final	Data Package: 15 DP Review	R
			Final	Presentation Material: At Review	R

Systems Engineering (SE)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
SE-01	Systems Engineering Management Plan	SOW-2.1-01	Initial	90 DACA	R
			Final	30 DP ISRR	R
			Update	As Required	I
SE-02	Change Requests	SOW-2.3-04	Current	As Generated	A

Systems Engineering (SE)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
SE-03	System Performance Verification Plan	SOW-2.3-06	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	A
SE-04	Instrument Performance Specification	SOW-2.2-03	Preliminary	30 DP ISRR	R
			Update	5 DP IPDR	R
			Final	With ICDR	R
SE-05	Indentured Drawing List and Drawing Trees	SOW-2.3-04	Preliminary	15 DP IPDR	I
			Final	15 DP ICDR	I
SE-06	Engineering Drawings	SOW-2.3-05	Current	As Generated	I
			Final	With EIDP	I
SE-07	Instrument Electrical Ground Support Equipment Verification Report	SOW-6.3-05	Final	14 DP First Use at Instrument-Level	I
			Update	As Required	I
SE-08	Instrument System Performance Verification Report	SOW-2.3-07	Final	15 DP ISAR	A
			Update	15 DP IPSR	R
SE-09	Instrument Mass Properties Report	SOW-7.3-05	Preliminary	15 DP IPDR	R
			Update	15 DP ICDR and IPER	R
			Final	15 DP ISAR	R
SE-10	Instrument Performance Trend Analysis Report	SOW-2.5-05	Initial	7 DP IPER	R
			Final	15 DP ISAR	R
			Update	15 DP IPSR	R

Systems Engineering (SE)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
SE-11	Spare Parts Plan and List	SOW-4.4-02	Preliminary	30 DP IPDR	A
			Update	As Required	A
			Final	With EIDP	I
SE-12	Radiometric Test Model Characterization Report	SOW-4.2-04	Final	90 DA Completion of RTM Testing	I
SE-13	Engineering Development Unit Characterization Report	SOW-4.3-05	Final	90 DA Completion of Environmental Testing	I
SE-14	Instrument Data Sets	SOW-10.2-01	Initial	15 DP IPER	I
			Final	With EIDP	I
SE-15	Requirements Verification Matrices	SOW-2.3-08	Preliminary	15 DP ISRR	R
			Update	15 DP ICDR	R
			Final	15 DP ISAR	A

Mission Assurance (MA)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
MA-01	Mission Assurance Implementation Plan	SOW-3.1-01, SOW-3.8-13	Final	60 DACA	A
			Update	As Required	A
MA-02	Safety and Mission Assurance Action Item Tracking List	SOW-3.1-06	Initial	60 DACA	R
			Update	Weekly	R
MA-03		SOW-3.2-32	Final		A

Mission Assurance (MA)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
	Contractor Waiver / Deviation Request			Within 30 DA Identifying the Need for Waiver / Deviation	
MA-04	Anomaly and Failure Reports	SOW-3.2-23, SOW-3.2-28	Initial	Within 24 Hours of Occurrence	I
			Final	Within 14 DA formal anomaly / failure closure	A
MA-05	System Safety Program Plan	SOW-3.3-01	Initial	30 DP ISRR	R
			Final	30 DP IPDR	A
MA-06	Safety Data Package	SOW-3.3-02, SOW-3.3-08, SOW-3.3-09, SOW-3.3-11, SOW-3.3-12	Initial	30 DP IPDR	A
			Update	30 DP ICDR and ISAR	A
			Final	With EIDP	A
MA-07	Design Safety Requirements Compliance Checklist	SOW-3.3-07	Preliminary	30 DP IPDR	R
			Update	30 DP ICDR	R
			Final	With EIDP	R
MA-08	Hazard & Verification Tracking Log	SOW-3.3-13	Preliminary	15 DP ICDR	R
			Final	15 DP ISAR	A
MA-09	Safety Waiver Requests	SOW-3.3-14	Final	Within 30 DA Identifying the Need for Waiver / Deviation	A
MA-10	Contamination Control Plan	SOW-3.9-02, SOW-3.9-05	Initial	15 DP ISRR	R
			Update	15 DP IPDR	R
			Final	30 DP ICDR	A
MA-11	Reliability Program Plan	SOW-3.4-01	Final	30 DP ISRR	R

Mission Assurance (MA)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
MA-12	Failure Mode and Effects Analysis and Critical Items List	SOW-3.4-05	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
MA-13	Fault Tree Analysis	SOW-3.4-06	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
MA-14	EEE Parts Stress & Derating Analysis	SOW-3.4-08	Preliminary	30 DP IPDR	R
			Final	30 DP ICDR	R
			Update	As Required	R
MA-15	Worst Case Circuit Analysis	SOW-3.4-09	Preliminary	30 DP IPDR	R
			Final	30 DA ICDR	R
			Update	As Required	R
MA-16	Reliability Assessments and Predictions	SOW-3.4-10	Preliminary	30 DP IPDR	R
			Final	30 DP ICDR	R
MA-17	Limited-Life, Limited Use, and Expendable Items List	SOW-3.4-12, SOW-3.4-13	Preliminary	15 DP IPDR	R
			Final	15 DP ICDR	R
MA-18	Software Assurance Plan	SOW-3.5-02	Final	15 DP ISRR	R
			Update	As Required	R
MA-19	Non-Standard Parts Approval Requests	SOW-3.7-02	Final	Within 10 Days of selection of any non-Standard EEE Part	A

Mission Assurance (MA)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
MA-20	ESD Control Plan	SOW-3.6-05	Final	ISRR	R
MA-21	EEE Parts Control Plan	SOW-3.7-01, SOW-3.7-04, SOW-3.7-11	Final	15 DP ISRR	A
			Update	As Required	R
MA-22	Project Approved Parts List (PAPL)	SOW-3.7-14, SOW-3.7-15, SOW-3.7-16	Preliminary	30 DP ISRR	R
			Update	30 DP IPDR	R
			Final	30 DP ICDR	A
			Update	As Required	A
MA-23	As-Designed Parts List	SOW-3.7-17	Preliminary	60 DP IPDR	R
			Final	30 DP ICDR	R
			Update	As Required	R
MA-24	As-Built Parts List	SOW-3.7-18	Final	With EIDP	I
MA-25	Materials & Processes Selection, Control, & Implementation Plan	SOW-3.8-01, SOW-3.8-09	Final	15 DP ISRR	A
			Update	As Required	A
MA-26	Life Test Plan for Mechanisms	SOW-3.8-04	Preliminary	90 DACA	A
			Final	ISRR	A
			Update	As Required	A
MA-27	Materials Usage Agreements	SOW-3.8-05	Final	Within 30 Days of Identification	A

Mission Assurance (MA)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
MA-28	Materials Identification and Usage List	SOW-3.8-06	Preliminary	60 DP IPDR	R
			Final	30 DP ICDR	R
			Update	With EIDP	I
MA-29	Printed Wiring Board Coupon Test Reports	SOW-3.8-14	Final	14 DP Use of Printed Wiring Board	R
MA-30	GIDEP Alert and NASA Advisory Dispositions	SOW-3.11-04	Current	Within 30 DA Issuance of Alert	R
			Final	With EIDP	I
MA-31	Significant Parts, Materials, and Safety Problems	SOW-3.11-06	Final	Within 30 Days of Problem Identification	R
MA-32	End Item Data Package	SOW-2.2-04, SOW-3.6-04, SOW-3.7-04	Final	30 DP ISAR	A
MA-33	Heritage Product Compliance Report	SOW-3.12-01	Final	30 DP IPDR	A

Analyses and Models (AM)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
AM-01	Structural and Mechanical Analysis Reports	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	ICDR	R

Analyses and Models (AM)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
			Update	30 DP ISAR, if required	R
AM-02	Stress Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	ICDR	R
			Update	30 DP ISAR, if required	R
AM-03	High Fidelity Structural and Mechanical Model	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Update	30 DP ICDR	R
			Final	30 DP ISAR	R
AM-04	Reduced Order Structural and Mechanical Model	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Update	30 DP ICDR	R
			Final	30 DP ISAR	R
AM-05	Thermal Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	ICDR	R
			Update	30 DP ISAR, if required	R
AM-06	High Fidelity Thermal Model	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Update	ICDR	R
			Final	30 DP ISAR	R
AM-07	Reduced Order Thermal Model	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Update	30 DP ICDR	R
			Final	30 DP ISAR	R
AM-08	Molecular Transport Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
			Update	30 DP ISAR, if required	R
AM-09	Electronic Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R

Analyses and Models (AM)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
AM-10	EMI/EMC Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
			Update	30 DP ISAR, if required	R
AM-11	Radiation Hardness Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
AM-12	Atomic Oxygen Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
AM-13	Orbital Debris Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
AM-14	Control System Analysis Reports	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	45 DA ICDR	R
			Update	30 DP ISAR, if required	R
AM-15	On-Orbit Pointing & Jitter Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
AM-16	Optical Design and Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
AM-17	Optical Numerical Models	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Update	30 DP ICDR	R
			Final	30 DP ISAR	R
AM-18	Sensor Radiometric Design and Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
			Update	30 DP ISAR, if required	R

Analyses and Models (AM)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
AM-19	Sensor Radiometric Numerical Models	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Update	30 DP ICDR	R
			Final	30 DP ISAR	R
AM-20	Measurement Uncertainty Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
AM-21	End-To-End System Performance Analysis Report	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
			Update	30 DP ISAR, if required	R
AM-22	Computer-Aided Design (CAD) Models	SOW-2.3-03	Preliminary	15 DP IPDR	R
			Update	30 DP ICDR	R
			Final	30 DP ISAR	R

Software (SW)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
SW-01	NPR 7150.2a Tailored Compliance Matrix	SOW-5.1-02	Preliminary	30 DP ISRR	R
			Final	15 DP IPDR	A
			Update	As Required	I
SW-02	Software Development Plan	SOW-5.1-05	Preliminary	30 DP ISRR	R
			Final	15 DP IPDR	A
SW-03	Software Test Plan	SOW-5.1-19	Preliminary	30 DP IPDR	R
			Final	30 DP ICDR	A
SW-04		SOW-5.2-01	Preliminary	15 DP ISRR	R

Software (SW)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
	Flight Software Requirements Specification		Update	15 DP IPDR	R
			Final	30 DP ICDR	A
SW-05	Flight Software Design Document	SOW-5.2-03	Preliminary	15 DP IPDR	R
			Final	15 DP ICDR	R
SW-06	Flight Software Test Procedures	SOW-5.2-05	Preliminary	14 DP Start of Test	R
			Final	As-Run, with Final Test Reports	I
SW-07	Flight Software Test Reports	SOW-5.2-06	Initial	7 DA Test Completion	I
			Final	30 DA Test Completion	R
SW-08	Flight Software Version Description Document	SOW-5.2-07	Final	With EIDP	I
SW-09	Flight Software User's Guide	SOW-5.2-08	Final	60 DA IPER	R
SW-10	Ground Software Requirements Specification	SOW-5.3-02	Preliminary	15 DP ISRR	R
			Update	15 DP IPDR	R
			Final	30 DP ICDR	A
			Update	60 DP PER	A
SW-11	Ground Software Design Document	SOW-5.3-04	Preliminary	15 DP IPDR	R
			Final	15 DP ICDR	R
			Update	60 DP PER	R
SW-12	Ground Software Test Procedures	SOW-5.3-06	Preliminary	14 DP Start of Test	R
			Final	As-Run, with Final Test Reports	I

Software (SW)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
SW-13	Ground Software Test Reports	SOW-5.3-07	Initial	7 DA Test Completion	I
			Final	30 DA Test Completion	R
SW-14	Ground Software Version Description Document	SOW-5.3-08	Final	With EIDP	A
SW-15	Ground Software User's Guide	SOW-5.3-09	Preliminary	30 DP -IPER	R
			Final	60 DA IPER	R
SW-16	Software Test Readiness Review Data Package	SOW-5.1-22 SOW-5.1-24	Final	14 DP Software Test Readiness Review	I
SW-17	Software Acceptance Review Data Package	SOW-5.1-23 SOW-5.1-25	Final	14 DP Software Acceptance Review	I
SW-18	Simulator Software Requirements Specification	SOW 5.5-09	Preliminary	15 DP Simulator Requirements EPR	R
			Final	15 DP Simulator Design EPR	A
SW-19	Simulator Software Design Document	SOW 5.5-11	Preliminary	15 DP Simulator Design EPR	R
			Final	60 DP Simulator TRR	A
SW-20	Simulator Software Test Procedures	SOW 5.5-16	Preliminary	14 DP Start of Test	A
			Final	As-Run, with Final Test Reports	I
SW-21	Simulator Software Test Reports	SOW 5.5-17	Initial	7 DA Test Completion	I
			Final	30 DA Test Completion	R
SW-22	Simulator Version Description Document	SOW 5.5-19	Final	With Software Delivery	R
SW-23	Simulator User’s Guide	SOW 5.5-20	Final	30 DP Simulator Acceptance Review	A

Software (SW)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
SW-24	Simulator Incremental Software	SOW 5.5-13 SOW 5.5-23	Preliminary	14 DP Simulator Code EPRs	R

Integration and Test (IT)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
IT-01	Instrument Fabrication and Assembly Plan	SOW-7.1-01	Preliminary	90 DP IPDR	R
			Final	30 DP ICDR	R
IT-02	Environmental Test and Verification Plan	SOW-7.2-02	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	A
IT-03	Test Procedures	SOW-7.3-01	Preliminary	14 DP Start of Test	R
			Final	As-Run, with Final Test Reports	I
IT-04	Test Reports	SOW-7.3-03	Initial	7 DA Test Completion	I
			Final	30 DA Test Completion	R
IT-05	Packaging, Handling, Storage, and Transportation (PHS&T) Plan and Procedures	SOW-9.1-02	Final	30 DP ISAR	R
			Update	15 DP IPSR	R
IT-06	EGSE Operations Manual and Procedures	SOW-6.3-04	Preliminary	15 DP IPER	R
			Final	30 DP ISAR	R

Calibration / Validation (CV)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
CV-01	Calibration System Requirements	SOW-8.1-01	Initial	15 DP ISRR	R
			Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	A
CV-02	Relative Spectral Response (RSR) Component Measurements and System RSR Analysis	SOW-8.2-03 SOW-8.2-04	Preliminary	30 DP ICDR	R
			Final	30 DP ISAR	R
CV-03	Flight Calibration Sources	SOW-8.2-02	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
CV-04	Ground Calibration Sources and Parameters Report	SOW-8.2-02	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
CV-05	Calibration & Validation Plan	SOW-8.1-02	Preliminary	15 DP IPDR	R
			Final	30 DP ICDR	R
CV-06	Calibration / Validation Procedures	SOW-8.4-01	Preliminary	60 DP IPER	R
			Final	7 DP To Use	A
CV-07	Calibration / Validation Reports and Summaries	SOW-8.4-02	Initial	7 DA Test Completion	I
			Preliminary	45 DA Test Completion	I
			Final	90 DA Test Completion	A

On-Orbit Operations (OO)					
DRD NO	**Item Name**	**SOW REF**	**MATURITY**	**DELIVERY SCHD**	**CAT**
OO-01	Instrument Concept of Operations Document	SOW-10.1-01	Preliminary	15 DP ISRR	R
			Update	15 DP IPDR	R
			Final	15 DP ICDR	R
OO-02	Instrument User's Manual	SOW-10.1-02	Preliminary	15 DP ICDR	R
			Final	15 DP IPER	A
			Update	As Required	I
OO-03	Instrument Command Telemetry, Science and Engineering Data Description	SOW-10.1-03	Preliminary	15 DP ICDR	R
			Final	15 DP IPER	A
			Update	As Required	I
OO-04	Instrument Constraints, Restrictions, and Warnings/Alerts Document	SOW-10.1-04	Preliminary	15 DP ICDR	R
			Final	15 DP IPER	A
			Update	As Required	I

2.0 DATA REQUIREMENT DESCRIPTIONS

2.1 PROJECT MANAGEMENT

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

PM-01 PROJECT MANAGEMENT PLAN

---

3. SOW/IPRD Reference:

SOW-1.1-02

---

4. Use:

The Government will review this document and use it as the basis of its understanding of how the contractor has organized and manages the project.

5. Preparation Information:

The Project Management Plan shall address the overall organization, management approach, and structure of the Contractor's project, plus the interrelationships with the parent company and the subcontractors. This plan should include graphical depictions (charts, flow diagrams, logic networks, etc.) to reduce verbal descriptive material where practicable.

The plan shall include the following as minimum:

1) Project management structure, including:
   a) Overall organization.
   b) Interrelationships of project, business, technical and subcontract management.
   c) Key personnel and functions.
   d) Responsible lines of authority.
2) Project Manager authority, including:
   a) Control over essential resources and functions necessary to accomplish the work.
   b) Management of interdepartmental work.
   c) Processes for obtaining decisions beyond the Project Manager's authority for such issues as resolving priority conflicts in resources and functions.
3) Implementation approach for the project, including:
   a) Potential problems related to this work and the approach to problem avoidance/solution.

b) How the risk management system and processes are integrated into the daily management, decision making, and strategic direction of the project.
c) How Government participation will be integrated into the management processes.
d) Make/buy strategies, acquisition plans, long-lead items and sparing philosophy.
e) Project dependencies such as facility requirements.
f) Significant work elements on critical paths.
g) How and where the project will operate during all phases of the contract.

4) Management techniques to be employed to minimize (1) project costs and schedule overruns, and (2) risks of violating interface requirements and agreements. Include:

a) Associated controls to be exercised over subcontractors and suppliers.
b) How issues will be surfaced in a timely manner and at the proper levels.
c) Initial proposed Technical Performance Metrics (TPMs) the project will use to monitor and report on interface compliance and resource status.

5) Control Board organization, roles, responsibilities, hierarchies, membership, and level of Government participation. Include the charter and authorities for the list below and any additional Control Boards:

a) Project Control Board
b) Schedule Control Board
c) Configuration Control Board (CCB)
d) Risk Management Board

6) Contractual procedures proposed for the project to effect administrative and engineering changes, describing any differences from standard company procedures.
7) Identification and description of interfaces with the Government.

Contractor format is acceptable.

6. Applicable Documents:
N/A

7. Reference Documents:
1) NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

PM-02 CONTRACT WORK BREAKDOWN STRUCTURE PACKAGE

3. SOW/IPRD Reference:

SOW-1.1-05

4. Use:

The Government will use the approved DRD as a basis for assessing the Contractor's planning, reporting status, program visibility, and assignment of responsibilities.

5. Preparation Information:

This contract data item has two elements:

1) Contract Work Breakdown Structure (CWBS) – A hierarchical display of the hardware, software, services, facilities and all other elements that contribute to and/or make up the total project scope of effort and work.
2) CWBS Dictionary – A narrative description of the work content, tasks and relevant efforts to be performed in each CWBS element.

Contract Work Breakdown Structure

The CWBS is to be a product-based, hierarchical breakdown of the work necessary to complete the contract tasks and deliverables. The CWBS is to be broken down to a minimum of three levels as defined in NASA/SP-2010-3404. The lowest level of the CWBS is to correspond to the lowest level at which work scheduled, work accomplished and actual costs can be compared. The CWBS shall identify major elements of subcontracted work.

The CWBS elements shall be identified by title and by a numbering system that performs the following functions:

1) Identifies the level of the Work Breakdown Structure (WBS) element.
2) Identifies the higher level element into which the WBS element will be integrated.
3) Provides the cost account number of the element.

WBS Dictionary

The CWBS Dictionary shall fully describe the scope of each element within the CWBS, including all tasks, products and/or services planned within the element. The CWBS Dictionary shall be ordered in accordance with the CWBS and shall include the following data for each CWBS element:

1) CWBS element title.
2) CWBS element code.
3) CWBS element content description, including all associated work, services, non-recurring end products, quantities and contract end items (where applicable).
4) Applicable SOW requirement number.
5) Applicable specification requirement number and title.
6) Associated Contract Deliverable line item(s).
7) Date and revision number.

6. Applicable Documents:
N/A

7. Reference Documents:
1) NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*
2) NASA/SP-2010-3404, *NASA Schedule Management Handbook*

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

PM-03 INTEGRATED SCHEDULE PACKAGE

---

3. SOW/IPRD Reference:

SOW-1.1-08, SOW-1.1-11, SOW-1.2-09

---

4. Use:

The Government will use the schedule package for management insight into the Contractor's time-phased plan, critical path, current status, key milestones, task interdependencies, and major development phases necessary to accomplish the total scope of work.

5. Preparation Information:

This contract data item shall comprise the following deliverable elements:

1) Summary Schedule
2) Detailed Schedule
3) Critical Path Report
4) Project Control Milestone Trend Report
5) Contractor Schedule Assessment Report
6) Schedule Revision Log

Summary Schedule:

The Summary Schedule shall be a one-page, top-level, Gantt-type summary document arranged by CWBS. The Summary Schedule shall show:

1) Progress
2) Critical path
3) Major project phases (design, fabrication, integration, assembly, etc.)
4) Contract and project control milestones
5) End-item delivery dates
6) Important subcontractor milestones
7) Government Furnished Property (GFP) need dates, if applicable

Integrated Master Schedule:

The IMS shall be an automated logic network database that links all sequencing and interdependencies between tasks. Work shall be defined at a level of detail to allow discrete progress measurement and visibility into the overall development, fabrication, integration, assembly, test, and delivery phase of each end item deliverable. The IMS shall contain task coding

attributes necessary to provide sort, select, and summarization capabilities by WBS element, project phase, critical tasks, and receivables/deliverables.

The schedule database shall support "what-if" scenario analysis and planning, particularly of risk mitigations. The objective is to be able to evaluate the effects of implementing risk mitigation steps on the critical path or CWBS delivery schedule.

Detailed task planning may be established in a rolling-wave process, but shall be defined for at least the next 12-month period or until the next milestone review (i.e., ISRR, IPDR, ICDR, IPER, IPSR, BAT), whichever is later.

Following IBR approval, the IMS will become the Contract Baseline Schedule and a basis for monitoring Contractor performance. Changes to the baseline shall be incorporated by a baseline change request (BCR) or complete reissue. A Time Phased Baseline report shall be provided during months when BCR's are approved. The report shall include detail at the lowest WBS level that budget is recorded and shall include a breakdown of hours and dollars by resource.

A BCR shall be developed for all rolling wave planning.

In addition to the CWBS-based tasks and activities, the IMS shall contain or show:

1) Approved baseline schedule (following IBR approval)
2) Current status
3) Current forecasted dates
4) Long-lead procurements
5) Receivables and deliverables between organizations (including subcontractors)
6) Critical path(s)
7) Schedule reserve
8) Schedule slack
9) Approved, authorized and funded risk mitigation triggers and activities
10) Lower tier supplier (LTS) schedule information
11) Project Control Milestones (PCMs)
12) Key decision points
13) Design reviews, readiness reviews, and pre-ship reviews
14) GFP need dates (if applicable)
15) The schedule status date
16) A legend identifying symbols used and their meaning

All data shall be updated each reporting period and based on the same status date/data date.

<u>Critical Path Report:</u>

The Critical Path Report shall include a clear delineation of the critical path(s), an assessment of the schedule risks, an assessment of keeping on schedule, and an assessment of choke-points and potential workarounds in the schedule. Include a list of all tasks and milestones with 10 workdays or less of total slack (float). The report shall be submitted in a waterfall format and organized in a manner such that the path with least amount of slack is delineated first and followed by each successive path according to total slack values.

<u>Project Control Milestone (PCM) Trend Report:</u>

The PCM cumulative trend report shall chart the baseline PCM early finish dates and current forecasted early finish dates (or actual completion dates).

Contractor Schedule Assessment Report:

The Contractor Schedule Assessment Report shall contain a narrative analysis of the schedule status, progress (accomplishments) and issues. Reporting shall be based on data extracted from the accompanying IMS and shall be organized in a manner consistent with the CWBS. At a minimum the report shall contain charts and narratives explaining:

1) IMS status
2) Accomplishment since the last report
3) Accomplishments planned for the next reporting period
4) Primary and secondary critical paths
5) Changes to the critical paths, impacts and workarounds
6) Variances, impacts and workarounds for contract milestones and PCMs delayed from their baseline dates
7) Tasks/activities/milestones that have no predecessor and/or successor relationships
8) Tasks/activities/milestones that have forced or fixed dates
9) Tasks/activities/milestones scheduled as other than "As Soon As Possible" Tasks/activities/milestones with logical relationships other than "Finish-to-Start"
10) Upcoming receivables and deliverables
11) Reconciliation with the variance analysis submitted with the Contract Performance Reports (CPR) (No Criteria)

Schedule Revision Log

The Contractor shall maintain and deliver a revision log documenting all IMS changes (baseline and current forecast) and their rationale (task additions, deletions, duration adjustments, changes to logic, constraints, activity relationships, etc.).

6. Applicable Documents:
N/A

7. Reference Documents:
1) NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*
2) NASA/SP-2010-3403, *NASA Schedule Management Handbook*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

PM-04 EARNED VALUE MANAGEMENT PLAN

3. SOW/IPRD Reference:

SOW-1.1-13

4. Use:

Earned Value Management (EVM), as used in this data requirements description, is a project and cost management system that effectively integrates the project technical scope of work with schedule and cost elements for optimum project planning and control utilizing performance measurement. The EVM Plan provides a description of the management system the Contractor will use to generate earned value information and report the required information to the Government.

5. Preparation Information:

1) The EVMS Plan shall describe in narrative format how the Contractor's EVMS complies with the 32 guidelines in the ANSI/EIA-748-C Standard, entitled Earned Value Management Systems, ensuring each guideline is specifically addressed.
2) The EVMS Plan shall describe the management system to be used to generate cost/schedule performance measurement information and how this system is integrated with the overall cost and schedule management control system. The EVMS Plan shall provide assurance that the contractor's EVMS will provide timely, integrated cost and schedule performance measurement information to support effective decision making by both Contractor and LaRC management. The EVM Plan shall also include any additional procedures the Contractor deems necessary to adequately manage its resources.
3) The Contractor shall submit a list of major (or critical) subcontractors and major (or critical) vendors that will include:
   a) Subcontract/Vendor Name
   b) Description of Product
   c) Applicable WBS Code
   d) Purchase Order/Subcontract Value
   e) Reporting requirements for the Contractor's EVMS
   f) Subcontract management plan

6. Applicable Documents:

1) ANSI/EIA-748-C, Earned Value Management Systems

7. Reference Documents:
   1) NFS 1852.234-1, *Notice of Earned Value Management System*
   2) NFS 1852.234-2, *Earned Value Management System*

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

PM-05 INTEGRATED BASELINE REVIEW MATERIALS

---

3. SOW/IPRD Reference:

SOW-1.1-16

---

4. Use:

The Government will assess this review material as part of the Integrated Baseline Review(s). The objective is to jointly assess the Contractor's baseline to be used for performance measurement to ensure complete coverage of the scope, logical scheduling of the work activities, adequate resourcing, and identification of risks.

5. Preparation Information:

An IBR Data Package shall be submitted for each review to support the IBR objectives stated above. The Contractor IBR Data Package(s) shall comply with the *NASA IBR Handbook* and contain the following:

1) Integrated Master Schedule
2) Critical Path
3) Project Risk Register
4) EVMS description and related business process descriptions
5) Contractor EVMS process documentation
6) Two months of EVM performance data
7) Control Account Plans (CAP), Basis of Estimates (BOE), Assumptions, and Risks
8) CWBS and Dictionary to the CA level
9) Organizational Breakdown Structure to the Control Account Manager (CAM) level
10) Responsibility Assignment Matrix showing dollars allocated by CA
11) Work Authorization Documents (all levels)
12) Subcontractor listing by WBS element and value of subcontracts
13) Contractor/Subcontractor EVMS flow-down requirements
14) Latest Estimate at Completion (EAC) and supporting documentation
15) Baseline Change Requests (BCR) approved thus far, if applicable
16) Baseline Control Logs (Management Reserve, Undistributed Budget, Budget Base)
17) Financial Reports such as 533M/Q or equivalent
18) Control Account/Work Package summary showing:

a) Number of work packages and total value by type of EV method
b) Longest and shortest CA, mean and median durations

c) Largest and smallest CA, mean and median values
d) Number of Planning packages and total Planning Package budget
e) All contract changes to date

6. Applicable Documents:
   1) NASA/SP-2010-3406, *NASA IBR Handbook*

7. Reference Documents:
   1) NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

PM-06 RISK MANAGEMENT PLAN

3. SOW/IPRD Reference:

SOW-1.1-18

4. Use:

The Risk Management Plan (RMP) is the basis for identifying and managing all performance, reliability, schedule, cost, and safety risks on the Contractor's project. The Contractor's risk management performance will be measured against the RMP.

5. Preparation Information:

The RMP shall comply with NPR 8000.4 and Joint Polar Satellite System (JPSS) 470-00004. The RMP shall clearly describe the:

1) Overview of the risk management process
2) Organizational responsibilities
3) Risk identification approach and process
4) Risk analysis and assessment (including Likelihood and Consequence criteria)
5) Risk mitigation planning and implementation
6) Integration of risk management with the overall project management processes
7) Risk management techniques, database tool(s) and tool capabilities
8) Risk monitoring/tracking/documentation/reporting
9) Risk Management Board membership, process, procedures
10) Differences in risk management philosophy for risks associated with:
    a) Developmental hardware and software
    b) Technical performance
    c) Commercial off-the-Shelf (COTS) components
    d) Safety
    e) Cost and Schedule

6. Applicable Documents:
1) NPR 8000.4A, *Risk Management Procedural Requirements*
2) JPSS 470-00004, *JPSS Program Continuous Risk Management Plan*

7. Reference Documents:
1) NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-07

2. Title: RISK ASSESSMENT AND MITIGATIONS REPORT

3. SOW/IPRD Reference:

SOW-1.1-20

4. Use:

To document risk assessment results and risk mitigation plans.

5. Preparation Information:

The Risk Assessment and Mitigations Report contains data extracted from the Risk Management Database. The report shall provide the results of the risk assessment (the list of identified risks) and the plans for mitigating each risk.

The risk assessment shall be a list of all identified risks on the project ranked by the level of risk identified through qualitative and quantitative analysis of likelihood, consequence and uncertainty of risk understanding.

Each risk shall have meaningful, measurable and relevant risk mitigations corresponding to the risk reduction that has been identified as part of the risk mitigation strategy. Risk mitigations plans shall, as a minimum, include:

1) Tasks or steps necessary for the mitigation
2) Decision trigger dates
3) Cost, schedule and resources associated with each step and for complete mitigation
4) Plans to fund the mitigation if from another cost account
5) Assessment of the mitigation impacts on the project schedule's Critical Path
6) The expected resultant risk level after the mitigation has occurred

The report shall also summarize the technical, cost, and schedule consequences of implementing the integrated risk mitigations for all top risks, and the timing of the key decision (trigger) points.

6. Applicable Documents:
N/A

7. Reference Documents:
1) NPR 8000.4A, *Risk Management Procedural Requirements*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-08

2. Title: CONFIGURATION AND DATA MANAGEMENT PLAN

3. SOW/IPRD Reference:

SOW-1.1-23

4. Use:

To define the Contractor's configuration and data management system (including policies and procedures) that will be implemented for the Instrument flight hardware, flight software, ground support equipment and ground software. The Contractor's configuration and data management performance will be measured against the Configuration and Data Management Plan (CDMP)

5. Preparation Information:

The CDMP shall comply with NASA-STD-0005 and with NPR 7150.2A, Sections 4.1 and 5.1. The plan shall describe the Contractor's approach, methodology and application of configuration management principles and practices. The plan shall explain how consistency is achieved and maintained between product definition, product configuration and product configuration records throughout the applicable phases of the life cycle. The plan shall explain how the Contractor intends to perform configuration control of the flight hardware, software, documents, data artifacts, electrical ground support equipment (EGSE), mechanical ground support equipment (MGSE) and any other equipment which interfaces with flight systems during development and test.

Contractor format is acceptable.

6. Applicable Documents:
   1) NASA-STD-0005, *NASA Configuration Management Standard*
   2) NPR 7150.2, *NASA Software Engineering Requirements*

7. Reference Documents:
   1) NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*
   2) ANSI-IEEE Standard 1042-1987, *Guide to Software Configuration Management*

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: PM-09

2. Title: CONFIGURATION ITEM IDENTIFICATION LIST (CIIL)

---

3. SOW/IPRD Reference:

SOW-1.1-27

---

4. Use:

To establish a structure for controlling the configuration of Instrument by identifying all Configuration Items (CIs) and Computer Software Configuration Items (CSCIs), including flight and ground support elements, used on the project and correlating those CIs/CSCIs to their Specification and test requirements documents.

5. Preparation Information:

The Configuration Item Identification List (CIIL) shall document all of the fundamental structural units of the development and/or deliverable system which need to be independently identified, stored, tested, reviewed, used, changed, delivered and/or maintained.

The CIIL shall contain the Configuration Items (CIs) for:

1) Hardware, software (CSCIs), firmware, drawings and models.
2) Plans, documentation and other process products. This includes planning documents (such as management plans, schedules and budgets), standard documentation (such as Interface Control Documents (ICDs) and test plans) and process products (such as review presentations and control board minutes).

For each CI, the CIIL shall contain the CI Identifier (unique identification), associated CWBS number, CCB required for release/revision, Current Release Designator (such as version number) and data restrictions for the product (such as Proprietary or International Traffic in Arms Regulations (ITAR)).

The hardware CIs and CSCIs shall be organized hierarchically as follows:

3) All system level CIs and CSCIs.
4) All subsystem level CIs and all CIs/CSCIs within each subsystem.

In addition, each hardware CI shall contain the following information:

5) CI top drawing number.
6) CI nomenclature.
7) Applicable specification number (as applicable).
8) Brief description of the CI.

9) Acceptance test procedure number and, if qualification tested, the qualification test procedure number. If the CI is neither acceptance nor qualification tested, the functional test procedure number should be entered in this column.
10) Flight or Ground Support designation.

In addition, each CSCI shall contain the following information:

11) Assigned CSCI Number.
12) CSCI nomenclature.
13) Applicable specification number (as applicable).
14) A brief description of the CSCI.
15) Acceptance test procedure number and, if qualification tested, the qualification test procedure number. If the CSCI is neither acceptance nor qualification tested, the functional test procedure number should be entered in this column.
16) Flight or Ground Support designation.

This list shall be prepared in the Contractor's format.

6. Applicable Documents:
   1) NASA-STD-0005, *NASA Configuration Management Standard*
   2) NPR 7150.2, *Software Engineering Requirements*

7. Reference Documents:
   1) ANSI-IEEE Standard 1042-1987, *Guide to Software Configuration Management*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-10

2. Title: PROJECT MANAGEMENT REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

The Government will use the Project Management Reports to evaluate contract status and facilitate communications and coordination; and to provide a basis for discussions regarding project status, plans, risks and issues.

5. Preparation Information:

The Project Management Reports shall be informal materials provided for discussion in advance of each monthly Project Management Review (PMR) meeting/telecon. Materials may be in Contractor format. At a minimum, content shall include:

1) Project Manager's overall status summary (technical, financial, schedule).
2) Key management and development metrics, and trends.
3) Summary of planned versus actual accomplishments since the previous report.
4) Technical and programmatic issues and anticipated approaches for resolution.
5) Status of open issues and problems from prior reporting periods.
6) Risk status for top 10 overall risks.
7) Status of action items with a focus on actions that are not closing in a timely manner.
8) Financial liens summary of encumbrances (realized liens), hard liens and soft liens.
9) Lower Tier Supplier status (performance, issues, risks, plans, surveillance audits).
10) CCB activities and status summary, including a summary of all Class I in-process and approved changes.
11) Integrated Master Schedule summary of current activities, critical path(s) and status.
12) CDRL product status (product; status; baseline and actual (or planned) dates).
13) CDRL products planned for delivery during the next reporting period.
14) Significant plans and activities for the next reporting period.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-11

2. Title: TECHNICAL PROGRESS REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09, SOW-3.2-19

4. Use:

The Government will use the Technical Progress Reports to document technical plans, status, development challenges and Technical Performance Measures for a long-term record of the Instrument; and to support discussions between the Contractor and the Government regarding technical progress, plans and issues.

5. Preparation Information:

The Technical Progress Reports (TPRs) shall be a formal record of the development process of the Instrument and supporting deliverables. The reports shall cover all technical engineering aspects of the contract effort. Materials may be in Contractor format.

The TPR shall include the following content:

1) Summary and comparison of planned versus actual accomplishments for the period of time since the prior report.
2) Technical status and activities for system and subsystem design and development, including (as applicable) design progress, procurements, subcontracts, manufacturing, testing and qualification
3) Integration & Test (I&T) status such as progress, test results and performance trends.
4) Calibration system status.
5) Verification & Validation (V&V) status.
6) Issues, problems and concerns encountered during the reporting period and anticipated approaches for resolution.
7) Status of open issues and problems from prior reporting periods.
8) Summary of pertinent Mission Assurance status such as Material Review Board (MRB) actions, failure investigations and corrective actions.
9) Number of drawing, identified in SE-05, completed and remaining to be completed.
10) Software Assurance status, including:
    a) Organization and key personnel changes
    b) Assurance accomplishments and resulting software assurance metrics
    c) Subcontractor assurance accomplishments

d) Trends in software quality metric data
e) Significant problems or issues
f) Plans for upcoming software assurance activities
g) Recommendations and lessons learned

11) Significant plans and activities for the following month
12) Tabulation of the combined (end-to-end) system uncertainty (see DRD AM-20).
13) Technical Performance Measures (see below).

Technical Performance Measures:

The report shall document the Instrument key Technical Performance Measures along with their baseline values, current estimated values, allocations, contingencies, margins and trends. Allocations and contingency values shall be appropriate to the current stage of hardware development. Necessary corrective actions shall be included for values whose margins fall below the target levels based on the maturity. The accuracy of all values and units shall be identified. Metrics unchanged since the referenced baseline shall be indicated as such.

The values to be reported shall be at least to the major component level of the subsystems (e.g. mechanisms, power supplies, heaters, cabling). The report shall be initially based upon calculated values and shall be updated as calculations are revised and actual measured data becomes available.

The Technical Performance Measures shall include the following at a minimum:

- Mass of each separately-mounted Instrument component
- Mass of aggregate total Instrument
- Average and peak operational power
- Average and peak survival power
- CPU utilization
- Memory Utilization
- Average and peak data rates
- Flight code size (Source Lines of Code – SLOC)
- Pointing knowledge and control
- Reliability – Probability of success over mission life
- Radiometric Performance error and margin budgets

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

PM-12 CONTRACTOR 533 FINANCIAL MANAGEMENT REPORTS

---

3. SOW/IPRD Reference:

SOW-1.2-09

---

4. Use:

To provide data necessary for a) projecting costs and hours to ensure that dollar and labor resources realistically support project and program schedules; b) evaluating the Contractor's actual cost and fee data in relation to negotiated contract value, estimated costs, and budget forecast data; c) planning, monitoring, and controlling project and program resources; and d) accruing cost in NASA's accounting system.

5. Preparation Information:

 # Initial Baseline Financial Management Report

1) The Contractor shall prepare a time-phased Baseline Financial Management Report, detailing by month how it plans to incur costs for the base period of performance utilizing the NASA Form 533Q format. The Contractor shall prepare and submit the report in accordance with instructions set forth on the reverse side of the 533Q Form and NASA Procedural Requirements (NPR) 9501.2E, NASA Contractor Financial Management Reporting. The Contractor shall submit the initial 533Q within 30 working days after the effective date of contract.
2) The Contractor shall update the report, as required, during performance of the contract for approval by the Contracting Officer. The report shall be revised each time a contract modification is executed which increases or decreases the contract estimated cost, for a reason other than an overrun. The contractor shall also provide supplemental data in the form of a monthly-phased baseline plan for the contract period of performance, inclusive of line items of the 533M and Q. This shall adequately address the "detailing by month" requirement noted above. The report shall not be revised to include overrun costs.
3) The minimum reporting categories indicated below shall be included in column 6 of this report.
   a) Direct Labor Hours
   b) Direct Labor Dollars
   c) Overhead(s)
   d) Subcontract
      Sub # 1 (SNC)
      Sub # 2 (SDL)

Sub # 3 (All others)
e) Material
f) Travel
g) Other Direct Cost
h) G&A
i) Total Estimated Cost
j) Fee
k) Total Estimated Cost and Fee

#. **Quarterly Financial Management Report**

1) The Contractor shall submit a quarterly financial report at the contract level on NASA Form 533Q at times and in accordance with the instructions contained on the reverse side of the form. Minimum reporting categories shall include:

a) Direct Labor Hours
b) Direct Labor Dollars
c) Overhead(s)
d) Subcontract
Sub # 1 (SNC)
Sub # 2 (SDL)
Sub # 3 (All others)
e) Material
f) Travel
g) Other Direct Cost
h) G&A
i) Total Estimated Cost
j) Fee
k) Total Estimated Cost and Fee

#. **Monthly Contractor Financial Management Report**

1) The contractor shall submit a Monthly Contractor Financial Management Report, at WBS level 2, in accordance with NFS 1852.242-73, NASA Contractor Financial Management Reporting. The Contractor shall prepare and submit the form in accordance with the instructions set forth on the reverse side of the form and NASA Procedural Requirements (NPR) 9501.2E, NASA Contractor Financial Management Reporting.
2) The Contractor shall submit the report not later than the 10^{th} working day following the close of the Contractor's accounting period being reported.
3) The Contractor shall submit a separate 533M for each authorized task order (applicable to CLIN 002).
4) The Contractor shall submit a summary 533M covering all authorized task orders (applicable to CLIN 002).
5) The contractor shall complete Columns 8.a and b using estimates (forecasts) for the succeeding two months.
6) The Contractor shall ensure that estimates (forecasts) are the best projection of the actual costs to be reported in column 7.a of the subsequent month's 533M. Since NASA uses the Contractor's estimate for the current month (column 8.a of the 533M) as accrued costs in

its monthly financial statements, the accuracy of these projections are critical to the integrity of NASA's financial data.

7) The Contractor shall report costs on the basis of the contractor's most current data for actual rates experienced at the time the report is prepared, rather than on the basis of Defense Contract Audit Agency (DCAA) approved provisional billing or bidding rates. In addition, the contractor shall make adjustments as needed for actual cost experience to reflect rates reported in its final indirect cost rate proposal submitted after the end of each of its fiscal years in accordance with paragraph (d) of FAR 52.216-7, Allowable Cost and Payment. The contractor shall explain in the footnotes on the 533 report any adjustments made for actual rates as determined by the contractor in its annual final indirect cost rate proposal.
8) The Contractor shall include a narrative explanation for variances exceeding plus or minus 10 percent (+/-10%) between estimated costs shown in the prior month and actual costs shown in the current month at the contract level. (For example, the estimated costs shown for June in column 8.a in the May 533M and the actual June costs shown in column 7.a in the June 533M.)
9) Changes from the original negotiated baseline shall be summarized in a "Reconciliation of Changes" form (referenced and included in 3.6.5 of the related NPR and in the 533 instructions) in the month in which the changes occur and included with the narrative remarks. It should reconcile to the present contract value, then to contractor's estimated final cost.
10) The Government will consider the Contractor's accuracy of financial reporting when evaluating the Contractor's performance in the Contractor Reporting Assessment Reporting System (CPAR).

The minimum reporting categories indicated below shall be included in column 6 of this report.

a) Direct Labor Hours
b) Direct Labor Dollars
c) Overhead(s)
d) Subcontract
    Sub # 1 (SNC)
    Sub # 2 (SDL)
    Sub # 3 (All others)
e) Material
f) Travel
g) Other Direct Cost
h) G&A
i) Total Estimated Cost
j) Fee
k) Total Estimated Cost and Fee

The Financial Management Reports shall include reconciliation between the 533M/533Q and the CPR, which shall be submitted as an attachment to the 533M/533Q reports and the CPR. The CPR reporting levels shall be in accordance with the Contract Work Breakdown Structure DRD.

---

6. Additional Distribution Requirements for the Financial Reports:

- All reports shall be submitted in accordance with the submittal process for contract deliverables via NX.

7. Applicable Documents:
   1) NPR 9501.2E, *NASA Contractor Financial Management Reporting*

8. Reference Documents:
   1) NFS 1852.242-73, *NASA Contractor Financial Management Reporting*
   2) NPD 9501.1I, *NASA Contractor Financial Management Reporting System*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-13

2. Title: CONTRACT PERFORMANCE REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

To provide information for: (1) integrating cost and schedule performance data with technical performance measures, (2) assessing the magnitude and impact of actual and potential problem areas causing significant cost and schedule variances, and (3) providing valid, timely project status information to higher management.

5. Preparation Information:

CPR formats shall be completed according to the instructions outlined in DI-MGMT-81466A. The monthly draft and final EVM system export shall be submitted in electronic XML format and at the lowest level reporting element. A signed CPR shall be submitted for the monthly final requirement.

All significant subcontractor performance data shall be integrated into the Prime's monthly final CPR in the same accounting period. Additionally, the significant subcontractor CPRs shall be submitted as an attachment to the Prime's monthly final CPR.

The CPR shall separate direct and indirect costs and identify elements of cost for all direct reporting elements. CPR formats shall be completed in accordance with the instructions in DI-MGMT-81466A and:

1) Format 1 shall include information below the Control Account, down to the resource code level. Formulas for all IEAC calculations shall be provided. A full grassroots (bottom-up) EAC shall be provided at a minimum of once/year, or more frequently if the contractor's EVM system or management policy requires it.
2) Format 3 shall include a time-phased budget report shall be provided as a supplement. The report shall include details at the lowest WBS level that budget is recorded. The report shall include a breakdown of hours and dollars by resource.
3) Format 5, Variance Analysis: The Variance Analysis shall be a narrative that includes problem analysis, narrative explanations and corrective action plan descriptions at the Control Account level for the following:
   a) Reporting elements that have a current period cost variance (CV) or schedule variance

(SV) exceeding ± $100K and a CV% or SV% of ±10, where $CV\% = \frac{CV}{BCWP} \cdot 100$ *and* $SV\% = \frac{SV}{BCWS} \cdot 100$.

b) Reporting elements with cumulative cost or schedule variances exceeding ±$100K and a CV% or SV% of ±10.

c) Reporting element with cost or schedule Variances at Complete (VAC) exceeding ±$500K and a VAC% of ±10, where $VAC\% = \frac{BAC-EAC}{EAC} \cdot 100$

d) Other significant variances that are causing or are likely to cause significant cost or schedule overruns (Contractor determined)
Variance analysis thresholds may change once the Government personnel evaluate the Contractor's schedule, cost performance, and risk.

A corrective action log, including how the contractor follows the corrective actions suggested, shall be provided as a supplement to format 5.

4) Cost and Schedule Drivers: List any other current contractor determined schedule and cost drivers, particularly those on the critical path. Discuss the reason(s) behind the determination and a suggested corrective action plan.

6. Applicable Documents:
1) DI-MGMT-81466A, *Data Item Description for Cost Performance Report.*

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-14

2. Title: CONTRACT FINAL REPORT

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

To provide a brief summary and index of the most significant documents (in terms of history and lessons learned) generated on this contract.

5. Preparation Information:

This report shall contain at a minimum:

1) Overview of the instrument development history (major events and timeline)
2) Overview of contract cost and schedule performance
3) Document index organized by:
    a) Conceptual design trades
    b) Final design and analysis
    c) As-built configuration
4) Development challenges and solutions
5) Calibration and performance summary
6) Out-of-specification items
    d) SOW waivers and deviations
    e) Instrument Performance Requirements Document (IPRD) waivers and deviations
    f) Interface waivers and deviations
    g) Technical issues
7) Lessons learned
    h) Technical
    i) Programmatic

6. Applicable Documents:
    1) NFS 1852.235-73, *Final Scientific and Technical Reports-Alternate II*

7. Reference Documents:
    N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-15

2. Title: MATERIAL INSPECTION AND RECEIVING REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

Provide evidence of Government Quality Assurance at origin and destination in support of shipment of contract end items.

5. Preparation Information:

At the time of each hardware delivery to the government under this contract, the Contractor shall furnish a Material Inspection and Receiving Report (DD Form 250 series) prepared in 2 hardcopies (i.e., the original paper form and one photocopy).

6. Applicable Documents:
N/A

7. Reference Documents:
1) NFS 1846.6, *Material Inspection and Receiving Reports*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-16

2. Title: NEW TECHNOLOGY REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

To provide the Government with technical information concerning any invention, discovery, improvement or innovation made by a Contractor in the performance of work under this contract for the purpose of determining title and rights.

5. Preparation Information:

Interim New Technology Report: after the first anniversary date of the contract, submit an annual list of subject inventions, certify that all subject inventions have been disclosed (or that there are no such inventions), and certify that the procedures required by paragraph (e)(1) of the NFS 1852.227-70, "New Technology", have been followed.

Final New Technology Report: A final report listing all reportable items or certifying that there were no such reportable items and listing all subcontractors at any tier containing a patent rights clause or certifying that there were no such subcontracts as set forth in NFS 1852.227-70, "New Technology".

6. Applicable Documents:
   1) NFS 1852.227-70, *New Technology*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-17

2. Title: INVENTION DISCLOSURE REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

To disclose each invention under the contract as set forth in NFS 1852.227-70, New Technology.

5. Preparation Information:

The Contractor shall disclose each subject invention under the contract as set forth in NFS 1852.227-70, New Technology. The electronic and paper version of NASA Form 1679, Disclosure of Invention and New Technology (Including Software) shall be used for this reporting. Both the electronic and paper versions of this form may be accessed at http://invention.nasa.gov. Disclosures are required within two months after the inventor discloses it in writing to Contractor personnel who are responsible for the administration of the New Technology clause.

6. Applicable Documents:
   1)NFS 1852.227-70, New Technology

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-18

2. Title: NASA PROPERTY IN CUSTODY OF CONTRACTOR REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

To annually report any government owned/Contractor held property that has been furnished or that has been acquired by the Contractor under the terms of this contract.

5. Preparation Information:

Complete NASA Form (NF) 1018, *NASA Property in the Custody of Contractors*, in accordance with NFS 1852.245-73, *Financial Reporting of NASA Property in the Custody of Contractors*. Complete forms following the instructions on the form and in NFS 1845.71, and per any supplemental instructions for the current reporting period issued by the NASA Contracting Officer.

Subcontractor use of NF 1018 is not required by this clause; however, the Contractor shall include data on property in the possession of subcontractors in the annual NF 1018**.**

6. Applicable Documents:
   1) NFS 1852.245-73, *Financial Reporting of NASA Property in the Custody of Contractors*
   2) NFS 1845.71, *Government Property / Forms Preparation*

7. Reference Documents:

N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
PM-19	FEDERAL CONTRACTOR VETERANS EMPLOYMENT REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

Annual report required by the Secretary of Labor on veteran's in the Contractor federal workforce.

5. Preparation Information:

In compliance with FAR 52.222-37, *Employment Reports on Veterans*, the Contractor shall submit the Federal Contractor Veteran's Employment Reports (VETS-100A), as required by this clause. Within 30 days following the VETS-100A report submittal, the Contractor shall submit a letter to the Contracting Officer confirming that it has submitted the most recent annual VETS-100A Report required by FAR 52.222-37.

6. Applicable Documents:
   1) FAR 52.222-37, *Employment Reports on Veterans*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-20

2. Title: SUBCONTRACTING REPORTS

3. SOW/IPRD Reference:

SOW-1.2-09

4. Use:

The Government uses Subcontracting Reports for collection of subcontract data from Federal contractors, which are required to establish plans for subcontracting with small and small disadvantaged business concerns.

5. Preparation Information:

The Contractor shall submit the Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and SF 295, Summary Contract Report, electronically submit the Individual Subcontracting Reports (ISR) and Summary Subcontractor Reports (SSR) using the Electronic Subcontract Reporting System (eSRS) at http://www.esrs.gov/

In addition to the above, the Contractor is required to comply with NFS 1852.219-75, *Small Business Subcontracting Reporting*.

6. Applicable Documents:
   1) NFS 1852.219-75, *Small Business Subcontracting Reporting*

7. Reference Documents:
   1) FAR 52.219-9, *Small Business Subcontracting Plan*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-21

2. Title: EVIDENCE OF INSURANCE

3. SOW/IPRD Reference:

SOW-1.2-19

4. Use:

Required by NFS 1852.228-75.

5. Preparation Information:

Submit evidence of the insurance coverage (i.e., a Certificate of Insurance or other confirmation) as required by NFS 1852.228-75, *Minimum Insurance Coverage*, to the Contracting Officer prior to performing under this contract. The Contractor shall also present such evidence to the Contracting Officer prior to commencement of performance under any options exercised, if applicable.

6. Applicable Documents:
   1) NFS 1852.228-75, *Minimum Insurance Coverage*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

PM-22 IT SECURITY MANAGEMENT PLAN

3. SOW/IPRD Reference:

SOW-1.2-19

4. Use:

To identify how the requirements for Information Technology (IT) security will be met.

5. Preparation Information:

The IT Security Management Plan shall be prepared in accordance with NFS 1852.204-76, *Security Requirements for Unclassified Information Technology Resources*. The IT Security Management Plan will be made a part of this contract and shall be updated as required by changes in the federal law or other NASA regulations. At a minimum, the plan shall:

1) Identify how the requirements for information technology (IT) security will be met (including developing and maintaining IT system security plans, contingency plans, and performing information system security assessment).
2) Identify how specifically mandated requirements with respect to security of NASA IT resources will be met.
3) Describe how the Contractor intends to hold its employees and subcontractors accountable for meeting all the requirements relative to the NPR 2810.1A, *Security of Information Technology*.
4) Describe how the Contractor will meet future or changing IT security requirements as directed by Federal Law or NASA requirements.
5) Describe how the Contractor plans to protect their corporate IT resources to ensure that they pose no adverse impact on NASA resources.
6) Describe how the Contractor will protect NASA or contract-specific information and data under their control.
7) Describe how the Contractor plans to provide documentation for any required IT security-related deliverable.
8) Describe how the Contractor will ensure compliance with all NASA IT security training and awareness requirements.
9) Describe how the Contractor will ensure compliance with NASA-established physical security requirements as they relate to IT security requirements.
10) Describe how the Contractor will ensure compliance with personnel screening requirements including assurance that employees with privileged access have the appropriate background screening.

11) Describe the Contractor's procedures for termination of employees including assurance that all access privileges (e.g., network, remote access, virtual private network (VPN), campus computing, and other application access) are terminated.

6. Applicable Documents:
   1) NFS 1852.204-76, *Security Requirements for Unclassified Information Technology Resources*
   2) NPR 2810.1A, *Security of Information Technology*

7. Reference Documents:
   1) NPD 1600.2E, *NASA Security Policy*
   2) NPR 1600.1, *NASA Security Program Procedural Requirements*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

PM-23 CONFLICTS OF INTEREST AVOIDANCE PLAN

3. SOW/IPRD Reference:

SOW-1.2-19

4. Use:

To meet requirements for avoiding Organizational Conflicts of Interest (OCI). The plan and subsequent revisions will be reviewed and approved by the Contracting Officer. The approved plan will be incorporated into the contract as a compliance document, once approved.

5. Preparation Information:

The plan shall comply with the requirements of NFS 1852.237-72, Access to Sensitive Information and Section H of the contract, Organizational Conflicts of Interest. The plan shall explain the approach to identifying, mitigating and/or avoiding OCIs that may arise under this contract. The plan shall include, at a minimum:

1) An assessment of the potential risk for various types of conflicts such as access to sensitive, non-public information
2) The process for identifying OCIs, including the Contractor's coordination with each of its parent, subsidiary, affiliates, office locations, divisions and/or other similar entities (collectively, the "Business Units") to determine whether OCIs currently exist
3) The approach for maintaining communication with each Business Unit during the performance of this contract to identify potential OCIs arising during such performance period
4) The approach to training and refresher training for its employees
5) Once identified, the methods the Contractor will utilize to mitigate the various types of OCIs
6) The approach for ensuring the processes and procedures included herein will be applied to each of its subcontractors and/or consultants (including their respective Business Units)

6. Applicable Documents:
   1) NFS 1852.237-72, *Access to Sensitive Information*
7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: PM-24

2. Title: SAFETY AND HEALTH PLAN REVISIONS

3. SOW/IPRD Reference:

SOW-1.2-19

4. Use:

To ensure the safety and occupational health of Contractor employees and to ensure the safety of all working conditions throughout the performance of the contract.

5. Preparation Information:

The contractor shall update the safety and health plan submitted with the proposal, when necessary.

6. Applicable Documents:
   1) 1852.223-70 Safety and Health

7. Reference Documents:
   N/A

2.2 REVIEWS

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: RE-01

2. Title: INSTRUMENT SYSTEMS REQUIREMENTS REVIEW (ISRR)

3. SOW/IPRD Reference:

SOW-1.3-05

4. Use:

The ISRR examines the functional and performance requirements defined for the Instrument and the preliminary project plan, and ensures that the requirements and Instrument concept will satisfy the mission. The ISRR also confirms that an Instrument design concept is presented that identifies lower level systems of interest and their resource allocations, and that traceability exists among the mission science, operations and technical requirements.

The ISRR Data Package establishes presentation material and documentation that the Government will make electronically available to Review Panel Members in preparation for and conduct of the review.

5. Preparation Information:

The ISRR Data Package shall consist of two elements: (1) Presentation Material (such as charts and any other associated media such as movies, animations, etc.) for oral presentation to Review Panel Members, and (2) Documentation Set for provision to Review Panel Members prior to the review. The ISRR Data Package shall contain all relevant information required to satisfy Section 4.4 of LPR 7120.7, Space Flight Independent Life Cycle Review Procedural Requirements. NPR 7123.1B contains additional guidance on the ISRR content, entrance, and success criteria. Specific details of the review data package will be defined in a review Terms of Reference document developed collaboratively between the Government and Contractor.

6. Applicable Documents:
   1) LPR 7120.7, *Space Flight Independent Life Cycle Review Procedural Requirements*
   2) NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*

7. Reference Documents:
   1) NASA SP-2007-6105, *NASA Systems Engineering Handbook*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

RE-02 INSTRUMENT PRELIMINARY DESIGN REVIEW (IPDR)

3. SOW/IPRD Reference:

SOW-1.3-05

4. Use:

The IPDR demonstrates that the Instrument preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. The IPDR will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described. Full baseline cost and schedules, as well as risk assessments, management systems, and metrics are presented.

The IPDR Data Package establishes presentation material and documentation that the Government will make electronically available to Review Panel Members in preparation for and conduct of the review.

5. Preparation Information:

The IPDR Data Package shall consist of two elements: (1) Presentation Material (such as charts and any other associated media such as movies, animations, etc.) for oral presentation to Review Panel Members, and (2) Documentation Set for provision to Review Panel Members prior to the review. The IPDR Data Package shall contain all relevant information required to satisfy Section 4.7 of LPR 7120.7, Space Flight Independent Life Cycle Review Procedural Requirements. NPR 7123.1B contains additional guidance on the IPDR content, entrance, and success criteria. Specific details of the review data package will be defined in a review Terms of Reference document developed collaboratively between the Government and Contractor.

6. Applicable Documents:
   1) LPR 7120.7, *Space Flight Independent Life Cycle Review Procedural Requirements*
   2) NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*

7. Reference Documents:
   1)NASA SP-2007-6105, *NASA Systems Engineering Handbook*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

RE-03 INSTRUMENT CRITICAL DESIGN REVIEW (ICDR)

3. SOW/IPRD Reference:

SOW-1.3-05

4. Use:

The ICDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, test, and calibration. The ICDR determines whether the technical effort is on track to complete the flight and ground support equipment development, meeting performance requirements within the identified cost and schedule constraints. Progress against management plans, budget, and schedule, as well as risk assessments are presented.

The ICDR Data Package establishes presentation material and documentation that the Government will make electronically available to Review Panel Members in preparation for and conduct of the review.

5. Preparation Information:

The ICDR Data Package shall consist of two elements: (1) Presentation Material (such as charts and any other associated media such as movies, animations, etc.) for oral presentation to Review Panel Members, and (2) Documentation Set for provision to Review Panel Members prior to the review. The ICDR Data Package shall contain all relevant information required to satisfy Section 4.8 of LPR 7120.7, Space Flight Independent Life Cycle Review Procedural Requirements. NPR 7123.1B contains additional guidance on the ICDR content, entrance, and success criteria. Specific details of the review data package will be defined in a review Terms of Reference document developed collaboratively between the Government and Contractor.

6. Applicable Documents:
   1) LPR 7120.7, *Space Flight Independent Life Cycle Review Procedural Requirements*
   2) NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*

7. Reference Documents:
   1) NASA SP-2007-6105, *NASA Systems Engineering Handbook*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: RE-04

2. Title: INSTRUMENT PRE-ENVIRONMENTAL REVIEW (IPER)

3. SOW/IPRD Reference:

SOW-1.3-05

4. Use:

The purpose of the IPER is to ensure that the Instrument hardware/software, test facilities, ground support equipment, personnel, and test procedures are ready for Instrument-level environmental testing, calibration, data acquisition, data processing and evaluation, and data archival. The review also ensures that a proper Instrument performance baseline has been established.

The IPER Data Package establishes presentation material and documentation that the Government will make electronically available to Review Panel Members in preparation for and conduct of the review.

5. Preparation Information:

The IPER Data Package shall consist of two elements: (1) Presentation Material (such as charts and any other associated media such as movies, animations, etc.) for oral presentation to Review Panel Members, and (2) Documentation Set for provision to Review Panel Members prior to the review. The IPER Data Package shall contain all relevant information required to satisfy Section 4.11 of LPR 7120.7, Space Flight Independent Life Cycle Review Procedural Requirements, plus details on the Instrument calibration campaign. NPR 7123.1B contains additional guidance on the IPER content, entrance, and success criteria. Specific details of the review data package will be defined in a review Terms of Reference document developed collaboratively between the Government and Contractor.

6. Applicable Documents:
   1) LPR 7120.7, *Space Flight Independent Life Cycle Review Procedural Requirements*
   2) NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*

7. Reference Documents:
   1) NASA SP-2007-6105, *NASA Systems Engineering Handbook*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: RE-05

2. Title: INSTRUMENT SYSTEM ACCEPTANCE REVIEW (ISAR)

3. SOW/IPRD Reference:

SOW-1.1-03, SOW-1.3-05

4. Use:

The purpose of the SAR is to examine the Instrument system(s), its end items and documentation, and test data and analysis that support verification and qualification and to ensure the Instrument meets acceptance criteria and that there is a high level of confidence that the Instrument complies with requirements and specifications, that the documentation delivered is complete and current, that the Instrument has sufficient technical maturity to warrant shipment to the Satellite integration facility.

The ISAR Data Package establishes presentation material and documentation that the Government will make electronically available to Review Panel Members in preparation for and conduct of the review.

5. Preparation Information:

The ISAR Data Package shall consist of two elements: (1) Presentation Material (such as charts and any other associated media such as movies, animations, etc.) for oral presentation to Review Panel Members, and (2) Documentation Set for provision to Review Panel Members prior to the review. The IPER Data Package shall contain all relevant information required to satisfy Section 4.12 of LPR 7120.7, Space Flight Independent Life Cycle Review Procedural Requirements, plus details on the Instrument calibration. NPR 7123.1B contains additional guidance on the ISAR content, entrance, and success criteria. Specific details of the review data package will be defined in a review Terms of Reference document developed collaboratively between the Government and Contractor.

6. Applicable Documents:
   1) LPR 7120.7, *Space Flight Independent Life Cycle Review Procedural Requirements*
   2) NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*

7. Reference Documents:
   1) NASA SP-2007-6105, *NASA Systems Engineering Handbook*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

RE-06 INSTRUMENT PRE-SHIP REVIEW (IPSR)

3. SOW/IPRD Reference:
SOW-1.3-05

4. Use:
The purpose of the IPSR is to assess the Instrument and ground support equipment health and status and readiness for shipment to the Satellite integration facility; readiness of the Satellite integration facility to receive the Instrument and associated equipment; and readiness of the plans, procedures, and personnel for transporting the Instrument and associated equipment to the Satellite integration facility. Authorization to ship may be granted following successful completion of the review. The IPSR Data Package establishes presentation material and documentation that the Government will make electronically available to Review Panel Members in preparation for and conduct of the review.

5. Preparation Information:
The IPSR Data Package shall consist of two elements: (1) Presentation Material (such as charts and any other associated media such as movies, animations, etc.) for oral presentation to Review Panel Members, and (2) Documentation Set for provision to Review Panel Members prior to the review. The IPSR Data Package shall contain, but not be limited to:

- Data and performance trend analyses indicating Instrument health & status;
- Readiness of Instrument and Ground Support Equipment for shipment;
- Detailed shipping / transportation plans and procedures;
- Receiving and unpacking plans and procedures at Satellite integration facility;
- Plans for conduct of Instrument Bench Acceptance Test at Satellite integration facility;
- Plans for verifying any requirements deferred until just prior to shipment or after delivery to Satellite integration facility.

Specific details of the review data package will be defined in a review Terms of Reference document developed collaboratively between the Government and Contractor.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

2.3 SYSTEMS ENGINEERING

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
SE-01	SYSTEMS ENGINEERING MANAGEMENT PLAN

3. SOW/IPRD Reference:

SOW-1.3-02

4. Use:

To document the Contractor's implementation plan for the performance of systems engineering functions and the development of systems engineering products.

5. Preparation Information:

The Systems Engineering Management Plan (SEMP) shall document the Contractor's systems engineering approach for requirements development; technical solution definition; design realization; product evaluation; product transition; and technical planning, control, assessment, and decision analysis. The SEMP shall provide the basis for implementing the Contractor's technical effort and communicating what will be done, by whom, when, where, cost drivers, and why it is being done. In addition, the SEMP shall identify the roles and responsibility interfaces of the technical effort and how those interfaces will be managed. The SEMP shall also address:

1) The Contractor's application of systems engineering to subcontractor-based activities and the approach to requirements flowdown, oversight, review, verification, acceptance, and integration of subcontractor products.
2) The Contractor's technical peer review process for instrument and ground support equipment components, subsystems, systems, software, and test / calibration, including:
    a) The review plan philosophy and hierarchy;
    b) The processes and review panel membership for each type of review;
    c) The process for receiving, tracking and closing Requests For Action (RFAs);
    d) A preliminary list and schedule of reviews to be held;
3) The Contractor's approach for preparation and support of major Project life cycle reviews such as ISRR, IPDR, ICDR, IPER, ISAR, IPSR.

The Contractor's SEMP may be developed in accordance with the Contractor's established corporate systems engineering frameworks and practices, but should be consistent with the SEMP content prescribed in NPR 7123.1B as applicable.

6. Applicable Documents:
   1) NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*

7. Reference Documents:
   1) NASA/SP-2007-6105 Rev. 1, *NASA Systems Engineering Handbook*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SE-02

2. Title: CHANGE REQUESTS

3. SOW/IPRD Reference:

SOW-2.1-04

4. Use:

Preparation and submission of change requests for NASA evaluation.

5. Preparation Information:

This DRD encompasses Contractor change requests, inclusive of engineering and cost / schedule baseline change requests. Change Requests may be submitted in contractor-preferred forms / format.

Changes shall be classified as either Class-I or Class-II per NASA-STD-0005 Section 5.5.2. Engineering Change Requests for all Class-I changes shall be prepared and submitted as prescribed in NASA-STD-0005 Section 5.5.1 and Appendix D. Class II configuration changes performed by the contractor normally do not require submission or government approval unless they are written against documents that are under Government configuration control.

6. Applicable Documents:
   1) NASA-STD-0005, *NASA Configuration Management (CM) Standard*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

SE-03 SYSTEM PERFORMANCE VERIFICATION PLAN

3. SOW/IPRD Reference:

SOW-2.3-06

4. Use:

Provides the overall approach for accomplishing the performance verification program. Defines the specific tests, analyses, calibrations, alignments, models, etc. that will demonstrate that the hardware, software, and ground support equipment meets performance requirements.

5. Preparation Information:

The System Performance Verification Plan (SPVP) shall be prepared in accordance with GSFC-STD-7000A Section 2.1.1.1. The SPVP shall be inclusive of instrument hardware, software, and ground support equipment and provide a comprehensive description of all planned analytical, test, and calibration activities that will assure the Instrument and associated Ground Support Equipment will meet the requirements of the Performance Specification and Instrument Performance Requirements Document. The SPVP shall additionally address, at a minimum:

1) The Contractor's approach to performance verification of subcontracted items;
2) The Contractor's approach to requirements tracking, verification, and Government concurrence;
3) Identification of requirements that can only be verified at subsystem levels, and rationale for not being able to verify / re-verify at Instrument level;
4) Identification of requirements that can only be verified during Observatory-level testing, and rationale for not being able to verify at Instrument-level;
5) Identification of requirements that can only be verified on orbit, and rationale for not being able to verify at Instrument or Observatory-level.

6. Applicable Documents:
1)GSFC-STD-7000A, *General Environmental Verification Standard for GSFC Programs and Projects*, April 2013.

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SE-04

2. Title: INSTRUMENT PERFORMANCE SPECIFICATION

3. SOW/IPRD Reference:

SOW-2.2-03

4. Use:

Provides documentation of detailed Instrument design specifications, requirements, allocations, and budgets to the Instrument component-level (or lower).

5. Preparation Information:

The Instrument Performance Specification shall document the Contractor's decomposition of requirements within the contract Instrument Performance Requirements Document and Instrument-to-Spacecraft Interface Control Document(s) to detailed Instrument design and performance specifications, requirements, allocations, and budgets, to the component-level (or lower). The Instrument Performance Specification shall contain detailed uncertainty budgets for all radiometric sensor channels and all elements that impact radiometric performance. Allocations and budgets shall include on-orbit effects and identify any remaining available margin. The Instrument Performance Specification shall include a specification tree that illustrates the flowdown of requirements to the component-level or lower. Document numbers shall be denoted on the specification tree, if applicable.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

SE-05 INDENTURED DRAWING LIST AND DRAWING TREE

---

3. SOW/IPRD Reference:

SOW-2.3-04

---

4. Use:

Provide information for: (1) Configuration Management of the Instrument and associated Equipment, (2) tool for understanding interaction between components and subsystems in case of non-nominal performance assessments are needed, and (3) tool for understanding effects of proposed changes of load environments or operation procedures on the Instrument.

5. Preparation Information:

The Indentured Drawing Lists shall be indented, hierarchical lists all engineering drawings used in the production of contract deliverables. Drawing Trees shall be graphical, flow-chart style representation of the drawing hierarchy. Separate mechanical and electrical drawing trees and lists shall be prepared for each contract deliverable item.

1) Indentured Drawing List

The Indentured Drawing List (IDL) shall list, in hierarchal form, all the drawings constituting the product design, including Subcontractor drawings.

2) For each drawing, the IDL shall contain the following information:

a) Indenture Level: This field shall document the indenture level of the drawing;
b) Drawing Number: This field shall document the drawing number;
c) Revision Letter: This field shall document the latest revision letter of the drawing applicable to the System, with any active engineering change orders noted;
d) Drawing Title: This field shall document the title of the drawing;
e) Drawing Type: This field shall document the drawing type which the drawing belongs to (e.g. Detail Assembly Drawing, Specification Control Drawing, Wiring List, Procured End Item, Modified End Item, etc.);
f) Drawing Size: This field shall document the sheet size of the drawing (e.g. A2, A3, etc.); and
h) Number of Sheets: This field shall document the number of sheets making up the drawing.

3) Contractor format is as acceptable.

4) Drawing tree (DT)

The Drawing Tree shall provide a graphical representation of the information contained in the IDL, including but not limited to, links to between upper and lower assemblies, indentured levels within sub-assemblies, and grouping of drawings within subassemblies.

5) Each Drawing shall be represented by a unique Drawing Object (DO) with the following information.

a) The DO collocated within the DT document in a manner that represents the indentured level specified in the IDL.

b) The IDL information included in the DO shall include but not be limited to the following:

i) Identification of the applicable system / subsystem / component;
ii) Drawing Name;
iii) Drawing Number and revision.

c) The DO shall be presented in the DT in a manner that shows relationship to upper and lower assemblies and same level components.

5.2.2 Contractor format is acceptable.

6. Applicable Documents:
N/A

7. Reference Documents:
1) ASME Y14.5-100
2) MIL-DTL-31000C

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

SE-06 ENGINEERING DRAWINGS

---

3. SOW/IPRD Reference:

SOW-2.3-04

---

4. Use:

To document detailed design and fabrication specifications in the form of engineering drawings. To provide engineering drawings for technical discussions, evaluations, manufacturing, fabrication, assembly, test, operations and maintenance.

5. Preparation Information:

The engineering drawings shall accurately represent all features that describe the construction of the instrument, including but not limited to mechanical, electrical and electronic components and assemblies; logic diagrams; schematics, assemblies as listed in documents specified in DRD SE-05. Engineering drawings shall accurately describe the instrument design and manufacture, including manufactured and procured components, assemblies, integration, and test and control interfaces. The engineering drawings shall include all reference type drawings such as layouts, schematics, diagrams, mechanical drawings, electrical schematics, logic diagrams, and block diagrams. Logic diagrams shall cover the system, subsystem and component electronics and shall identify the signal inputs and outputs, internal signal flow, and the next level external connections.

Interface control drawings and applicable Instrument layouts shall include the envelopes of stowed, extended, and critical intermediate positions of the moving mechanical assemblies and deployables with respect to fields of view and surrounding structure, components or other hardware. All drawing changes including engineering change orders / notices are included under this requirement.

This delivery includes wiring diagrams. These wiring diagrams shall cover the system, subsystem, component electronics, and interface with electrical/mechanical ground support equipment. It shall identify each wire by its classification:

1) Ground (differentiate between power return, shield, and chassis grounds)
2) Signal
3) Power
4) Wire type, ratings, material, etc.
5) Connector/Backshells
6) Harness bundle braids and termination with backshell
7) Harness between subsystems and EGSE

The diagrams shall trace each wire's runs identifying all path connections (by connector/pin number). Wire designators shall be clearly delineated for legibility.

All engineering drawings shall be Contractor's designated format, no larger than E size (34 inches x 44 inches) and be capable of being reproduced.

Electronic image format files shall be in full sized Portable Document Format (PDF).

All engineering drawings shall be accessible by the Government in a secure web-based database to serve as a source of information exchange.

All engineering drawings shall comply with standard ASME Y14.5-100. Final drawings shall contain all necessary revisions to incorporate all approved changes (engineering orders) and to reflect all changes through final acceptance of the Instrument by the government.

6. Applicable Documents:
   1) ASME Y14.5-100

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SE-07

2. Title: INSTRUMENT ELECTRICAL GROUND SUPPORT EQUIPMENT VERIFICATION REPORT

3. SOW/IPRD Reference:

SOW-6.3-05

4. Use:

Documents compliance of instrument electrical ground support equipment to functional performance requirements and establishes suitability for use with instrument flight hardware.

5. Preparation Information:

The Instrument EGSE Verification Report shall document the steps and procedures used to verify the EGSE meets the design and functional performance requirements of the Instrument Performance Requirements Document and Contractor's EGSE specification. The report shall document that the EGSE is suitable for its safe and intended use with instrument hardware. The report shall include, at a minimum:

1) Overview description of the verification effort;
2) Identification and description of all hardware and software components and systems used to verify proper functionality of the EGSE;
3) Identification of methods, tests, and procedures used to verify proper functional performance;
4) Summary of verification activity results;
5) Detailed description of notable findings, discrepancies, anomalies, or out-of-family performance and their dispositions;
6) Completed Requirements Verification Matrix per DRD SE-15 attached as an appendix; and
7) As-run test and/or verification procedures attached as an appendix.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
SE-08	INSTRUMENT SYSTEM PERFORMANCE VERIFICATION REPORT

3. SOW/IPRD Reference:

SOW-2.3-07

4. Use:

Documents the Instrument performance verification results and compliance with functional, radiometric, and interface requirements.

5. Preparation Information:

The Instrument System Performance Verification Report shall summarize the results and findings of verification activities performed per the Instrument System Performance Verification Plan, DRD SE-03. The report shall include all information needed to demonstrate and assure NASA that Instrument performance requirements are and will continue to be fully met over the mission lifetime. This information shall include summaries of appropriate analyses, data, test results, and calibration data used in support of Instrument performance verification.

The report shall contain, at a minimum:

1) Summary of as-run verification sequence including dates, times, personnel present, cross-reference to the test procedure number(s), test reports, or analyses used in the verification;
2) Summary and results of each activity and an assessment of the quality and acceptability of the item tested, including pass/fail criteria, and performance against the criteria;
3) Margin analysis of key performance measures based on actual vs. required values;
4) Summary of any non-conformances, discrepancies, anomalies, failures, and out-of-family results and the resolution and corrective actions taken;
5) Listing of Waivers / Deviations;
6) Summary of instrument peculiarities;
7) Reference to the completed Requirements Verification Matrices per DRD SE-15.

6. Applicable Documents:
N/A
7. Reference Documents:
1) GSFC-STD-7000A, *General Environmental Verification Standard for GSFC Programs and Projects*, April 2013, Section 2.1.1.6.

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SE-09

2. Title: INSTRUMENT MASS PROPERTIES REPORT

3. SOW/IPRD Reference:

SOW-7.3-05

4. Use:

To document mass properties and mass margins for the instrument and its major components / subsystems.

5. Preparation Information:

The Instrument Mass Properties report shall contain detailed tabulated values of mass properties and margins for the instrument and each major instrument component and/or subsystem in (a) launch mode, and (b) fully-deployed on-orbit nominal operational mode. Mass properties shall include mass, center of gravity, moments of inertia, and products of inertia, for each separately-mounted component of the instrument, and aggregate values for the total instrument. The report shall document any variability in mass properties caused by moving masses or deployables. Values reported shall be organized by each major component / subsystem. Values shall be reported in metric (SI) (primary) and U.S. English (secondary) units. The report shall be initially based upon calculated values and shall be updated as calculations are revised and actual measured data become available. Values shall be denoted to indicate whether each value is estimated, calculated, or measured. Following environmental testing and prior to Instrument shipment to the Spacecraft integration facility, the report shall contain a complete mass properties summary of the final Instrument mass properties as measured and remaining margins. The report shall include nominal and 3-sigma uncertainties for measured and/or measurement-derived mass, centers of gravity, moments of inertia, and products of inertia. The report shall contain a chronological log of mass history and a summary of all mass property changes incurred since the prior revision of the report.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

SE-10 INSTRUMENT PERFORMANCE TREND ANALYSIS REPORT

---

3. SOW/IPRD/PI Reference:

SOW-2.5-05, Performance Incentive f.3 and f.4

---

4. Use:

Documents measurement and performance trends of key instrument parameters for the purposes of indicating either stable performance or unstable performance that may indicate degradation or reduction in reliability of the instrument.

5. Preparation Information:

The Instrument Performance Trend Analysis Report shall present graphical trend results of key Instrument performance parameters mutually determined by the Contractor and the Government for the purposes of illustrating performance stability. Plots shall contain measured data and allowable limits plotted as a function of time. Any variability in trend plots caused by environmental conditions (e.g., Thermal Vacuum hot vs. Thermal Vacuum cold) shall be explained. Trend plots shall begin as early as the subsystem level (where applicable) and continue through the instrument environmental test campaign and final Comprehensive Performance Test. The report shall additionally contain, at a minimum:

1) The listing of each parameter trended, including:
    a) Identification and description of each parameter;
    b) Units of measure for each parameter;
    c) Whether each parameter is directly measured or derived, and if derived, the explanation of the derivation;
    d) Allowable limits for each parameter;
2) Narrative sections that evaluate and summarize trend results of each parameter;
3) Detailed descriptions of the cause and impact of any unique or unexpected performance trend attributes, including any dependence on instrument orientation;
4) Instrument Operations Log, including:
    a) Date, Operational Event, and Power On / Power Off Times;
    b) Discrete and cumulative values for:
        i) Survival and operational power;
        ii) Mechanism actuations;
        iii) Number of cycles on any limited life / limited use / expendable item;

c) Number of hours since last failure.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SE-11

2. Title: SPARE PARTS PLAN AND LIST

3. SOW/IPRD Reference:

SOW-4.4-02

4. Use:

To document the Contractor's approach and plan for identifying and obtaining spare parts and establish a spare parts list.

5. Preparation Information:

The Spare Parts Plan and List shall define the Contractor's rationale and plan for identifying and obtaining spare parts for contract deliverables to ensure the Instrument is ready for launch. The Spare Parts Plan and List shall focus on spares for parts that are deemed critical because they may be fragile, hard to reproduce, not commonly stocked, or require long lead times that may result in project schedule delays if a spare was needed and is not available. The Plan shall address how spare flight parts will be qualified, tested, and calibrated to the same standards as the flight instrument articles consistent with their spared level of assembly.

The Spare Parts List shall:

1) List the spare parts, devices, materials, assemblies and components to be provided;
2) Identify the "critical spares," those with limited life/cycle, hard to reproduce, or long lead items
3) Identify Assembly part number, serial number, and next assembly.
4) Identify serial numbers, lot numbers, purchase order numbers, or any other means which will assure traceability of each listed item;
5) Include quality assurance verification to substantiate that each item is built and flight qualified to the as-planned configuration.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
SE-12	RADIOMETRIC TEST MODEL CHARACTERIZATION REPORT

3. SOW/IPRD Reference:

SOW-4.2-02

4. Use:

This report is used to document the Radiometric Test Model (RTM) design, fabrication, testing, radiometric performance, and lessons learned for incorporation into the flight Instrument design.

5. Preparation Information:

The RTM Characterization report shall include, but not be limited to:

1) Any studies, analyses, trades, or assessments performed to develop/refine the RTM component/sub-system design, parts/component selection, fabrication/manufacturing, screening, selection, assembly, integration and test, including calibration targets;
2) Description of RTM test activities;
3) Characterization data and test results indicating the RTM radiometric performance including short-term (48 hour) stability and linearity;
4) RTM spectral response measurements characterization by analysis using piece part measurements from 0.3 um to 50 um;
5) Description of RTM optical performance design, including telescope optical performance data collected at the telescope suppliers;
6) RTM spatial and temporal response characterization, spatial response analysis, and measurement of temporal response;
    a) Characterization of potential strain effects on the detector due to acceleration;
7) Description of design elements used to minimize stray light susceptibility and mitigation approaches;
8) Risk Assessments of the RTM;
9) Technology maturation of RTM components required for the flight Instrument;
10) Lessons Learned for incorporation into the flight Instrument design.

6. Applicable Documents:
N/A
7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
SE-13	ENGINEERING DEVELOPMENT UNIT CHARACTERIZATION REPORT

3. SOW/IPRD Reference:

SOW-4.3-02

4. Use:

This report is used to document the Engineering Development Unit (EDU) design, fabrication, testing, functional and radiometric performance, and lessons learned for incorporation into the flight Instrument design.

5. Preparation Information:

The Contractor shall document all EDU studies, analyses, trades, performance, characterization, and risk assessments.

This report shall include and is not limited to:

1) Any studies, analyses, trades, or assessments performed to develop/refine the component/sub-system design, parts/component selection, fabrication/manufacturing, screening, selection, assembly, integration, and test;
2) Demonstrated radiometric performance of EDU sensor channels and assessment of compliance with Instrument performance requirements;
3) Structural performance and compliance with flight Instrument structural requirements;
4) Demonstrated performance of all EDU subsystems;
5) Correlation with numerical model predictions;
6) Demonstrated performance of the operational modes;
7) Demonstrated performance of the software;
8) Assessment of meeting physical and mass property constraints for the flight unit;
9) Reliability assessments;
10) Risk Assessments;
11) Technology maturation required for the flight unit;
12) Lessons Learned; and
13) An assessment of the work required to upgrade the EDU to a flight unit.

6. Applicable Documents:
N/A

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

SE-14 INSTRUMENT DATA SETS

---

3. SOW/IPRD Reference:

SOW-10.2-01

---

4. Use:

To provide Instrument data sets for use in JPSS Ground Segment testing and for independent review. To provide interim data files of the key acceptance test data taken during the acceptance test sequence in the Contractor's format and with appropriate logs in a timely manner for real-time discussion of test results with the Government. Final Test Data Files shall be submitted as part of the EIDP / Acceptance Data Package.

5. Preparation Information:

The Contractor shall prepare and deliver Instrument test data sets simulating at least 72-hour continuous science data. The sensor test data sets will be determined by the Contractor and will include at least two sets: one representing normal Instrument operation and one with as many different configuration modes and data types as possible.

For Instrument-level test output these data sets shall consist of:

1) Unprocessed detector sample data with associated time indexing information.
2) Instrument ancillary data that would be included in the JPSS mission data stream and associated time indexing information.
3) Instrument housekeeping information that would be included in the observatory telemetry stream and associated time indexing information.

These data shall be provided in a format consistent with the Instrument-to-Spacecraft ICD accompanied by corresponding descriptive documentation.

These data sets shall be provided on standard commercially available digital media.

For the preparation of observatory-level test output these data sets shall consist of:

1) Unprocessed detector sample data with associated time indexing information.
2) Instrument ancillary data that would be included in the JPSS mission data stream and associated time indexing information.
3) Observatory ancillary data that would be included in the JPSS mission data stream and associated time indexing information. Ancillary data fields that are not available or are not meaningful in the prelaunch environment (e.g., ephemeris) may be simulated.

4) Instrument housekeeping information that would be included in the observatory telemetry stream and associated time indexing information.
5) Observatory housekeeping information that would be included in the observatory telemetry stream and associated time indexing information.

These data shall be provided in a format consistent with the Instrument-to-Spacecraft ICD accompanied by corresponding descriptive documentation.

These data sets shall be provided on standard commercially available digital media.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

SE-15 REQUIREMENTS VERIFICATION MATRICES

---

3. SOW/IPRD Reference:

SOW-2.3-08

---

4. Use:

Tracking and documentation of verification of compliance to requirements.

5. Preparation Information:

One or more Requirements Verification Matrices shall be prepared. Requirements Verification Matrices shall include the following columns at a minimum:

1) Requirement Unique Identifier (e.g. Requirement Number)
2) Requirement Statement
3) Responsibility*: I = Instrument Contractor, S/C = Spacecraft Contractor, N = NASA, or combinations of these responsibilities (I-N, I-S/C, N-S/C).
4) Verification Level:

   a) On-Orbit: 1
   b) Observatory + Ground System**: 2
   c) Observatory (Spacecraft + Instruments)***: 3
   d) Instrument or Spacecraft****: 4
   e) Instrument Subsystem: 5
   f) Box, component, or part: 6

5) Verification Method: I = Inspection, A = Analysis, D = Demonstration, T = Test, or combinations of these methods (IA, AT, etc.)
6) Compliance: Y = Yes, W = Waiver, P = Pending, D = Deferred
7) Verification Artifact: Citation to the procedure, test report, analysis report, inspection report, etc. used as the verification artifact;
8) Verification Step: Identification of the procedure step, report section, etc. that shows compliance (or non-compliance) with the requirement;
9) Approval: Identification of personnel certifying verification of the requirement;
10) Comments: For any additional pertinent comments related to the requirement, such as reference to a waiver number.

*The Contractor is not responsible for completing the verification items (4) through (10) for requirements that do not have Instrument Contractor responsibility. However, these requirements shall be included in the matrices for tracking purposes.

**The Observatory + Ground System verification level is a verification that occurs during an End-to-End ground test utilizing the fully assembled Observatory and Observatory ground system.

***Observatory-level verification is a verification that occurs after the Instrument has been integrated to the Spacecraft.

****Instrument or Spacecraft-level verification is a verification that occurs at the fully-assembled Instrument or Spacecraft bus level, but before the Instrument has been integrated to the Spacecraft.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

2.4 MISSION ASSURANCE

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: MA-01

2. Title: MISSION ASSURANCE IMPLEMENTATION PLAN

---

3. SOW/IPRD Reference:

SOW-3.1-01; SOW-3.8-13

---

4. Use:

To identify the (1) applicable Systems Safety, Reliability, Quality, Parts, Materials and Processes, Configuration Management, and Software Assurance requirements; (2) methods, procedures, and instructions to be used to implement the requirements; and (3) organization (including position and names) responsible to assure applicable requirements are satisfied for the implementation of a system safety and mission assurance program.

Documents the Contractor's plan for GSE that will be used in the development of flight items.

Establishes the Non-Destructive Evaluation (NDE) plan for the procedures and specifications employed in the inspection of materials.

---

5. Preparation Information:

1) The Mission Assurance Implementation Plan (MAIP) shall cover:
   a) All flight hardware and software that is designed, built, or provided by the Contractor and its subcontractors, from project initiation through launch and mission operations
   b) The GSE that interfaces with flight equipment to the extent necessary to assure the integrity and safety of flight items
   c) A Nondestructive Evaluation (NDE) Plan
   d) Applicable and reference documents
   e) Order of precedence
   f) Contractor organization, responsibility assignments, interfaces, and reporting structures
   g) CDRL submittal plan
   h) Implementation of engineering changes
   i) Usage of any legacy hardware/software from any NASA program/project (flight, nonflight, GSE)
   j) Anticipated waivers

k) Reviews
l) Suspension of work activities
m) Supplier oversight, audits and requirements flow-down
n) Internal audits at Contractor facilities
o) Nonconformance management system (MRB/Anomaly Review Board (ARB))
p) Government Surveillance and Mandatory Inspection Points (MIPs)
q) Safety and Mission Assurance (S&MA) meeting/reporting frequency and deliverables
r) Acronym list

2) The MAIP shall include the Instrument Mission Assurance Requirements (IMAR) Compliance Matrix for all mission assurance requirements.

3) Subsequent to approval, the MAIP will become the implementation document for RBI Program Assurance tasks.

4) The MAIP shall include the Quality Status Stamp (QSS) control system.

5) The GSE section of the MAIP shall address the GSE systems and equipment requirements with respect to procurement, development, test, operation, and maintenance for flight systems. The plan shall address support to flight items to the extent necessary to assure functional integrity of flight items, including health and safety.

   a) The Contractor shall address tool and hardware controls within their plan (addressing accountability and missing tool/hardware prevention).

   b) The Contractor shall identify GSE functions necessary to develop and test flight items and plans for developing and building GSE.

6) The NDE Plan shall describe the process for establishment, implementation, execution and control of NDE. The plan shall meet the intent of MIL-HDBK-6870, Inspection Program Requirements, Non-destructive for Aircraft and Missile Materials and Parts and NASA-STD-5009 Non-destructive Evaluation Requirements for Fracture-Critical Metallic Components, as specified by NASA-STD-6016.

   a) The plan shall define Non-Destructive Test (NDT) planning and requirements to include the following:

      i. Hardware Design
      ii. Manufacturing Planning
      iii. Personnel Training
      iv. NDE Reliability Requirements for Fracture Critical Parts
      v. NDE Reporting

---

6. Applicable Documents:
   1) GSFC-PPL-21, *Goddard Space Flight Center (GSFC) Preferred Parts List*, PPL-21

2) NASA-STD-8729.1, *Planning, Developing and Managing an Effective Reliability and Maintainability (R&M) Program*
3) NASA-STD-8709.2, *NASA Safety and Mission Assurance Roles and Responsibilities for Expendable Launch Vehicle Services*
4) MIL-STD-882, *Department of Defense Standard Practice for System Safety*
5) NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*
6) NASA STD-8719.13, *Software Safety*
7) NASA-STD-8719.24, *NASA Expendable Launch Vehicle Payload Safety Requirements*
8) *NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts*
9) NASA-STD-8719.9, *Standard for Lifting Devices and Equipment*
10) GSFC-STD-1000, *Rules for the Design, Development, Verification, and Operation of Flight Systems*
11) ANSI/NCSL Z540.1-1994, *Requirements for the Calibration of Measuring and Test Equipment*
12) ANSI/ESD S20.20-1999, *Protection of Electrical and Electronic Parts, Assemblies and Equipment*
13) NASA-STD-6016, *Standard Materials and Processes Requirement for Spacecraft*
14) MIL-HDBK-6870, *Inspection Program Requirements, Non-destructive for Aircraft and Missile Materials and Parts*
15) NASA-STD-5009, *Non-destructive Evaluation Requirements for Fracture-Critical Metallic Components*

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-02

2. Title: SAFETY AND MISSION ASSURANCE ACTION ITEM TRACKING LIST

3. SOW/IPRD Reference:

SOW-3.1-06, SOW-3.2-18

4. Use:

Track the Contractor's action items for weekly status updates.

5. Preparation Information:

1) The Safety and Mission Assurance Action Item Tracking List shall include the following information:
    a) Item identification
    b) Title
    c) Description
    d) Actionee(s)
    e) Date of initiation
    f) Estimated closure target date
    g) Status updates with individual entry dates
    h) Actual closure date.
2) The Safety and Mission Assurance Action Item Tracking List shall include the status of delivery and approval of Mission Assurance (MA) DRDs.
3) The Safety and Mission Assurance Action Item Tracking List shall include a list of all Minor nonconformances and the recommended and implemented dispositions of each.

6. Applicable Documents:
N/A
7. Reference Documents:

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-03

2. Title: CONTRACTOR WAIVER / DEVIATION REQUEST

3. SOW/IPRD Reference:

SOW-3.2-32

DRD MA-32

4. Use:

Request government approval of a waiver, to control departure from specified contract requirements.

5. Preparation Information:

1) The Contractor shall identify the requirements that apply to the product and provide specific information regarding the noncompliance of the product with the requirements.
2) The Contractor shall identify the effect of the proposed noncompliance on product performance at higher levels of assembly.
3) Deviation/Waiver Requests shall be prepared on a NASA Langley Form 147, "Contractor Deviation/Waiver Requests," and submitted to the Government CO or designated representative for approval. Deviation/Waiver Requests shall be sequentially numbered.
4) Where urgency is a prime requirement, the Government CO or designated representative may grant a deviation/waiver request by telephone and/or email which must be followed by a written request within one working day. The Government CO shall confirm the authorization for the submitted waiver/deviation.
5) The request shall include any impact that would result from Government CO disapproval.
6) When a specific safety requirement cannot be met, the Contractor shall enter the word “SAFETY” as the first word in the Contractor Deviation/Waiver Request", NASA Langley Form 147, Section 2, Description of Deviation/Waiver.
7) The Contractor shall address the risk and the method of controlling risk introduced by the approval of this waiver/deviation.

6. Applicable Documents:

1) SAE AS9100, *Quality Systems - Aerospace - Model for Quality Assurance in Design, Development, Production, Installation and Servicing*

2) LF 147, *Contractor Deviation/Waiver Requests* (LaRC) form.

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

MA-04 ANOMALY AND FAILURE REPORTS

---

3. SOW/IPRD Reference:

SOW-3.2-23; SOW-3.2-28

---

4. Use:

Develop a Major Anomaly / Failure Report for each major anomaly / failure for submission to the Government for approval.

Document major anomalies and/or failures, investigative activities, rationale for closure, and corrective and preventive actions.

To provide reporting, corrective action, risk assessment, and closure of all hardware and software failures.

---

5. Preparation Information:

1) Reporting of failures shall begin with the first power application at the start of end-item acceptance testing of the major component, subsystem, Instrument RBI level (as applicable to the hardware for which the Contractor is responsible) or the first operation of a mechanical item; it shall continue through formal acceptance by the Government of the RBI.
2) All failures shall be documented on existing Contractor failure report forms, which shall identify all relevant failure information.
3) Anomaly and Failure Reports shall include a copy of all referenced data and shall have had all corrective actions accomplished and verified.
4) Each Anomaly and Failure Report shall contain as a minimum the following information in a format that can be stored and retrieved:

   NOTE: Asterisk (*) indicates NASA entry.

   a) The Report Number (sequential)
   b) Project Name
   c) Spacecraft Identification
   d) Operation Time (tenths of hours) or cycle data
   e) Experiment Name
   f) Date and Time of failure

g) Identification of failed item (e.g., assembly, sub-assembly, or part)
h) Date the Failure Report is originated
i) Red Flag (yes or no) block. (Red Flag refers to uncertainty of the effectiveness of a corrective action due to a failure that could result in a major or significant degradation to the mission)
j) Software Product, I.D. No., Release Date, Life Cycle Phase
k) Component Name, I.D. No., Serial No., & Manufacturer
l) Assembly Name, I.D. No., Serial No., & Manufacturer
m) Sub-Assembly Name, I.D. No., Serial No., & Manufacturer
n) Part Name, Manufacturer Part No., & Manufacturer
o) Test or operation when failure occurred
p) Environment-when failure occurred
q) Hardware Level when failure occurred
r) Ref. Info. - Log No./Page, Proc. No./Page, Nonconformance No.
s) Description of failure
t) Impact Rating
u) Originator Name, phone number, and organization
v) Cause of failure
w) Corrective Action to be taken
x) Corrective Action Effect on other units by Serial No.
y) Corrective Action approval by Failure Review Board
z) Failure Analysis Report Number
aa) Action taken on failed unit
bb) Retest requirements
cc) Failed unit Acceptable for Flight - Yes or No
dd) Failure Review Board Concurrence
ee) Contractor Project Manager Closure, signature and date
ff) * Government Project Manager Closure, signature and date
gg) Risk ratings—mission impact and certainty in corrective actions

6. Applicable Documents:
   1) GSFC-EEE-INST-002, *Instructions for EEE Parts Selection, Screening, Qualification, and Derating*
   2) NASA-STD-8729.1, *Planning, Developing and Managing an Effective Reliability and Maintainability (R&M) Program*
   3) SAE AS9100, *Quality Systems - Aerospace - Model for Quality Assurance in Design, Development, Production, Installation and Servicing*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

MA-05 SYSTEM SAFETY PROGRAM PLAN

3. SOW/IPRD Reference:

SOW-3.3-01

4. Use:

The System Safety Program Plan (SSPP) 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.

5. Preparation Information:

The Contractor shall prepare a SSPP that describes the development and implementation of a system safety program that complies with the requirements of NPR 8715.7. The Contractor shall:

1) Define the tasks, roles and responsibilities of personnel
2) Define the required documentation, applicable requirements documents, and completion schedules for analyses, reviews, and safety packages
3) Address support for Safety Reviews, Safety Working Group Meetings and Technical Interchange Meeting (TIMs)
4) 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. This includes hazards associated with safety critical software as described in Section 5.2.1 of this document.
5) Address compliance with industrial safety requirements imposed by NASA and OSHA design and operational needs (e.g., NASA-STD-8719.9 Lifting Devices and Equipment, as applicable) and contractually imposed mission unique obligations
6) Address software safety so as to identify and mitigate safety-critical software products in compliance with NASA-STD-8719.13 NASA Software Safety Standard by the following:
    a) Identification of software related hazards
    b) Identification of hazard controls that are implemented with software
    c) Identification and tracking of software safety requirements
    d) Verification results and approved waivers and exceptions for software safety requirements

e) Verification of safety discrepancy disposition approvals
f) Commands that can potentially damage the spacecraft, instrument or cause injury to personnel shall require NASA JPSS authorization prior to being sent to the instrument for execution.

6. Applicable Documents:
   1) NPR 8715.3, *NASA General Safety Program Requirements*
   2) NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

MA-06 SAFETY DATA PACKAGE

---

3. SOW/IPRD Reference:

SOW-3.3-02; SOW-3.3-08; SOW-3.3-09; SOW-3.3-11 SOW-3.3-12; SOW-3.3-16; SOW-3.5-07
DRD MA-07; DRD MA-32

---

4. Use:

Identification, analysis, and documentation of hazards and safeguards applicable to flight instrument hardware, critical instrument GSE, observatory, and personnel. Identification and documentation of instrument-related hazardous procedures to be used during instrument-level fabrication, integration, and test, observatory-level integration and test, launch site processing, and on-orbit operations. Documentation of compliance to payload safety requirements.

---

5. Preparation Information:

The Safety Data Package deliverable shall contain:

1) Hazard Analysis Summaries, Hazard Reports, and safeguards and mitigation strategies pertaining to the following:

   a) Flight instrument;
   b) Critical Instrument Ground Support Equipment, including software;
   c) Instrument Lifting Hardware;
   d) Instrument and Ground Support Equipment Hazardous Materials and Processes;
   e) Observatory, resulting from presence of instrument; and
   f) Personnel.

2) Identification and documentation of instrument-related hazardous or safety-critical procedures and operations that are or may potentially be used during the following:
   g) Instrument fabrication and testing;
   h) Observatory integration and testing;
   i) Launch site operations; and
   j) On-orbit operations.

3) Hazard severity, probability, and risk classifications shall be in accordance with MIL-STD-882E.

4) Hazard Analyses and Reports shall contain the content prescribed in NPR 8715.7 Section 2.5.5.

5) The initial, update, and final Safety Package releases shall contain the content prescribed in NPR 8715.7 Sections 2.5.6, 2.5.7, and 2.5.8 respectively.

6) The plan shall identify the processes and procedures to be followed to respond to and control a mishap or a close call, as well as identify the chain of individuals (including Project Office personnel) to be contacted in the event a mishap or close call occurs.

7) The plan shall include the Software Safety Analysis as per SOW 3.5-07, and an Instrument Safety Assessment Report as per SOW 3.3-12.

---

6. Applicable Documents:

1) 29 CFR Part 1910, *Occupational Safety and Health Standards for general Industry*
2) GSFC 500-PG-8715.1.2, *AETD Safety Manual* (for GSFC I&T operations)
3) NASA-STD 8709.22, *Safety and Mission Assurance Acronyms, Abbreviations, and Definitions*
4) NASA-STD-8719.9, *Standard for Lifting Devices and Equipment*
5) NASA-STD-8719.13, *NASA Software Safety Standard*
6) NASA-STD-8719.24, *NASA Expendable Launch Vehicle Payload Safety Requirements*
7) NPR 8621.1, *NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping*
8) NPR 8715.3, *KSC Safety Practices Procedural Requirements*
9) NPR 8715.3c, *NASA General Safety Program Requirements*
10) NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*
11) MIL-STD-882E, *Department of Defense Standard Practice: System Safety*

---

7. Reference Documents:

N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-07

2. Title: DESIGN SAFETY REQUIREMENTS COMPLIANCE CHECKLIST

3. SOW/IPRD Reference:

SOW-3.3-07; DRD MA-32

4. Use:

The checklist indicates for each requirement whether the proposed design is compliant, non-compliant but meets intent, non-compliant, or if the requirement is not applicable. An indication other than compliant will include rationale.

NOTE: the Contractor shall submit safety waivers for non-compliant design elements per paragraph SOW 3.3-14 and DRD No. MA-09.

5. Preparation Information:

The Contractor shall prepare a compliance checklist of all design, test, analysis, and data submittal requirements. The following shall be included:

1) Criteria and requirement.
2) System
3) Indication of compliance, noncompliance, or not applicable
4) Resolution
5) Reference
6) Copies of all Range Safety and NASA approved non-compliances including waivers and equivalent levels of safety certifications

6. Applicable Documents:

1) NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*
2) NASA-STD-8719.24, *NASA Expendable Launch Vehicle Payload Safety Requirements*

7. Reference Documents: N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

MA-08 HAZARD & VERIFICATION TRACKING LOG

3. SOW/IPRD Reference:

SOW-3.3-13; DRD MA-32

4. Use:

Provides a verification matrix to NASA-STD-8719.24 for applicable instrument and GSE requirements, and NASA-STD-8719.12 if the RBI instrument uses any type of explosive or pyrotechnic device for deployment of doors or devices.

NOTE: The Contractor shall close items with the appropriate rationale prior to first operational use or restraint.

5. Preparation Information:

The Verification Tracking Log (VTL) provides documentation that demonstrates the process of verifying the control of all hazards by test, analysis, inspection, similarity to previously qualified hardware, or any combination of these activities. All verifications that are listed on the hazard reports shall reference the tests/analyses/inspections.

The VTL shall contain the following information in tabular format:

1) Hazard Report #
2) Safety Verification #
3) Description (Identify procedures/analyses by number and title)
4) Constraints on Launch Site Operations
5) Independent Verification Required (e.g., mandatory inspection points)
6) Scheduled Completion Date
7) Completion Date
8) Method of Closure

6. Applicable Documents:
   1) NASA-STD-8719.24, *NASA Expendable Launch Vehicle Payload Safety Requirements*
   2) NPR 8715.7 Section 2.5.9, *Expendable Launch Vehicle Payload Safety Program*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-09

2. Title: SAFETY WAIVER

3. SOW/IPRD Reference:

SOW-3.3-14; DRD MA-32

4. Use:

A Safety Waiver documents a safety requirement that cannot be met and the rationale for approval of a waiver, as defined in NPR 8715.7. NOTE: a waiver may require Range Safety concurrence.

5. Preparation Information:

The Contractor shall include the following information in the Safety Waiver request:

1) A statement of the specific safety requirement and its associated source document name and paragraph number for which a waiver is requested.
2) A technical justification for the waiver.
3) Analyses to show the mishap potential of the proposed alternate requirement, method, or process as evaluated against the specified requirement.
4) An assessment of the risk involved in accepting the waiver, including a list of all associate hazards and FMEA/Critical Items List (CILs); when it is determined that there are no hazards, the basis for such determination should be provided.
5) A narrative on possible ways of reducing hazards severity and probability and existing compliance activities.
6) When a specific safety requirement cannot be met, the Contractor shall enter the word "SAFETY" as the first word in the Contractor Deviation/Waiver Request, NASA Langley Form 147, Section 2, Description of Deviation/Waiver.
7) Starting and expiration dates for waiver, if applicable.

6. Applicable Documents:

1) NASA-STD-8719.24, *NASA Expendable Launch Vehicle Payload Safety Requirements*
2) KNPR 8715.3, *KSC Safety Practices Procedural Requirements*
3) NASA Non-Compliance Report/Corrective Action System (NCR/CAS) Web-based Online System
4) NPR 8715.7, *ELV Payload Safety Program*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-10

2. Title: CONTAMINATION CONTROL PLAN

3. SOW/IPRD Reference:

SOW-3.9-02; SOW-3.9-05

4. Use:

The Government will use the Contamination Control Plan for (a) documentation of the required levels of instrument cleanliness to achieve required Instrument performance throughout the mission life; (b) insight into contamination control practices during Instrument development through delivery; and (c) implementation of the Contamination Control Plan during Observatory Integration & Test activities through launch.

5. Preparation Information:

The Contamination Control Plan shall be based on an Instrument contamination budget established to ensure the Instrument meets performance requirements throughout the mission life. The budget shall account for all phases of instrument development beginning with initial Instrument fabrication through end-of-mission. The budget shall account for on-orbit effects to contaminants such as photopolymerization. The plan shall include detailed documentation of the contamination budget and its derivation. The plan shall include the following additional items, at a minimum, derived from the budget:

1) Identification of Instrument contamination-sensitive parts or components and any specific cleanliness requirements for each;
2) Required Instrument interior and exterior cleanliness levels throughout all phases of Instrument development through end-of-mission;
3) Maximum allowable effluent flux to the Instrument aperture from other Observatory subsystems and instruments;
4) Identification of any necessary vent paths to direct Instrument self-contaminants away from sensitive components;
5) Any specific bakeout requirements of instrument materials, assemblies, components, or subsystems;

6) Identify critical fabrication and assembly activities that will be performed and the cleanliness levels required;
7) Identification of key points in the Instrument fabrication / assembly / test flow when contamination inspections and/or measurements are to be made, and the types of inspections / measurements to be made;
8) Use of optical witness samples for Instrument cleanliness monitoring during Instrument fabrication / assembly / test / transportation;
9) Define the frequency, methods, and procedures required to maintain Instrument cleanliness during Observatory Integration & Test through launch;
10) Instrument purge and bagging requirements;
11) Instrument contractor facility environmental control and monitoring practices including atmospheric contaminants, temperature, and humidity that will be implemented during Instrument fabrication (including soldering) and test;
12) Ground Support Equipment cleanliness requirements and cleaning procedures;
13) Design features of shipping containers that will minimize contamination during shipping and storage.

6. Applicable Documents:
N/A

7. Reference Documents:
1) JPSS Document 472-00228, *Joint Polar Satellite System (JPSS) Project Contamination Control Plan*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

MA-11 RELIABILITY PROGRAM PLAN

3. SOW/IPRD Reference:

SOW-3.4-01

4. Use:

This plan will be used to guide implementation of reliability activities.

5. Preparation Information:

The Reliability Program Plan shall include:

1) A discussion of how the Contractor intends to implement and comply with Probabilistic Risk Assessment (PRA) and Reliability program requirements.
2) Charts and statements describing organizational responsibilities and functions conducting each task to be performed as part of the Program.
3) A summary (matrix or other brief form) that indicates for each requirement, the organization responsible for implementing and generating the necessary documents.
4) Identify the approval, oversight, or review authority for each task.
5) Narrative descriptions, time or milestone schedules, and supporting documents describing the execution and management plan for each task.
6) Details of the collaboration between engineering disciplines
7) PRA for use by the spacecraft Contractor in performing a limited scope PRA for JPSS that includes mission critical maneuvers and ground system interactions required for the mission operations as applicable
8) Documentation, methods, procedures, and reporting specific to each task in the plan.

6. Applicable Documents:

1) NPD 8720.1, *NASA Reliability and Maintainability (R&M) Program Policy*
2) NASA-STD-8729.1, *Planning, Developing and Managing an Effective Reliability and Maintainability (R&M) Program*
3) NPR 8705.4, *Risk Classification for NASA Payloads*
4) NPR 8705.5, *PRA Procedures for NASA Programs and Projects*

7. Reference Documents:

N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.:

MA-12

2. Title:

FAILURE MODE AND EFFECTS ANALYSIS (FMEA) AND CRITICAL ITEMS LIST (CIL)

---

3. SOW/IPRD Reference:

SOW-3.4-05

---

4. Use:

Used to evaluate design against requirements, to identify single point failures and hazards, and to identify modes of failure within a system design, including hardware and software for the early mitigation of potential catastrophic and critical failures.

---

5. Preparation Information:

The FMEA Report shall include the following:

1) A discussion of the approach of the analysis, methodologies, assumptions, results, conclusions, and recommendations.
2) Objectives
3) Level of the analysis
4) Ground rules
5) Functional description
6) Functional block diagrams
7) Reliability block diagrams
8) Equipment analyzed
9) Data sources used
10) Problems identified
11) Single-point failure analysis, to include the root cause, mitigation, and retention rationale for those with severity categories 1, 1R, 1S, 2 or 2R as defined in SOW Table 3.4-1 Severity Categories.
12) Listing of all credible single point failures, where “credible” is defined as having a probability of greater than 0.1% at end-of-life.
13) Corrective actions
14) Work sheets identifying failure modes, causes, severity category, and effects at the item, next higher level, and mission level, detection methods, and mitigating provisions.
15) CIL for severity categories 1, 1R, 1S, 2, and 2R, including item identification, cross-reference to FMEA line items, and retention rationale. Appropriate retention rationale may

include design features, historical performance, acceptance testing, manufacturing product assurance, elimination of undesirable failure modes, and failure detection methods.

6. Applicable Documents:
   1) GSFC Flight Assurance Procedure, FAP P-322-208, Performing a Failure Mode and Effects Analysis *(Available at Rapid Spacecraft Development Office (RSDO) website: http://rsdo.gsfc.nasa.gov/documents/Rapid-III-Documents/MAR-Reference/GSFC-FAP-322-208-FMEA-Draft.pdf)*
   2) NPR 8705.4, *Risk Classification for NASA Payloads*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-13

2. Title: FAULT TREE ANALYSIS (FTA)

3. SOW/IPRD Reference:

SOW-3.4-06

4. Use:

Used to assess Instrument failure from the top level perspective. Undesired top-level states are identified and combinations of lower-level events are considered to derive credible failure scenarios. The technique provides a methodical approach to identify events or environments that can adversely affect Instrument success and provides an informed basis for assessing system risks.

5. Preparation Information:

The Instrument FTA Report shall contain:

1) Analysis ground rules including definitions of undesirable end states
2) References to documents and data used
3) Fault tree diagrams, including hardware and software
4) Results and conclusions

NOTE: Separate FTA reports are not required for fault trees generated in support pivotal event analysis in the PRA report.

6. Applicable Documents:
   1) NPR 8705.4, *Risk Classification for NASA Payloads*
   2) NPR 8715.3, *NASA General Safety Program Requirements*

7. Reference Documents:
   1) NASA Fault Tree Handbook with Aerospace Applications (http://www.hq.nasa.gov/office/codeq/doctree/fthb.pdf)

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

MA-14 PARTS STRESS & DERATING ANALYSIS

---

3. SOW/IPRD Reference:

SOW-3.4-08

---

4. Use:

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

---

5. Preparation Information:

The Parts Stress Analysis Report shall consist of the following as a minimum:

1) The Instrument Contractor shall perform a Parts Derating Analysis of all RBI parts, to verify that the derating requirements of GSFC EEE-INST-002 are met. This analysis shall be presented to and approved by the Parts Control Board (PCB). The derating policy applied to all flight instrument electrical and electronic parts shall limit the application conditions of voltage, current, power, temperature, mechanical environment, and duty cycle to achieve part failure rates consistent with reliability requirements in GSFC-EEE-INST-002. The de-rating shall be consistent with the improvements in failure rate achievable as depicted in MIL-HDBK-217 or equivalent. Any part that exceeds the recommended guidelines will be added to the high risk parts list and reported on a maintained list to the Government.
2) The Contractor shall perform a Part Stress Analysis (PSA), verifying that the derating requirements of MIL-STD-975 are met. The derating criteria and ground rules, including the approach to be taken for any EEE parts not covered by MIL-STD-975, will be documented on a maintained list and reported to the Government.
3) Analysis ground rules
4) Reference documents and data used
5) Results and conclusions including:
    a) Design trade study results
    b) Parts stress analysis results impacting design or risk decisions
6) Analysis worksheets; the worksheets at a minimum shall include:

a) Part identification (traceable to circuit diagrams)
b) Assumed environmental (consider all expected environments)
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

6. Applicable Documents:
   1) GSFC EEE-INST-002, *Instructions for EEE Parts Selection, Screening, Qualification, and Derating*
   2) MIL-HDBK-217 (or equivalent), *Military Handbook Reliability Prediction of Electronic Equipment*
   3) MIL-STD-975, *Military Standard NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List*

7. Reference Documents:
   1) http://nepp.nasa.gov/DocUploads/FFB52B88-36AE-4378-A05B2C084B5EE2CC/EEE-INST-002_add1.pdf
   2) NASA Parts Selection List <http://nepp.nasa.gov/npsl/index.htm>

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

MA-15 WORST CASE CIRCUIT ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-3.4-09

4. Use:

Demonstrate design margins in mission critical electronic and electrical circuits, and electromechanical items. The initial release includes circuits that are available and a plan for how the contractor is going to do the remainder of the analysis.

5. Preparation Information:

The Worst Case Circuit Analysis Report shall include the following:

1) The Instrument Contractor shall evaluate the flight instrument components to identify mission critical circuits that have a degradation concern over the mission duration. Critical circuits shall be identified from a detailed review of the system, subsystem, and component designs. The Instrument Contractor shall perform a Worst Case Circuit Analysis (WCA) on these critical circuits and shall document the rational for not analyzing a component. The WCA shall cover combinations of electrical, thermal and radiation stresses.
2) Address worst case conditions performed on each component.
3) Discuss how each analysis includes the mission life.
4) Discuss consideration of critical parameters at maximum and minimum limits.
5) The effect of environmental stresses on the operational parameters being evaluated.

6. Applicable Documents:
1) NPD 8720.1, *NASA Reliability and Maintainability (R&M) Program Policy*
2) NASA-STD-8729.1, *Planning, Developing and Managing an Effective R&M Program*
3) NPR 8705.4, *Risk Classification for NASA Payloads*

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-16

2. Title: RELIABILITY ASSESSMENTS AND PREDICTIONS

3. SOW/IPRD Reference:

SOW-3.4-10

4. Use:

Used to assist in evaluating alternative designs and to identify potential mission limiting elements that may require special attention.

5. Preparation Information:

The Reliability Assessment and Prediction Report shall include the following:

1) The methodology and results of comparative reliability assessments including mathematical models
2) Reliability block diagrams
3) Failure rates
4) Failure definitions
5) Degraded operating modes
6) Trade-offs
7) Assumptions
8) Any other pertinent information used in the assessment process
9) A discussion to show reliability was considered as a discriminator in the design process

6. Applicable Documents:

1) IEEE Standard Methodology for Reliability Prediction and Assessment for Electronic Systems and Equipment – Std 1413
2) RADC-TR-85-229, *Reliability Prediction for Spacecraft*
3) MIL-HDBK-217

7. Reference Documents:

N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-17

2. Title: LIMITED LIFE, LIMITED USE, AND EXPENDABLE ITEMS LIST

3. SOW/IPRD Reference:

SOW-3.4-12, SOW-3.4-13

4. Use:

Tracks the selection and application of limited life, limited use, and expendable items and the predicted impact on instrument operations.

5. Preparation Information:

The Limited Life List shall include a prepared and maintained list of life-limited items and their predicted impact on mission operations. The list shall include expected life, required life, and duty cycles for each limited life item. Rationale for selecting and using the items with a life less than 2X including ground operations shall be provided. The list may include such items as structures, thermal control surfaces, solar arrays, electromechanical mechanisms, batteries, compressors, seals, bearings, valves, tape recorders, momentum wheels, gyros, actuators, and scan devices. The environmental or application factors that may affect the items include such things as atomic oxygen, solar radiation, shelf life, extreme temperatures, thermal cycling, wear, and fatigue.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-18

2. Title: SOFTWARE ASSURANCE PLAN

3. SOW/IPRD Reference:

SOW-3.5-02

4. Use:

Documents the Contractor's Software Quality Assurance roles and responsibilities and surveillance activities to be performed as outlined in the NASA Software Assurance Standard.

5. Preparation Information:

The Software Assurance Plan (SAP) shall address the following:

1) Purpose
2) Scope
3) Reference documents and definitions
4) Assurance Organization and Management
5) Assurance Activities by discipline
    a) Software Quality (process and product)
    b) Software Safety
    c) Software Reliability
    d) Software Verification and Validation
    e) Independent Verification and Validation (if applicable)
6) Assurance tools, techniques, and methodologies
7) Software Assurance Program Metrics
8) Problem Reporting and Corrective Action
9) Assurance records, collection, maintenance, and retention
10) Training
11) Risk Management
12) SAP Change procedure and history

6. Applicable Documents:

1) IEEE Standard 730-2002, *Software Quality Assurance Plans*
2) NASA-STD-8719.13, *NASA Software Safety Standard*
3) NASA-STD-8739.8, *NASA Standard for Software Assurance*

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-19

2. Title: NON-STANDARD PARTS APPROVAL REQUESTS (NSPAR)

3. SOW/IPRD Reference:

SOW-3.7-02

4. Use:

Implementation of an NSPAR request and approval program.

5. Preparation Information:

NONSTANDARD PART APPROVAL REQUEST (NSPAR) INSTRUCTION (LaRC Form 170)

Item 1. Supply information necessary to define the user.

Items 2,3,4,5. Custom specifications or Source Control Drawings (not mil specs.) should be attached. List Commercial Equivalent No., only if it is necessary for identification. Otherwise, write "same."

Item 6. Functionally describe the part. Discuss any special characteristics required, and any parameter selection screening to be performed. Specify "custom" parts.

Item 7. State where and how the part is to be used for unique applications. If the part is to be used throughout the instrument, write "General Usage." Any unique application requirements not discussed in Item 6 should be discussed here. If the part is to be used above any recommended derating guidelines, it should be so stated.

Item 8. Compare the proposed nonstandard part to the nearest equivalent standard part. It is not necessary to discuss design compromises required to use the standard part.

Item 9. Discuss the basis for qualification, which will usually be some combination of history, similarity, and test. List any known program/agencies which have used/qualified the part. Attach any available test data. If there is no basis for qualification, write "none."

Item 10. Discuss plans to evaluate or qualify any nonqualified parts, and attach qualification test plans if required. List any additional screening or incoming inspection tests not included in procurement specification.

6. Applicable Documents:

1) LaRC Form 170, *Nonstandard Part Approval Request (NSPAR)*

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-20

2. Title: ELECTROSTATIC DISCHARGE (ESD) CONTROL PLAN

3. SOW/IPRD Reference:

SOW-3.6-05

4. Use:

Implementation of an ESD control program at the Contractor's facility

5. Preparation Information:

1) The ESD Control Plan shall be prepared and implemented to comply with ANSI/ESD S20.20 requirements and the ESD sensitivity of the product being developed.
2) The ESD Control Plan should comply with the LPR 8739.21 to ensure Quality Assurance wherever- and whenever ESDS work is being performed.
3) The Project ESD Control Plan shall include the Contractor's complete corporate ESD Plan with stated evidence of full compliance with ANSI/ESD S20.20 and LPR 8739.21.

6. Applicable Documents:

1) ANSI/ESD S20.20 For the Development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)

7. Reference Documents:

1) LPR 8739.21 Langley Research Center (LaRC) Procedures and Guidelines for Electrostatic Discharge (ESD) Control of ESD-Sensitive (ESDS) Devices Program (Excluding Electrically Initiated Explosive Devices)

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

MA-21 EEE PARTS CONTROL PLAN

---

3. SOW/IPRD Reference:

SOW-3.7-01, SOW-3.7-04, SOW-3.7-11

---

4. Use:

Development and implementation of an EEE parts control plan that addresses the system requirements for mission lifetime and reliability.

Organization and operation of the Parts Control Board regarding the implementation of the Parts Control Program.

---

5. Preparation Information:

The PCP shall address, as a minimum, the following:

1) Plan Purpose
2) Plan Scope
3) Definitions, Acronyms And Abbreviations
4) Applicable Documents And References
5) Parts Program Organization And Management
6) EEE Parts Selection, Specification, Standardization, Qualification And Approval
    - Parts Risk Level
    - PCB
    - Parts Selection Criteria
    - Parts Specification
    - Parts Qualification
    - Parts Screening
    - Hybrids, Pin Photodiode, MCM and Other Advanced Microcircuits
    - ASICs, Gate Arrays, System-on-chip, Custom ICs
    - Custom Components
    - Off-The-Shelf Equipment And New Builds Of Existing Designs
    - Destructive Physical Analysis (DPA) per S-311-M-70
    - Alerts (Government-Industry Data Exchange Program (GIDEP), NASA Advisories)
    - Supplier Selection Criteria And Surveillance

- Subcontractor Controls
- Subcontractor Parts Program Plan
- Vendor Controls
- Traceability And Lot Control
- Vendor Source Inspection And Acceptance
- Failure Analysis
    - Parts Derating Analysis
    - Parts Stress Analysis
    - WCA
- Parts Age Control
- Radiation Hardness
- ESD Control
- Parts Documentation Control
- Environment
- Part Identification List (PIL)
- Counterfeit EEE Parts Control Plan per SAE AS5553
- Parts Classification (Flight H/W / Non Flight H/W / Safety Critical, etc.)
- Procurement/Shipping/Handling Requirements (X-Ray Sensitivity, Labeling)
- Receipt Inspection Requirements

The Contractor shall address the following in the Parts Control Board procedures:

7) Organization and membership
8) Meeting schedule
9) Meeting notices
10) Distribution of meeting agenda, notes, and minutes
11) Review and approval responsibilities and processes

6. Applicable Documents:

1) GSFC EEE-INST-002, *Instructions for EEE Parts Selection, Screening, Qualification, and Derating*
2) S-311-M-70, *Specification for Destructive Physical Analysis*
3) SAE AS5553, *Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition*

7. Reference Documents:

N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

MA-22 PROJECT APPROVED PARTS LIST (PAPL)

3. SOW/IPRD Reference:

SOW-3.7-14, SOW-3.7-15; SOW-3.7-16

4. Use:

A list of EEE parts selected for use in flight hardware and approved by the Parts Control Board for use in flight hardware.

5. Preparation Information:

The Project Approved Parts List shall contain the following information:

1) Flight component identity to the circuit board level
2) Complete part number (i.e., Defense Electronics Supply Center (DSCC) part number, Source Control Drawings (SCD) part number, with all suffixes)
3) Manufacturer's Generic Part number
4) Manufacturer (not distributor)
5) Part Description (please include meaningful detail)
6) Federal Supplier Code (FSC)
7) Procurement Specification
8) Comments and clarifications, as appropriate
9) Estimated quantity required (for procurement forecasting)
10) Procurement Part Number
11) Flight Part Number (if different from the procurement part number)
12) Package Style/Designation
13) Single Event Latch-up (SEL) Hardness/Tolerance and Data Source
14) Single Event Upset (SEU) Hardness/Tolerance and Data Source
15) Total Ionizing Dose (TID) Hardness/Tolerance and Data Source
16) Displacement Damage Hardness/Tolerance and Data Source
17) Proton Hardness/Tolerance and Data Source

6. Applicable Documents:

1) GSFC-EEE-INST-002, *Instructions for EEE Parts Selection, Screening, Qualification, and Derating*

2) GSFC-PPL-21, *Goddard Space Flight Center (GSFC) Preferred Parts List*

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-23

2. Title: AS DESIGNED PARTS LIST (ADPL)

3. SOW/IPRD Reference:

SOW-3.7-17

4. Use:

Provides a list of EEE parts that are incorporated in the design of flight hardware.

Provides a summary of as-designed EEE parts and components usage with "where used" and qualification information for designs released for production.

To provide the actual as-built record for EEE parts and components installed in delivered equipment.

5. Preparation Information:

The As Designed Parts List (ADPL) shall contain all Project Approved Parts List (PAPL) fields plus the following information:

1) Assembly Name/Number
2) Next Level of Assembly
3) Need Quantity
4) Reference Designator(s)
5) Item number (if applicable)

6. Applicable Documents:
   1) GSFC-EEE-INST-002, *Instructions for EEE Parts Selection, Screening, Qualification, and Derating*
   2) GSFC-PPL-21, *Goddard Space Flight Center (GSFC) Preferred Parts List*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-24

2. Title: AS BUILT PARTS LIST (ABPL)

3. SOW/IPRD Reference:

SOW-3.7-18

4. Use:

Provides a list of EEE parts that are used in the flight hardware.

5. Preparation Information:

The As Built Parts List (ABPL): shall contain all ADPL fields plus the following minimum information:

1) Assembly serial number
2) Item revision
3) Next Level of Assembly serial number
4) Lot/Date/Batch/Heat/Manufacturing Code, as applicable
5) Manufacturer's Cage Code (specific plant location preferred)
6) Distributor/supplier, if applicable
7) Part number
8) Part serial number (if applicable)

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.:

MA-25

2. Title:

MATERIALS AND PROCESSES SELECTION, CONTROL, & IMPLEMENTATION PLAN

---

3. SOW/MA Reference:

SOW-3.8-01; SOW-3.8-09

DRD MA-28; DRD MA-32

---

4. Use:

Defines the implementation of NASA-STD-6016 with changes as described in the Preparation Information.

---

5. Preparation Information:

For each paragraph in Paragraphs 4 and 5 of NASA-STD-6016 with the changes prescribed below, the plan shall state the requirement from NASA-STD-6016, identify the degree of conformance under the subheading "Degree of Conformance," and identify the method of implementation under the subheading "Method of Implementation."

The plan shall address the following:

1) Conformance to the requirements of NASA-STD-6016 with the changes prescribed below and a description of the method of implementation.
2) Organizational authority and responsibility for review and approval of M&P specified prior to release of engineering documentation.
3) Identification and documentation of Materials and Processes
4) Procedures and data documentation for proposed test programs to support materials screening and verification testing
5) Materials Usage Agreement (MUA) Procedures
6) Determination of material design properties, including statistical approaches to be employed.
7) Identification of process specifications used to implement requirements in NASA-STD-6016.
8) In addition to the requirements of paragraph 4.2.2.11, the Contractor shall meet the requirements of GEIA-STD-0005-1 and GEIA-STD-0005-2 for solders and surface finishes that are less than 3% lead by weight.

9) In paragraph 4.1.2, the Contractor may use GFSC forms or the Contractor's equivalent forms in lieu of the MAPTIS format.

    a. The Contractor may use the GSFC outgassing database in addition to MAPTIS (URL http://outgassing.nasa.gov).

10) Prescribed changes to NASA-STD-6016:

    a) The Contractor shall use NASA-STD-8719.4 Range Safety Users Requirements Manual section 10.1 in place of paragraph 4.2.1.

    b) In addition to the requirements of paragraph 4.2.3.4, the Contractor shall qualify all lubricated mechanisms either by life testing in accordance with a life test plan or heritage with an identical mechanism used in an identical application. The Contractor shall perform a lubricant loss analysis for all mechanisms to show that the design meets a 10X margin (see DRD No. MA-40).

    c) In addition to the requirements of paragraph 4.2.3.6, the Contractor shall provide the vacuum bake out schedule for materials that fail outgassing requirements with the Materials Identification and Usage List (MIUL) or MUA.

    d) Paragraph 4.2.3.8 does not apply.

    e) In paragraph 4.2.5.1, the Contractor shall develop and implement a Non-Destructive Evaluation Plan only for fracture critical flight hardware (see DRD No. MA-43).

    f) In paragraph 4.2.6.5, the Contractor shall use 541-PG-8072.1.2 GSFC Fastener Specification in place of NASA-STD-6008.

    g) Paragraph 4.2.6.6 does not apply.

---

6. Applicable Documents:
   1) NASA-STD-6016, *Standard Materials and Processes Requirement for Spacecraft*
   2) NASA-STD-8719.14, *Process for Limiting Orbital Debris*

---

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.:

MA-26

2. Title:

LIFE TEST PLAN FOR MECHANISMS AND MOVING MECHANICAL ASSEMBLIES

---

3. SOW/IPRD Reference:

SOW-3.8-04

---

4. Use:

Defines the plan for life test evaluation of mechanisms, mechanism components, subassemblies, and moving mechanical assemblies.

---

5. Preparation Information:

The term “mechanism” applies to mechanical and electrical components, subassemblies, and moving mechanical assemblies subject to motion required for operation of the instrument (e.g. bearings, potentiometers, twist-capsules, cable-wraps, motor gear heads, harmonic drives, bushings, etc.). The Life Test Plan shall be compliant with GSFC-STD-1000 Rev. E GOLD Rule 4.23 and developed in accordance with GSFC-STD-7000A Section 2.4.5.1. The Life Test Plan shall contain, but not be limited to, the following:

Preliminary Release:

1) Table of Contents
2) Identification and description of any mechanisms, an overview of the operation, summary of specifications, life requirements, anticipated lubrication type, and required number of cycles of operation;
3) Identification of any mechanisms claimed to not require a life test because of flight validated performance in a similar application and operational environment as the present mission;
    a) Rationale for why life testing is not required. Include detailed descriptions of: Prior application(s) and similarity to the present implementation; any changes in mechanism design and/or fabrication relative to the flight-validated mechanism; motion range and rates; environment(s) where used; design life; demonstrated life; number of cycles; torque margins; lubrication used; any available on-orbit engineering data and trends; results from previous life tests of identical units.

Final Release:

4) Content of the preliminary release, updated to include the following for each mechanism requiring a life test:
    a) Planned life test schedule;
    b) Description of life test procedure(s) for each mechanism including vacuum, temperature, and vibration test environmental conditions, required ground support equipment, facilities to be used, data to be collected, and test duration;
    c) Detailed technical evaluation of any impacts associated with altering the mechanism configuration or operation for the purposes of accelerating the life test, and the subsequent relationship between life test performance and extrapolated end-of-life performance;
    d) Description of methods and tools used to evaluate life test data;
    e) Criteria for a successful test.

6. Applicable Documents:

1)GSFC-STD-1000E, *Goddard Space Flight Center Rules for the Design, Development, Verification, and Operation of Flight Systems*
2)GSFC-STD-7000A, *General Environmental Verification Standard for GSFC Programs and Projects*, April 2013.

7. Reference Documents:

1) NASA-STD-6016, *Standard Materials and Processes Requirement for Spacecraft*
2) NASA-TM-86556, *Lubrication Handbook for the Space Industry* (Part A: Solid Lubricants, Part B: Liquid Lubricants)
3) NASA/CR-2005-213424, *Lubrication for Space Applications*
4) AIAA S-114-2005, *Moving Mechanical Assemblies for Space and Launch Vehicles*
5) Aerospace Report No. TR-2004(8583)-1, *Test Requirements for Launch, Upper-Stage, and Space Vehicles*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-27

2. Title: MATERIALS USAGE AGREEMENT (MUA)

3. SOW/IPRD Reference:

SOW-3.8-05

4. Use:

Establishes the process for submitting a MUA for a material or process that does not meet the requirements of NASA-STD-6016 and does not affect reliability or safety when used per the Materials and Processes Selection, Control, and Implementation Plan.

5. Preparation Information:

The MUA system shall be defined in the Materials and Processes Selection, Control, and Implementation Plan as approved per paragraph 1.2 (see DRD No. MA-25).

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-3029 (see NASA-STD-6016) and a stress analysis.

6. Applicable Documents:
   1) NASA-STD-6016, *Standard Materials and Processes Requirement for Spacecraft*
   2) MSFC-STD-3029, *Guidelines for the Selection of Metallic Materials for Stress Corrosion Cracking Resistance in Sodium Chloride Environments*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-28

2. Title: MATERIALS IDENTIFICATION AND USAGE LIST (MIUL)

3. SOW/IPRD Reference:

SOW-3.8-06

4. Use:

Establishes the Materials Identification and Usage List (MIUL).

5. Preparation Information:

The MIUL documentation approach shall be defined in the Materials and Processes Selection, Control, and Implementation Plan as approved per paragraph 1.2 (see DRD No. MA-25).

6. Applicable Documents:
   1)NASA-STD-6016, *Standard Materials and Processes Requirement for Spacecraft*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-29

2. Title: PRINTED WIRING BOARD (PWB) COUPON TEST REPORT

3. SOW/MA Reference:

SOW-3.8-14

DRD MA-32

4. Use:

PWB test coupons are evaluated to validate that PWBs are suitable for use in space flight and mission critical ground applications.

5. Preparation Information:

1) The Contractor will prepare a report for each Printed Wiring Board (PWB) made.
2) The report will be the written analysis from the supplier.
3) The Contractor will maintain the coupons until such time they can be delivered to the Government in the EIDP
4) The Contractor will maintain the test results for the life of the project; copies will be included in the EIDP

6. Applicable Documents:

1) IPC-6011 Generic Performance Specifications for Printed Boards (Class 3 Requirements)
2) IPC-6012B Qualification and Performance Specification for Rigid Printed Boards (Class 3/A Requirements /Performance Specification Sheet for Space and Military Avionics)
3) IPC-6013 Qualification and Performance Specification for Flexible Printed Boards (Class 3)
4) IPC-6018 Microwave End Product Board Inspection and Test
5) IPC A-600 Guidelines for Acceptability of Printed Boards (Class 3 Requirements)
6) IPC 2221B, Generic Standard on Printed Board Design

7. Reference Documents:

N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-30

2. Title: GIDEP ALERT / NASA ADVISORY DISPOSITIONS

3. SOW/IPRD Reference:

SOW-3.11-04

4. Use:

Document the Contractor's disposition of GIDEP ALERTs; GIDEP SAFE-ALERTs; GIDEP Problem Advisories; GIDEP Agency Action Notices; NASA Advisories and component issues, hereinafter referred to collectively as “Alerts” with respect to parts and materials used in NASA product.

5. Preparation Information:

The Contractor shall submit:

1) The lists submitted per SOW-3.11-8 shall be updated with Alert information as parts and materials are added.
2) GSFC Form 4-37, “Problem Impact Statement Parts, Materials and Safety” or equivalent Contractor form, for Alerts provided by the GSFC Project Office.

6. Applicable Documents:
   1) GIDEP Operations Manual (SO300- BT-PRO-010)
   2) GIDEP Requirements Guide (SO300-BU-GYD-010)

7. Reference Documents:
   1)GSFC Form 4-37, *Problem Impact Statement Parts, Materials and Safety*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-31

2. Title: SIGNIFICANT PARTS, MATERIALS, AND SAFETY PROBLEMS

3. SOW/MA Reference:

SOW-3.11-06

DRD MA-32

4. Use:

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.

5. Preparation Information:

The Contractor shall submit relevant information (e.g., failure analyses, test reports, root cause and corrective action evaluations).

6. Applicable Documents:
   1) GIDEP Operations Manual (SO300- BT-PRO-010)
   2) GIDEP Requirements Guide (S0300-BU-GYD-010)

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

MA-32 END ITEM DATA PACKAGE

---

3. SOW/IPRD Reference:

SOW-2.2-04; SOW-3.6-04; SOW-7.3-04; DRD MA-06; DRD MA-26; DRD MA-28; DRD MA-30;

---

4. Use:

Provide cognizance of the configuration, the functional characteristics, and flight worthiness of the hardware to be shipped.

---

5. Preparation Information:

The End Item Data Package shall contain, at a minimum:

1) Readme file (or equivalent) identifying item(s) and content being delivered;
2) Calibration / Validation:
   a) Final ground Calibration Report per DRD CV-07;
3) Integration & Test:
   a) Instrument Build Record (e.g. shop order traveler);
   b) All instrument data files beginning with the pre-environmental Comprehensive Functional Test through completion of the final post-environmental Comprehensive Functional Test prior to System Acceptance Review.
4) Mission Assurance:
   a) Summary table of Waivers / Deviations submitted under DRDs MA-03 and MA-09, to include the following for each Waiver / Deviation:
      i. Unique Identifier (e.g. Waiver Number);
      ii. Waiver / Deviation Title;
      iii. Approval Date;
      iv. Summary Description;
      v. Summary Impact Statement;
      vi. Identification of any credible risk or residual risk associated with the accepted waiver / deviation;

b) Electronic copies of final versions of all waiver / deviation requests submitted under DRDs MA-03 and MA-09, including any supplemental documentation submitted with each request, showing final approval certification;
c) Summary table of all Type I and Type II Material and/or Workmanship Discrepancies for all deliverable hardware, to include the following for each discrepancy:

i. Unique Identifier (e.g. Discrepancy Report Number);
ii. Discrepancy Report Title;
iii. Date of Occurrence;
iv. Part or Assembly number;
v. Summary Description;
vi. Disposition;
vii. References to any documentation or data supplemental to the discrepancy report;
viii. Identification of any credible residual risk for any discrepancy with a Repair or Use-As-Is disposition.

d) Electronic copies of final versions of all material and/or workmanship discrepancy reports showing final disposition and closure certification;
e) Summary table of all hardware and software failures and anomalies (both major and minor), to include:

i. Unique Identifier (e.g. Anomaly / Failure Report Number);
ii. Report Title;
iii. Date of Occurrence;
iv. Test Procedure;
v. Summary Description;
vi. Summary Outcome / Corrective Action;
vii. References to any documentation or data supplemental to the anomaly / failure report;
viii. Identification of any remaining credible residual risk resulting from the failure / anomaly after corrective action has been implemented.

f) Electronic copies of final versions of all failure and anomaly reports showing final disposition and closure certification;
g) Supplier Material Certifications, including subcontracted items;
h) Final Safety Data Package per DRD MA-06;
i) Final Safety Requirements Compliance Checklist per DRD MA-07;
j) Final Hazard & Verification Tracking Log per DRD MA-08;
k) Final As-Built Parts List per DRD MA-25;
l) Final As-Built Materials Identification and Usage List per DRD MA-29;
m) Final listing and dispositions to GIDEP, NASA, and other Alerts per DRD MA-31;
n) Certification documentation (e.g. Proof Load and Non-Destructive Evaluation) for all instrument lifting hardware, and identification of next date due;
o) Metrology records and certification documentation for all Electrical Ground Support Equipment requiring calibration, and identification of next date due;
p) Flight Instrument Contamination Measurement History Report, inclusive of the chronology, description, and results from all contamination inspections, measurements, and cleaning activities on instrument flight hardware;

5) Software:

a) Flight Software Version Description Document per DRD SW-08;
b) Ground Software Version Description Document per DRD SW-15;

6) Project Management:

a) Final updated Configuration Identification Items List per DRD PM-09;
b) Open Items List;
c) Shortage List;
d) Risk and Problem List, to include:

i. All closed risks and problems with reference to closure documentation;
ii. All open risks, their Likelihood and Consequence ranking, description, realization impact, and recommended mitigations;
iii. All residual risks, their Likelihood and Consequence ranking, description, realization impact, and rationale for acceptance as residual risk.

7) Systems Engineering:

a) Class I Changes Summary List;
b) As-built Instrument Performance Specification per DRD SE-04;
c) As-built Indentured Drawing List and Drawing Trees per DRD SE-05;
d) As-built Drawings per SE-06;
e) Final Instrument System Performance Verification Report per DRD SE-08;
f) Final As-built Instrument Mass Properties Report per DRD SE-09;
g) Final Instrument Performance Trend Analysis Report per DRD SE-10;
h) Final Spare Parts List per DRD SE-11;
i) Completed Requirements Verification Matrices per DRD SE-15 for all ground support equipment, instrument subsystems and systems, and interface requirements;
j) Electronic copies of End Item Data Packages for all Instrument and Ground Support Equipment subsystems, assemblies, and components obtained through subcontract, corporate subsidiary, or intra-corporate business unit.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: MA-33

2. Title: HERITAGE PRODUCT COMPLIANCE REPORT

3. SOW/IPRD Reference:

SOW-3.12-01

4. Use:

Documents the compliance of previously developed product with the requirements of the SOW and the IMAR.

5. Preparation Information:

The Heritage Product Compliance Report shall identify any previously developed products that are to be used as components of the RBI and a description of the requirements that governed their prior development. Where the requirements that governed their prior development do not comply with the requirements of the RBI SOW and IMAR, a waiver shall be submitted to the relevant requirements, or an analysis and test plan identified for verifying that the performance of the previously developed products will meet the requirements of the RBI.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

2.5 ANALYSES & MODELS

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
AM-01	STRUCTURAL AND MECHANICAL ANALYSES REPORTS

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the analyses and data demonstrating that all Instrument structural and mechanical performance requirements will be met. These reports shall support and justify the design approach and solutions.

5. Preparation Information:

One or more analysis reports may be submitted that encompass the structural and mechanical analyses performed.

The analysis report(s) shall contain, but not be limited to, the following attributes:

1) Introduction/Overview;
2) Performance Requirements;
3) Approach, assumptions, and design criteria used in the analysis;
4) Descriptions of the analytical models and results;
5) All detail calculations/analysis necessary to substantiate results; computer detailed calculations other than standard outputs are exempt;
6) All test data;
7) Summary, conclusions and recommendations.

Report updates shall include updated model predictions based on correlation with test results as the test results become available. Report updates shall verify the final Instrument design meets the required positive margins of safety.

Reports of Analyses to be Performed:

Additional analyses beyond those listed may be required to document compliance with specific performance requirements. Examples may include lubrication analyses, bearing analysis, specific mechanism components, etc.

1) Stress analyses: This report shall document the stress analysis performed on each separately mounted instrument component. Analysis of all critical elements shall

demonstrate the adequacy of the Instrument to withstand the static and dynamic environment resulting from transportation, launch, and on-orbit loads and to verify that the minimum frequency criteria have been met. Stress analyses of the flight instrument design shall be performed using finite element analysis and classical analysis to determine safety margins based on allowable stress levels. (refer to DRD AM-02 for more detail)

2) Mechanical performance: This report(s) shall document the tests and analyses performed to verify the performance of the instrument mechanisms and deployment devices. Analyses and test data used to verify the instrument structural performance and workmanship shall also be provided. This report(s) shall also address any methods utilized during fabrication and assembly that verify workmanship of the instrument structure and mechanical components.
3) Instrument pointing, alignment, and stiffness: This report shall document structural and mechanical design aspects and tolerancing of the Instrument pointing subsystem that supplement DRD AM-14, “Control System Analysis Reports” and AM-15, “On-Orbit Pointing & Jitter Analysis Report”.
4) Instrument clearances: This report shall document all instrument critical clearances and loss of clearances with the associated analyses. This shall include dynamic loss of critical clearances between instrument components determined for all mission phases, including launch, on-orbit deployments and on-orbit operations. Factors contributing to clearance loss, such as manufacturing and assembly tolerances, clearance loss due to spacecraft dynamics and thermal gradients shall be quantified. Analysis and test data that describes the "swept" or deployed volume which accounts for all distortions and misalignments shall also be included.
5) Shock: This report shall document the analysis performed to evaluate the instrument’s compliance with shock requirements – both self-induced (if applicable) and spacecraft induced. The shock analysis report shall identify key elements within the instrument design that are considered most susceptible to shock loads, provide the predicted shock load path losses and provide the results of calculated element responses to the resulting loads.
6) Acoustic: This report shall document the analysis performed to evaluate the instrument’s tolerance to the launch acoustic environment.
7) Decompression/venting: This report shall document the results of analyses performed to verify that all closed volumes vent as predicted to relieve cavity pressure and that no damage will occur to the instrument.

6. Applicable Documents:
N/A

7. Reference Documents:
1) NASA-STD-5002, *Load Analyses of Spacecraft and Payloads*
2) NASA-STD-5019, *Fracture Control Requirements for Spaceflight Hardware*
3) NASA-STD-5020, *Requirements for Threaded Fastening Systems in Spaceflight Hardware*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-02

2. Title: STRESS ANALYSIS REPORT

3. SOW/IPRD Reference: SOW-2.3-03

4. Use:

To serve as the formal document that details the methodology and results of all structural and dynamic analyses performed for Instrument design. This report shall demonstrate that the design will lead to an Instrument that meets all structural and dynamic requirements.

5. Preparation Information:

The stress analysis report shall document the adequacy of the Instrument structural design to withstand the required loading conditions during instrument-level testing, handling, launch, and flight operations. This includes verification of structural strength, dynamic responses of printed wiring boards and chassis walls, deflection analysis, and that the minimum frequency criteria have been met. The Contractor shall analyze each component based on the design intent and load environments of the structure. The analyses performed shall ensure that all failure modes and worst case combined loads have been examined. The analyses shall cover hardware in its as-built configuration, including stowed and deployed configurations as appropriate. The stress analysis report shall include the following attributes at a minimum:

1) Introduction including any relevant historical information that contributes to a better understanding of the context of the analysis;
2) Detailed description of the instrument and major components including mass and centers-of-gravity;
3) Executive summary, results, and conclusions;
4) Summary table of all Margins of Safety, description of relevant structural element, its critical loading path, including thermal and mechanical loading, failure mode, factor of safety, and a reference to the detailed analysis;
5) Summary of all material properties and allowables. This shall also include alloy type, heat treatment, hardness, chemical treatment, finish, and other physical properties that have an influence on the analyses;
6) FEM analysis approach and detailed descriptions of model attributes;
7) Loads summary including the identification of the primary load paths and the critical loads applied. All simplifying assumptions shall be clearly stated. The loads shall include (but not limited to) launch, random vibration, worst-case combined loading, decompression/venting, thermal, electrical, and transportation and handling;

12) Detailed stress analyses showing assumptions that document the calculations for stresses, deformations, margins of safety, and fracture analysis if applicable, for all components including fasteners;
13) Any parametric studies and analyses directed toward minimizing component loads and stresses;
14) Any back-up information necessary to understand the analysis shall be provided in conjunction with the stress analysis report.

Report updates shall include updated model predictions based on correlation with test results as the test results become available. Report updates shall verify the final Instrument design meets the required positive margins of safety.

6. Applicable Documents:
N/A

7. Reference Documents:
1) NASA-STD-5002, *Load Analyses of Spacecraft and Payloads*
2) NASA-STD-5019, *Fracture Control Requirements for Spaceflight Hardware*
3) NASA-STD-5020, *Requirements for Threaded Fastening Systems in Spaceflight Hardware*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
AM-03	HIGH-FIDELITY STRUCTURAL MODEL AND DOCUMENTATION

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

The Government will use a high-fidelity structural model (HFSM) of each separately mounted Instrument component to support Government-internal analyses, requirements verification, Instrument and Observatory environmental test campaigns, and on-orbit Instrument operations.

5. Preparation Information:

The HFSM shall have adequate fidelity to fully analyze the structural and dynamic properties of the Instrument including member loads and stresses, accelerations, critical displacements, random loads, thermal distortion loads, and jitter due to transportation, launch, and on-orbit environments.

The HFSM shall have the following attributes:

1) NASTRAN format.
2) The HFSM shall be a "full" model with no symmetry assumptions made to reduce model size. "Super elements" shall not be used.
3) The HFSM, when rigidly supported at the interface, shall adequately represent all dynamic modes up to the lower of 500 Hz or up to the first two modes in each of the three translations and 3 rotations.
4) Components having fixed base frequencies greater than 500 Hz may be represented as rigid masses if the rigid modeling will not affect the modes less than 500 Hz.
5) The local coordinate system shall be rectangular with the same orientation as the Spacecraft coordinate system. Coordinate cards shall be provided to establish the local system. The origin of the local coordinate system shall be documented in the ICD.
6) All constraints internal to instruments and output shall be in the local coordinate system. There shall be no constraints external to the model upon submittal.
7) The bulk data deck shall not contain BAROR, GRDSET, PARAM K6ROT or PARAM AUTOSPC NASTRAN cards.
8) The specification of vector components for element coordinate system definition shall be used in lieu of referenced grid (i.e., CBAR, CBEAM).
9) SI units shall be used unless precluded by design or manufacturing heritage.

10) An instrument-unique numbering system for all NASTRAN model identification numbers shall be used (for grids, coordinates systems, elements, property and material IDs, as well as constraint and loading IDs). This number shall be of the form XXX00001 through XXX99999, where XXX is the instrument identification number provided by the spacecraft contractor. All instrument components which are physically separate units shall be modeled separately with unique identification numbers within the unique XXX instrument number allocation. No ID number duplications shall be allowed.
11) The HFSM model shall be capable of representing different dynamic response characteristics (if any) resulting from planned configuration changes between launch and deployment.

NASTRAN Model Verification:

1) The HFSM shall be test-verified for all primary modes less than 100 Hz if the instrument exceeds 23 kilograms and the fundamental resonant mode frequency is less than 100 Hz, as shown by analysis.
2) The HFSM shall be updated as necessary to agree with the structural and dynamic test results and the latest hardware design.
3) If either an analysis or frequency verification test show any significant mode of vibration below 50 Hz (in a fixed base configuration), an additional factor of 1.5 shall be applied to portions of the structure whose motion in the mode of vibration exceeds the motion of the centroid.
4) The analytical frequency predictions shall agree with dynamic test data to within 5 percent for the fundamental mode and to within 10 percent for all remaining significant modes to 50 Hz.
5) A cross orthogonally check between test and analytical mode shapes shall have diagonal terms above 0.9 and off diagonal terms below 0.1 for all significant modes up to 50 Hz.
6) In support of the development of the test-verified HFSM, a verification plan shall be developed which includes identification of the target modes, testing techniques, excitation levels, correlation analysis, and updating strategy. This plan shall be submitted prior to verification testing.

Deliverable NASTRAN Model and Data:

1) NASTRAN model capable of defining loads at the instrument/support interface due to gravity loads and structural element temperature changes.
2) Be of sufficient detail to accurately represent the dynamic behavior of the instrument up to 500 Hz. In general, no more degrees of freedom than necessary should be used.
3) The method of data transfer is electronic, or by other means agreed upon with the Spacecraft contractor.
4) Description of the model, any special modeling features used, and rational for the modeling methodology. State version of NASTRAN used. Name and version of pre/post processor used.
5) Bulk data deck files.
6) Results of computer runs and data checks that confirm validity of the model.
7) List of all material properties used in the NASTRAN model.
8) Copy of mass and stiffness calculations used in generating the input data for the model and a description of how the masses were distributed throughout the structure.

9) A description of the dynamic ASET degrees of freedom.
10) Detailed plots of the NASTRAN model clearly showing all grid points, element numbers, and element types, as well as, Instrument/spacecraft interface point locations with respective degrees of freedom identified.
11) Mechanical and functional description of all mechanisms in the Instrument, whether they are modeled or not.
12) Mode plots of the first three significant modes.
13) CAD model geometry file(s) used as the basis of the NASTRAN model.

6. Applicable Documents:
   1) NASA-STD-5002, *Load Analyses of Spacecraft and Payloads*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
AM-04	REDUCED-ORDER STRUCTURAL MODEL AND DOCUMENTATION

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

The Government will provide the Instrument reduced-order structural model (ROSM) to JPSS, who will subsequently provide it to the Spacecraft provider. The Instrument ROSM will be integrated into an Observatory structural model. JPSS and the Spacecraft contractor will utilize the Observatory model to perform analyses to determine and refine loads in the Instrument and Spacecraft including accurate dynamic predictions of frequencies, mode shapes, and loads at the Instrument – Spacecraft interface.

5. Preparation Information:

The ROSM shall have the following attributes:

1) NASTRAN format.
2) The ROSM model shall be a coarse model or a Craig-Bampton reduction of the High Fidelity Structural Model.
3) The Instrument interface structures shall be modeled in sufficient detail to provide accurate interface forces.
4) Be of sufficient detail to accurately represent the dynamic behavior of the instrument up to 100 Hz when rigidly supported at the interface. In general, no more degrees of freedom than necessary should be used.
5) The local coordinate system shall be rectangular with the same orientation as the Spacecraft coordinate system. Coordinate cards shall be provided to establish the local system. The origin of the local coordinate system shall be documented in the ICD.

NASTRAN Model Verification and Validation:

1) Computer runs and data checks shall be performed to ensure the accuracy of the ROSM including rigid body, 1-G, stiffness-equilibrium, effective model weights, and mass properties.
2) Modal results for the ROSM shall agree with the High Fidelity Structural Model as follows:

a) Fundamental frequency shall agree to 3%.
b) All remaining modes to 100 Hz shall have frequencies to within 5%.
c) Cross orthogonally check with full-up model shall have diagonal terms greater than 0.95 and off-diagonal terms less than 0.05.

Deliverable NASTRAN Model and Data:

1) NASTRAN structural model of the Instrument capable of defining loads at the instrument/support interface due to gravity loads and structural element temperature changes.
2) The method of data transfer is electronic, or by other means agreed upon with the Government;
3) Description of the model, any special modeling features used, and rationale for the modeling methodology. State version of NASTRAN used. Name and version of pre/post processor used.
4) Bulk data deck files.
5) Results of computer runs and data checks that confirm validity of the model.
6) Copy of mass and stiffness calculations used in generating the input data for the model and a description of how the masses were distributed throughout the structure.
7) A description of the dynamic ASET degrees of freedom.
8) Detailed plots of the NASTRAN model clearly showing all grid points, element numbers, and element types, as well as, Instrument/spacecraft interface point locations with respective degrees of freedom identified.
9) Mechanical and functional descriptions of all Instrument mechanisms whether they are modeled or not.
10) Mode plots of the first three significant modes.

6. Applicable Documents:
   1) NASA-STD-5002, *Load Analyses of Spacecraft and Payloads*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

AM-05 THERMAL ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the predicted thermal performance of the Instrument and key Instrument subsystems during ground test, launch and orbit transfer, and on-orbit environment. To document the full and reduced thermal analyses utilized for Instrument design.

5. Preparation Information:

The Thermal Analysis Report shall contain detailed technical descriptions of the thermal analyses performed in support of Instrument thermal design. Description of each analysis shall contain the following as a minimum:

1) All pertinent assumptions used for the analysis;
2) Description of the thermal model with associated boundary condition;
3) All detailed calculations necessary (if used) to substantiate the results;
4) The temperature and mechanical effects on the unit of thermal vacuum (if required) versus thermal ambient, and results;
5) Conclusions and recommendations.

If there are any special requirements such as special temperature control, heater power, thermal distortions, etc., which are pertinent to the design, these considerations shall be identified and included in the analysis. The detailed analysis shall demonstrate that the equipment meets all thermal design requirements and that all internal parts meet established thermal design criteria, based upon program de-rating or electrical performance requirements. This document shall describe in detail the various analysis cases (e.g., launch, transfer orbit, on-orbit, on-orbit hot and cold cases, etc.). This description shall include:

1) List of all parameters and assumptions used;
2) Interrelationships between various models and how boundary conditions are obtained;
3) Verification plan for the detailed and reduced thermal models;
4) Detailed calculations and descriptions of computer models and analyses;
5) Results of final analyses including predicted thermal performance over worst case extremes and design margins.

The final report shall contain, in addition to the minimum elements stated above, each item/part identification number, type, power dissipation, calculated temperature, and the de-rated and maximum rated design limits according to the Instrument Mission Assurance Requirements.

6. Applicable Documents:
   N/A

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: AM-06

2. Title: HIGH FIDELIGY THERMAL MODEL AND DOCUMENTATION

---

3. SOW/IPRD Reference:

SOW-2.3-03

---

4. Use:

The detailed thermal model (DTM) will be used internally by the Government to support requirements verification, environmental test campaigns and on-orbit Instrument operations activities.

5. Preparation Information:

1) The high fidelity thermal model shall be provided using Thermal Desktop and SINDA/FLUINT with the following attributes:

   a) The detailed thermal model shall include an adequate level of detail to predict all critical component temperatures under worst case hot and cold environments, in all operational modes.
   b) The geometry used to represent instrument radiators, apertures, optical elements, mounting feet and any other components identified as ‘critical’ in the thermal model shall be congruent with the geometry found in the mechanical/CAD model to the greatest extent possible.
   c) All nodes and conductors shall be modeled graphically in the Thermal Desktop environment. Inclusion of nodes or conductors not graphically represented in Thermal Desktop (i.e. via SINDA/FLUINT INCLUDE or INSERT files) requires Project approval.
   d) All required logic blocks shall be placed in the Thermal Desktop Logic manager, and not in external INSERT files.

2) A descriptive document will be included with the model, and should include the following:

   a) List of major assumptions, and simplifications that went into the model
   b) Table of all critical components with their descriptions, node number(s), operational temperature limits, and survival temperature limits
   c) Table of all heat dissipating components/nodes (excludes heaters) with the heat dissipation for each operational mode

d) Table of all modeled heaters, including which nodes or components they are applied to, their set points and dead-bands, and how they are physically controlled (thermostat, software, etc.)
e) Table of any special thermal hardware such as heat pipes and thermoelectric cooling chips (TECs), and how they are being modeled, and what nodes they apply to
f) Table of all symbols or registers that are used to change the state of objects in the model. Should include a description of each symbol, including the valid values with their descriptions. For example, symbols that change the power profile in the model based on the operational mode should be described (Flag_Power: 1=Hot case, 2=Cold case, …)
g) Descriptions of user defined logic and subroutines.
h) Plan for model correlation

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.:

AM-07

2. Title:

REDUCED ORDER THERMAL MODEL AND DOCUMENTATION

---

3. SOW/IPRD Reference:

SOW-2.3-03

---

4. Use:

The Government will provide the Reduced Order Thermal Model to the Spacecraft provider and to JPSS instrument providers for Observatory requirements verification, Observatory environmental test activities, flight predictions and assessments of payload crosstalk.

5. Preparation Information:

1) The reduced order thermal model shall be provided using Thermal Desktop and SINDA/FLUINT with the following attributes:
   a) The reduced thermal model shall include an adequate level of detail to predict all critical component temperatures under worst case hot and cold environments, in all operational modes.
   b) The geometry used to represent instrument radiators, apertures, optical elements, mounting feet and any other components identified as ‘critical’ in the thermal model shall be congruent with the geometry found in the mechanical/Computer-Aided Design (CAD) model to the greatest extent possible.
   c) All nodes and conductors shall be modeled graphically in the Thermal Desktop environment. Inclusion of nodes or conductors not graphically represented in Thermal Desktop (i.e. via SINDA/FLUINT INCLUDE or INSERT files) requires Project approval.
   d) All required logic blocks shall be placed in the Thermal Desktop Logic manager, and not in external INSERT files.
2) A descriptive document will be included with the reduced thermal model, and shall include the following:
   a) List of major assumptions, and simplifications that went into the model. Include a description of the changes from the detailed thermal model.
   b) Table of all critical components with their descriptions, node number(s), operational temperature limits, and survival temperature limits
   c) Table of all heat dissipating components/nodes (excludes heaters) with the heat dissipation for each operational mode

d) Table of all modeled heaters, including which nodes or components they are applied to, their set points and dead-bands, and how they are physically controlled (thermostat, software, etc.)
e) Table of any special thermal hardware such as heat pipes and TECs, and how they are being modeled, and what nodes they apply to
f) Table of all symbols or registers that are used to change the state of objects in the model. Should include a description of each symbol, including the valid values with their descriptions. For example, symbols that change the power profile in the model based on the operational mode should be described (Flag_Power: 1=Hot case, 2=Cold case, …)
g) Descriptions of user defined logic and subroutines.
h) Plan for model correlation

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-08

2. Title: MOLECULAR TRANSPORT ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the molecular transport model and analysis performed on the Instrument to establish potential contamination sources within the instrument, as well as a list of surfaces sensitive to contamination depositions.

5. Preparation Information:

The Molecular Transport Analysis Report shall document the Contractor's development of the Instrument internal Molecular Transport Model and results from analyses using that model. The primary focus of the instrument internal mass transport analysis is to establish the potential contamination sources within the instrument and a list of surfaces sensitive to contamination depositions.

The report shall contain, at a minimum:

1) Overview description of the instrument molecular transport model;
2) Model assumptions, limitations, and accuracy estimation;
3) Description of modeling methodology;
4) A list of the deposition onto sensitive surfaces (usually cold surfaces) for the duration of mission life as well as the temperature history of these elements;
5) A list of the surfaces of concern as contamination sources;
6) The maximum permissible fluence to sensitive instrument apertures from external sources such as spacecraft bus, other instruments, solar arrays, and environmental return flux sources;
7) Assessment of the necessary levels of bakeout at the part or component, subsystem, and instrument-levels;
8) Documentation of the outgassing paths within the instrument.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-09

2. Title: ELECTRONIC ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the design and performance analysis of Instrument electronic circuits.

5. Preparation Information:

The Electronic Analysis Report shall document Instrument electronic designs and circuit functions and substantiate that these circuits will perform within specifications throughout the mission life over the range of environmental conditions expected. The report shall document electronic circuit performance criteria and specifications including, but not limited to, gain error and stability, signal-to-noise ratio, common-mode rejection ratio, power supply rejection ratio, signal amplitude and phase nonlinearities over full circuit dynamic range to include analog-to-digital conversion effects, filter and sampling aliasing, and noise immunity for functions and circuits when exposed to the predicted environmental conditions. The report shall include an error budget for the critical circuits which affect Instrument radiometric accuracy and performance. The analysis and error budget shall include, at a minimum, performance over all environmental levels and parameter drifts due to such things as circuit parts aging, temperature and voltage variations, and radiation effects. The report shall include schematics and timing diagrams to describe the functional and timing relationships of all circuit card assemblies and Instrument electronic components with each other as well as with the Spacecraft.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-10

2. Title: EMI / EMC ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the EMI/EMC analyses used in the design of the Instrument, and to provide early identification of potential areas of concern for radio frequency susceptibility or emission.

5. Preparation Information:

The EMI/EMC Analysis report shall document the EMI/EMC analyses used in the design of the Instrument to substantiate that the design will lead to an Instrument that will meet all EMI / EMC requirements. The analysis report shall address EMI/EMC effects from internal and external sources – including radio frequency and/or microwave heating - on all major Instrument subsystems including:

1) Detectors
2) Calibration Subsystems
3) Wiring, wiring harnesses, and grounding
4) Electronic subsystems
5) Thermal control
6) Mechanisms

The analysis report shall include, but not be limited to:

1) The analytical bases, derivations, and methods used to perform the analyses;
2) Identification and technical overview of any software modeling tools used;
3) Analysis results;
4) Supplementary test results - obtained at the component, subsystem, or Instrument-level – obtained by the Contractor for the purposes of analysis verification;
5) Assessment of compliance with Instrument design and performance requirements;
6) A list of analysis results predicting out-of-specification performance, including proposed solutions to each occurrence.

6. Applicable Documents:
N/A

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-11

2. Title: RADIATION HARDNESS ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the Radiation Hardness Analysis performed for Instrument design. To demonstrate the Instrument will meet performance specifications and reliability requirements when exposed to the on-orbit radiation environment throughout the mission life.

5. Preparation Information:

The Radiation Hardness Analysis Report shall document the radiation analyses performed for Instrument design and provide verification that the Instrument will meet performance requirements when exposed to the on-orbit and ground test radiation environment throughout the mission life. The Radiation Analysis Report shall include, at a minimum:

1) Radiation effects/degradations on:
   a) Instrument materials, optical components and optical coatings
   b) Instrument electronic performance
   c) Instrument radiometric performance and calibration
2) Characteristics of each radiation susceptible flight part including:
   d) Total Ionizing Radiation
   e) Displacement Damage Dose
   f) Enhanced Low Dose Rate Sensitivity
   g) Single Event Effects
   h) Single Event Upset
   i) Single Event Latchup
3) Dose shielding Analysis – This analysis shall determine the worst case total ionizing doses at the semiconductors within the unit to a level of detail sufficient to support the Piece Parts Radiation De-rating and Margins Analysis. The equivalent shielding afforded by the host spacecraft and other structure adjacent to the unit will be provided by the Government to the Contractor for use in this analysis.
4) Piece Part De-ratings and Margins Analysis – This analysis shall use the results of the Dose Shielding Analysis to determine the dose levels to which unit semiconductor part parameters must be de-rated to meet circuit performance requirements with margin. The

de-rated parameter values shall be established at a dose level with sufficient margin above the received dose in accordance with the hardness assurance requirements of equipment specification. These radiation de-rated parameters shall be combined with other appropriate de-ratings for age and temperature and used in the worst-case circuit analysis.

5) Single Event Effects Analysis – This analysis shall verify that the Instrument meets the single event upset and damage requirements of the specification. Single event upset rates for parts shall be obtained from existing literature or new tests and used to determine the upset rates and modes for the unit. This analysis shall also demonstrate that no catastrophic modes occur as the result of a single event heavy ion or proton hit. The analysis may be limited to Single Event Transient analysis if the parts used are immune to other Single Event Effects, however the report shall cite the method and documentation that validated the part's immunity.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-12

2. Title: ATOMIC OXYGEN ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the Atomic Oxygen Analysis performed for Instrument design and Instrument material erosion rate determination.

5. Preparation Information:

The Atomic Oxygen Analysis Report shall document Atomic Oxygen analyses performed for Instrument design and provide verification that the Instrument will meet performance requirements when exposed to the on-orbit Atomic Oxygen environment throughout the mission life. The Atomic Oxygen Report shall include, at a minimum:

1) Overview description of the theoretical bases and analysis methods used;
2) Analysis assumptions, limitations, and uncertainty estimates;
3) Identification of Instrument materials and components / subsystems determined to be sensitive to degradation from atomic oxygen exposure;
4) Erosion rates and/or other surface property changes for materials determined to be sensitive to atomic oxygen exposure;
5) Predicted impacts on instrument performance throughout mission life resulting from atomic oxygen exposure;
6) Identification of any constraints / restrictions / requirements that must be implemented on the Observatory or during on-orbit Instrument operations to mitigate detrimental effects of atomic oxygen exposure.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-13

2. Title: ORBITAL DEBRIS ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

Ensure NASA requirements for post mission orbital debris control are met.

5. Preparation Information:

The assessment shall be done in accordance with NPR 8715.6 NASA Procedural Requirements for Limiting Orbital Debris and NASA-STD-8719.14 Process for Limiting Orbital Debris. The preliminary assessment is conducted to identify areas where the RBI instrument may contribute debris and to assess this contribution relative to the guidelines. The final assessment is conducted shall include comments on changes made since the preliminary assessment. The detail should be consistent with the available information of design and operations. The Contractor shall submit updates to the final assessment for design changes after CDR that impact the potential for debris generation.

NOTE: Orbital Debris Assessment Software is available for download from Johnson Space Center at URL: http://sn-callisto.jsc.nasa.gov/mitigate/das/das.html

6. Applicable Documents:
   1) NPR 8715.6A, *NASA Procedural Requirements for Limiting Orbital Debris*
   2) NASA-STD-8719.14, *Process for Limiting Orbital Debris*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-14

2. Title: CONTROL SYSTEM ANALYSIS REPORTS

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the estimated margins and performance of any Instrument closed-loop or open-loop mechanism control systems. To document that Instrument subsystems will be able to operate as required when assembled and operated as a system under representative inputs and disturbances. Used as input to DRD #AM-16, "On-orbit Pointing & Jitter Analysis".

5. Preparation Information:

Spacecraft disturbances at the Instrument-to-Spacecraft interface will be provided by the Government. For this DRD, the term "Instrument" implies the science Instrument combined with any pointing, line-of-sight compensation, vibration suppression, or interface mechanisms, platforms, or structures. The analysis report(s) shall include:

Open-Loop Performance:

Analysis of any open-loop controlled mechanisms, e.g. stepper motor driven mechanisms such as filter wheels, Instrument on-orbit calibration mechanisms, deployment mechanisms, aperture covers, or focusing mechanisms. Analysis includes the range of required Instrument supplied voltage and power levels with the flight stepper motor commutation logic, gear train losses, resonances, torque loads, inertia properties, and damping. Analysis includes the range of required Instrument operational temperatures.

1) A description of the models used for the analysis.
2) Analysis to show simulated errors of the mechanism motion with respect to commanded inputs representative of the flight Instrument, e.g. filter wheel position errors, focus mechanism position errors during calibration scan, ability to deploy and stow.
3) Analysis to show motor torque margin compliance under beginning of life (BOL) and end of life (EOL) conditions with lowest and highest case power availability.
4) Analysis to show mechanism operation with uncertainties in damping and load inertia.
5) Analysis to show repeatability compliance.

Closed-Loop Performance:

Analysis of any closed-loop controlled mechanisms with position, rate, or acceleration requirements, e.g. pointing gimbals or platforms, steering mirrors, or focusing mechanisms.

Analysis includes analog and digital control architectures. Analysis includes flexible body dynamics. Analysis includes worst case and nominal modes of operation at BOL and EOL, e.g. changes in inertia, damping, or available power. Analysis includes any “bang-bang” type control loops.

A description of the models used for the analysis.

Analysis to show phase margin compliance.

Analysis to show gain margin compliance.

Analysis to show -3dB closed-loop bandwidth compliance.

Analysis to show simulated errors of the closed-loop system with respect to commanded inputs representative of the flight Instrument, e.g. scan profiles for any gimbals, calibration cycles, commanded positions for mechanisms used during calibration, or ability to deploy and stow.

Descriptions of any disturbance inputs used in the models.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

AM-15 ON-ORBIT POINTING & JITTER ANALYSIS REPORT

---

3. SOW/IPRD Reference:

SOW-2.3-03

---

4. Use:

Evaluation of internal and external effects of the Instrument pointing subsystem and the impact of pointing subsystem error sources on Instrument functional and radiometric performance.

5. Preparation Information:

Both frequency domain and time domain results shall be included in the analyses. Results shall include all Instrument modes of operation. The analysis report shall include:

Pointing & Jitter Performance:

1) Instrument Generated Disturbances: Show the expected angular jitter and linear acceleration disturbances created by any Instrument mechanisms or moving parts based on either component specifications or direct measurements, and mechanical analysis.
2) Line-of-Sight Pointing: Provide an analysis of the combined effects of distortion due to all mechanical and thermal error sources.
3) Line-of-Sight Jitter: Provide an analysis of the combined effects of mechanical jitter from all Spacecraft and Instrument sources on the Instrument line of sight. Include the effects of any jitter suppressing mounting fixtures. Spacecraft jitter sources will be provided by the Government.

Error Budgets and Projected Margins:

1) Geolocation Knowledge Uncertainty Budget: Geolocation knowledge uncertainty budget and predicted performance margins for meeting Instrument geolocation knowledge performance requirements. The budget shall be formulated based on the framework prescribed in Appendix B3 of the Instrument Performance Requirements Document. Spacecraft values within the budget will be provided by the Government.
2) Geolocation Control Error Budget: Geolocation control error budget and predicted performance margins for meeting Instrument geolocation control requirements. The budget shall be formulated based on the framework prescribed in Appendix B3 of the Instrument Performance Requirements Document. Spacecraft values within the budget will be provided by the government.

Additional Analyses:

1) Maximum allowable linear acceleration at the Instrument – Spacecraft interface: Provide an analysis that determines the maximum allowable linear acceleration due to jitter, per axis at Instrument – Spacecraft interface, as a function of frequency from 1 to 1000 Hz, that can be incurred without experiencing Instrument performance degradation that would result in not meeting functional or radiometric performance requirements.
2) Maximum allowable angular rotation at the Instrument – Spacecraft interface: Provide an analysis that determines the maximum allowable zero-to-peak angular rotation due to jitter, per axis at the Instrument – Spacecraft interface, as a function of frequency from 1 to 1000 Hz, that can be incurred without experiencing Instrument performance degradation that would result in not meeting functional or radiometric performance requirements.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-16

2. Title: OPTICAL DESIGN AND ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

Documentation of the design, tolerancing, and sensitivities of Instrument optical components and subsystems for the purposes of providing evidence that the Instrument optical design will lead to an Instrument capable of satisfying requirements of the performance specification.

5. Preparation Information:

The Optical Design and Analysis Report shall provide detailed design information for Instrument optical components, subsystems, and systems. The report shall include, but not be limited to:

Optical Design:

1) Geometric optical design of all Instrument optical elements and subsystems, to include:
    a) Geometrical ray tracing;
    b) Identification of optical axes, cardinal points, focal points;
    c) Tolerance assessment for critical optical elements (e.g. radius of curve, index, coating quality, centering, surface finish);
    d) Optical component substrates and coatings;
    e) Stray light, glint, and baffling;
    f) Polarization sensitivity;
    g) Optical aberrations;
    h) Spectral throughput or reflectivity;
    i) Field-of-view (geometric and effective);
    j) Optical system modulation transfer function;
    k) Sensor / Detector Point Spread Function.

Optical Analyses:

1) Analyses of optical system performance and stability in response to:
    a) Thermal and structural distortion resulting from the expected on-orbit environment, including ground-to-orbit gravitational effects;
    b) Mechanical disturbances and jitter, both self-induced and spacecraft-induced;
    c) Ground Dynamics Test levels (vibration, acoustics, shock).

6. Applicable Documents:
   N/A

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-17

2. Title: OPTICAL NUMERICAL MODELS

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

Government insight of the design of Instrument optical subsystems. To provide numerical models of instrument optical subsystems for potential diagnostics during on-orbit operations.

5. Preparation Information:

Optical Numerical Models used in the development of AM-18, "Optical Design and Analysis Report" shall be provided. Optical Numerical Model(s) shall be provided for each Instrument optical subsystem and the fully integrated Instrument optical system. Models shall be provided in Code V compatible format. Numerical models shall be accompanied with a descriptive "readme" (or equivalent) document that includes the following:

1) Modeling software and version used;
2) Model version number and date;
3) Model Summary Description;
4) Relevant technical notes, model limitations, and assumptions;
5) Listing of input parameters and nominal parameter values;
6) Listing of key output parameters and their values when the input parameter nominal values are used.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-18

2. Title: SENSOR RADIOMETRIC DESIGN AND ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

Documentation of the RBI sensor module radiometric design and predicted performance to provide evidence that the RBI sensor module design will lead to an Instrument that meets radiometric performance requirements.

5. Preparation Information:

For the purposes of this DRD, "sensor module" denotes the front end optics, detector, and detector signal conditioning electronics used to collect and sense Earth radiance in each independent spectral measurement band (e.g. reflected solar, emitted thermal, and total). The Sensor Radiometric Design and Analysis Report shall provide detailed radiometric design information for each sensor module used on the Instrument. The report shall include, but not be limited to, the following for each sensor:

1) Detailed uncertainty allocations;
2) Spectral response;
3) Time constant;
4) Response offset and linearity;
5) Output sensitivity to detector spatial response non-uniformity;
6) Output sensitivity to opto-mechanical effects (such as distortion, strain, and inertia);
7) Assessment of stability in the on-orbit environment;
8) Signal to Noise ratio over the sensor dynamic range;
9) Noise Equivalent Radiance;
10) For RBI Earth Spectral Scenes, calculated radiometric power (in Watts) at the detector and predicted sensor response;
11) For Instrument on-board calibration sources, including the sun and moon as applicable, calculated radiometric power (in Watts) at the detector and predicted sensor response;
12) For detectors comprised of multiple discrete pixels:
    a) Pixel-to-pixel crosstalk and its quantified impact on radiometric performance;
    b) Quantified impact on radiometric performance of aggregating independent pixel outputs to constitute a singular RBI measurement sample.

6. Applicable Documents:
   N/A

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: AM-19

2. Title: SENSOR RADIOMETRIC NUMERICAL MODELS

---

3. SOW/IPRD Reference:

SOW-2.3-03

---

4. Use:

Government insight of the RBI sensor module design and predicted radiometric performance. To provide numerical model(s) of sensor radiometric response for potential diagnostics during on-orbit operations.

5. Preparation Information:

For the purposes of this DRD "sensor module" denotes the front end optics, detector, and detector signal conditioning electronics used to collect and sense Earth radiance in each independent spectral measurement band (e.g. reflected solar, emitted thermal, and total). The Sensor Radiometric Numerical Model(s) shall, at a minimum:

1) Be either one model of each sensor module (e.g. reflected solar, emitted thermal, and total), or a single model capable of simulating any sensor module;
2) Be refined and correlated using results of hardware-based tests (such as the Radiometric Test Model) throughout the development program;
3) Simulate the sensor predicted output, before and after analog-to-digital conversion, to temporally and spatially variable scene inputs when viewed as a function of time;
4) Accurately predict time-dependent sensor analog and digital output and noise.

Model(s) shall be delivered with:

1) All source code, scripts, and executable code;
2) Input files representing standard RBI earth scenes, and corresponding model output files;
3) Input files representing all instrument on-orbit calibration sources, including those on-board the instrument and sun and moon as applicable, and corresponding model output files;
4) Input files representing planned ground calibration sources, and corresponding model output files;
5) Descriptive "readme" (or equivalent) document that includes:
    a) Modeling software and version used;
    b) Model version number and date;
    c) Model Summary Description;
    d) Relevant technical notes, model limitations, and assumptions;

e) Instructions for installing and/or compiling (as applicable);
f) Model use / operating instructions.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
AM-20	MEASUREMENT UNCERTAINTY ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

To document the end-to-end measurement uncertainty analysis of the Instrument.

5. Preparation Information:

The Measurement Uncertainty Analysis Report shall document a combined (end-to-end) uncertainty allocation for each radiometric channel such that overall performance expressed in the IPRD, Section 4, Instrument Science Performance Requirements, can be achieved. The uncertainty allocations shall address the effects of the required ground storage period, launch, ground-to-on-orbit calibration transfer, and on-orbit environment and mission life. The report shall address the Instrument Type A and Type B uncertainty requirements. The report shall provide a tabular listing of uncertainties for each channel. This tabulation shall list each channel measurement giving measurement title identification symbol, the expected data frequency, sampling rate, type of signal output to the JPSS-2 polar platform attached payload (analog or digital), and tabulation of channel uncertainty allocation and end-to-end system uncertainty. The method of summing the individual uncertainties to arrive at the combined (end-to-end) system uncertainty for each channel measurement shall also be reported. This tabulation shall be expanded to incorporate analytical and test data as these data are generated to validate the uncertainty allocations. All supporting calculations leading to each budgeted quantity shall be shown. If any item is a function of range, such range shall be shown.

The uncertainty analysis shall address each variable of the Instrument Calibration Equation (see DRD CV-01). Sources of uncertainty to be addressed include, but are not limited, to the following:

1) Optical misalignment
4) Optical contamination
5) Optical aberrations
6) Optical vignetting
7) Optical polarization
8) Temperature and temperature stability of detector and optical components
9) Channel out-of-field-of-view response
10) Degradation of the optics and detector
11) Uncertainty in spectral response of optics and detector and in spectral outputs of the ground and in-flight calibration sources

12) Nonlinearity
13) Aliasing and blurring
14) Electronic system
15) Pointing, distortion, and jitter
16) Scan and azimuth drive irregularities due to bearing lubrication and/or wear
17) EMI/radio frequency interference (RFI)
18) Power supply output variations
19) Microphonics
20) Channel frequency response
21) Calibration - these uncertainties relate to the ability to tie the specific channel to the master reference used for that channel.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-21

2. Title: END-TO-END SYSTEM PERFORMANCE ANALYSIS REPORT

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

Documents the Contractor's End-to-End System Performance Analysis capability. Documents the utility and fidelity of end-to-end numerical models for Instrument design and measurement uncertainty analysis. Provides comparison of actual vs. predicted performance for various test cases. Extrapolates ground-based test results to predicted on-orbit performance.

5. Preparation Information:

The End-to-End System Performance Analysis Report shall document the contractor's numerical modeling capability for end-to-end (input radiance to output data) prediction of Instrument radiometric performance during ground testing and on-orbit operation. The report shall include, but not be limited to, documentation of the following:

1) Modeling and simulation codes used and simulation methodology;
2) Model assumptions and limitations;
3) Detailed descriptions of key algorithms and mathematics;
4) Detailed descriptions of statistical uncertainty or noise models;
5) Detailed descriptions of methods for uncertainty propagation, from uncertainties in model input parameters to uncertainties in model output parameters;
6) Detailed description of simulation methodology and uncertainties for application of ground calibration parameters, to on-orbit calibration transfer, to on-orbit calibration parameters;
7) Predicted radiometric performance of all sensor channels (e.g. reflected solar, emitted thermal, and total) including uncertainty estimates for calibrated radiance for:
    a) RBI standard earth scenes for all earth-viewing operational modes;
    b) Ground calibration sources for all ground calibration modes;
    c) In-flight calibration sources, including Instrument on-board sources and sun and moon as applicable, for all on-orbit calibration modes;
8) Predicted sensitivities and dependence of sensor output signal to environmental conditions, both ground and on-orbit;
9) Comparison and validation of model output results to ground test measurements;
10) Verification that the assumptions and simplifications within the models will not preclude the actual flight instrument from meeting performance requirements;

11) Extrapolations of ground test results to flight conditions so that on-orbit performance can be evaluated.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: AM-22

2. Title: COMPUTER-AIDED DESIGN (CAD) MODELS

3. SOW/IPRD Reference:

SOW-2.3-03

4. Use:

Government insight to the physical design of the Instrument and any auxiliary equipment. Model(s) may be used to evaluate interface fit checks, clearance studies, mass properties, thermal and/or structural analyses, or other independent Government studies of Instrument physical characteristics.

5. Preparation Information:

Solid 3D CAD model(s) shall be provided for the entire Instrument and any auxiliary equipment, and shall represent the physical characteristics of the Instrument.

1) Model(s) shall be provided in both STEP and IGES formats;
2) Model(s) shall contain a global coordinate system consistent with the Instrument Coordinate system specified in the Instrument Performance Requirements Document.
3) Models shall contain the same assemblies as the Contractor model(s);
4) The Government reserves the right to request the model(s) be exported in its native file format, which shall maintain its associated metadata (user specified mass properties, material properties, coordinate systems, layer names, parameter descriptions, etc.);
5) Model(s) shall be accompanied with a descriptive document in Contractor format with the following attributes:
    a) Modeling software and version used;
    b) Model version number and date;
    c) Model summary and description including total mass, and material properties used;

6. Applicable Documents:

N/A

7. Reference Documents:

N/A

2.6 SOFTWARE

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
SW-01	NPR 7150.2A TAILORED COMPLIANCE MATRIX

3. SOW/IPRD Reference:

SOW-5.1-02

4. Use:

The NPR 7150.2A Tailored Compliance Matrix specifies compliance of the Contractor's processes with each Software Engineering Requirement (SWE) from the NPR that is levied by NASA on the Contractor.

5. Preparation Information:

The Contractor shall complete a matrix which demonstrates compliance of their RBI software (SW) development and management processes with each of the applicable SWE entries for Class C, non-Safety Critical Software, including those marked as P(Center) in Appendix D of the NPR.

The Tailored Compliance Matrix shall be completed based on the Contractor's institutional and program processes applied to the RBI development work. This information will be used by the Government to assess the Contractor's process compliance. The requirements levied in the matrix should not instigate new work or updates to any DRD unless directed by the Government.

6. Applicable Documents:
   1) NPR 7150.2A, *SWE-20, Appendix D, and Appendix E*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

SW-02 SOFTWARE DEVELOPMENT PLAN

---

3. SOW/IPRD Reference:

SOW-5.1-04

---

4. Use:

Defines Contractor activities required to develop and manage all RBI Project software, whether developed by the Contractor or by a third party. The Software Development Plan includes processes, organizations, schedules, and resources required for each activity.

5. Preparation Information:

The Software Development Plan (SDP) shall describe processes and activities used in the development and testing of all CSCIs being produced or acquired for the RBI Project. The SDP shall include a list of all CSCIs governed by the SDP, with a brief high level description for each.

Topics to be included in the SDP shall include, but are not limited to, those listed in NPR 7150.2a, SWE-102. In addition, the SDP shall include the Contractor's plan for the identification and analysis of unreachable and unnecessary Flight Software code, in compliance with GSFC-STD-1000E GSFC Gold Rules, section 3.02.

The SDP shall include a Software Development Facility Specification which identifies all hardware, software, facilities, and other resources that the Contractor will require for developing, debugging, testing, and integrating the Project software. This specification shall include a brief explanation of each identified component and its purpose, and an explanation of the Contractor's plan for maintaining the Development Facility environment and its components. This environment may include, but is not limited to: development computer systems, high-level language compilers and debuggers, automatic code generation software systems, machine language emulators, and component test scenarios and procedures. It will also include software used in the Instrument test environment simulators to model the detectors and mechanisms, and development support software, such as configuration management systems for tracking software and document versions.

The SDP shall also include a list of all software metrics to be tracked, and the frequency that they will be presented. At a minimum, the metrics list shall include:

1) Number of software requirements, requirements changes, and their change status
2) Number of Software Change Requests/Problem Reports and their status
3) Number of source lines of code by categories (new, modified, reused, etc.), planned vs. actual

4) Resource margins for Utilization of memory, central processing unit (CPU), I/O Bandwidth and Bus traffic
5) Effort data (staffing profile) estimates versus actuals
6) Software Peer Review measures (reviews planned vs. actual, review findings, action items open/closed)

Material that is too detailed to be placed in the main body of text may be placed in an appendix or included as a reference. Include the appropriate reference in the main body of the text. Appendices may be bound separately, but are considered to be part of the document and shall be placed under configuration control as such.

6. Applicable Documents:
   1) NPR 7150.2A, *SWE-102*
   2) GSFC-STD-1000E, *GSFC Gold Rules, Section 3.02*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-03

2. Title: SOFTWARE TEST PLAN

3. SOW/IPRD Reference:

SOW-5.1-18

4. Use:

The Software Test Plan describes the overall plan for testing the Flight Software and Ground Software and Simulator Software, including component-level testing, integration testing, qualification testing, acceptance testing, and system-levels tests.

5. Preparation Information:

The Software Test Plan shall be developed according to the requirements listed in NPR 7150.2A, SWE-104. The Test Plan shall also identify key FSW and GSW and Simulator Software tests which will require Software Test Reports to be generated according to DRD SW-07 and DRD SW-13 at their completion.

The Software Test Plan shall include descriptions of the testing environment(s) to be used and schedule information for test activities.

6. Applicable Documents:
   1) NPR 7150.2A, *Section 5.1.3, SWE-104*

7. Reference Documents:
   1) NPR 7150.2A, Section 3.4

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-04

2. Title: FLIGHT SOFTWARE REQUIREMENTS SPECIFICATION

3. SOW/IPRD Reference:

SOW-5.2-02

4. Use:

The Flight Software Requirements Specification (FSW SRS) specifies in detail the requirements for each CSCI within the Flight Software, including functional and performance requirements and rationale, interface requirements, testing requirements, security, and safety requirements.

5. Preparation Information:

The FSW SRS shall be prepared in accordance with NPR 7150.2A, SWE-109, and shall include detailed requirements for all of the CSCIs identified in DRD SW-02 which are part of the FSW.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-109

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-05

2. Title: FLIGHT SOFTWARE DESIGN DOCUMENT

3. SOW/IPRD Reference:

SOW-5.2-03

4. Use:

The Flight Software Design Document (FSW SDD) is used to describe the architecture and components of the FSW and explain how they will be structured and implemented in order to meet the FSW requirements specified in DRD SW-03.

5. Preparation Information:

The FSW SDD shall provide an overview of the processes used to create the FSW Design, including:

1) Design Methodology
2) Design Overview
3) Design Studies
4) Design Issues

The FSW SDD shall include a FSW design overview that describes the overall structure of the FSW, the relationships between the various FSW components, internal and external interfaces, and dependencies among FSW entities and resources.

For each FSW component, the FSW SDD shall contain a Software Design Description in accordance with NPR 7150.2A, SWE-111.

The FSW SDD shall include a Requirements Traceability Matrix showing bi-directional traceability between the FSW Requirements and the FSW Design and test plan.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-111

7. Reference Documents:
   1) NPR 7150.2A, Section 3.2

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-06

2. Title: FLIGHT SOFTWARE TEST PROCEDURES

3. SOW/IPRD Reference:

SOW-5.2-05

4. Use:

The FSW Test Procedures provide identification of and detailed instructions for each of the software test procedures/scripts to be implemented as described in the Software Test Plan (DRD SW-03).

5. Preparation Information:

For each of the tests identified in DRD SW-03, the FSW Test Procedures should include a detailed test description and a test procedure specification in accordance with NPR 7150.2A, SWE-114.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-114 and section 5.2.6

7. Reference Documents:
   1) NPR 7150.2A, Section 3.4

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-07

2. Title: FLIGHT SOFTWARE TEST REPORTS

3. SOW/IPRD Reference:

SOW-5.2-06

4. Use:

The Flight Software Test Reports are records of key software tests performed on the Flight Software or one of its subsystems. Key FSW tests requiring Software Test Reports will be identified in DRD SW-03. These test procedure results are provided for review following the test completion.

5. Preparation Information:

For each Key FSW Test identified in DRD SW-03, the Contractor shall deliver the Test Reports in two stages:

1) The initial Flight Software Test Report shall contain an overview of the test results, including:
   a) Overall evaluation of the software as shown by the test results
   b) Brief descriptions of remaining deficiencies, limitations, or constraints detected during testing
   c) Summary of discrepancies, problems, and deviations from test procedures
2) The final Software Test Report shall contain a detailed record of the test activities and results, and shall be written in accordance with NPR 7150.2A, SWE-118.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-118, section 5.3.2

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-08

2. Title: FLIGHT SOFTWARE VERSION DESCRIPTION DOCUMENT

3. SOW/IPRD Reference:

SOW-5.2-07

4. Use:

The Flight Software Version Description Document (VDD) identifies and describes the Flight Software version being delivered, the actual executable software, and accompanying documentation.

5. Preparation Information:

The FSW Version Description Document shall be prepared according to NPR 7150.2A, SWE-116, and shall be included with the FSW delivery.

For all firmware media, formatted and numbered drawings are required with assembly numbers assigned to all loaded chips and drawing notes used to identify specific loading and test procedures, markings, etc.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-116

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

SW-09 FLIGHT SOFTWARE USER'S GUIDE

3. SOW/IPRD Reference:

SOW-5.2-08

4. Use:

The Flight Software Users Guide contains all information required to build, install, operate, and maintain the Flight Software, including detailed procedures and functionalities. This Guide shall provide this information for all operating environments (GSE, flight Instrument pre-delivery and pre-launch, on orbit, etc.) in which the FSW will be installed.

5. Preparation Information:

The User's Guide shall include, as a minimum:

1) An overview of the Flight Software, including organization, operating environment, overview of operation, interfaces, operating modes, and security.
3) Build procedures, including required hardware and software tools, host environment, support equipment, facilities and environments, problem reporting, and contingencies
4) Procedures for installing Flight Software on simulators, test equipment, and the RBI flight instrument
5) Operating procedures
6) Procedures for modifying and updating the Flight Software if necessary in all intended operating environments , including required tools, testing and verification procedures, reviews, approvals, and responsible parties

6. Applicable Documents:
N/A

7. Reference Documents:
1) NPR 7150.2A, SWE-115

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-10

2. Title: GROUND SOFTWARE REQUIREMENTS SPECIFICATION

3. SOW/IPRD Reference:

SOW-5.3-03

4. Use:

The Ground Software Requirements Specification (GSW SRS) specifies in detail each Software Element's requirements within the Ground Software, including functional and performance requirements, rationale, interface requirements, testing requirements, security, and safety requirements.

5. Preparation Information:

The GSW SRS shall be prepared in accordance with NPR 7150.2A, SWE-109, and shall contain requirements for all of the CSCIs identified in DRD SW-02 which are part of the GSW, including the Instrument Ground Operations Software, the Instrument Operations Support Software, and the Instrument Performance Trending Software.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-109

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-11

2. Title: GROUND SOFTWARE DESIGN DOCUMENT

3. SOW/IPRD Reference:

SOW-5.3-04

4. Use:

The Ground Software Design Document (GSW SDD) is used to describe the architecture and components of all of the GSW systems and explain how each will be structured and implemented in order to meet the GSW requirements specified in DRD SW-10.

5. Preparation Information:

The GSW SDD shall provide an overview of the processes used to create the GSW Design, including:

1) Design Methodology
2) Design Overview
3) Design Studies
4) Design Issues

The GSW SDD shall include a system-level GSW design overview that describes the overall structure of each the GSW systems, including the Instrument Ground Operations Software, the Instrument Operations Support Software, and the Instrument Performance Trending Software. These overviews shall explain the relationships between the components of the GSW system, internal and external interfaces, and dependencies among system entities and resources.

For each GSW component, the GSW SDD shall contain a Software Design Description in accordance with NPR 7150.2A, SWE-111.

The GSW SDD shall include a Requirements Traceability Matrix showing bi-directional traceability between the GSW Requirements and the GSW Design and test plan.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-111

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-12

2. Title: GROUND SOFTWARE TEST PROCEDURES

3. SOW/IPRD Reference:

SOW-5.3-06

4. Use:

The GSW Test Procedures provide identification of and detailed instructions for each of the GSW test procedures/scripts to be implemented as described in the Software Test Plan (DRD SW-03).

5. Preparation Information:

For each of the GSW tests identified in DRD SW-03, the GSW Test Procedures should include a detailed test description and a test procedure specification in accordance with NPR 7150.2A, SWE-114.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-114 and section 5.2.6

7. Reference Documents:
   1) NPR 7150.2A, Section 3.4

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-13

2. Title: GROUND SOFTWARE TEST REPORTS

3. SOW/IPRD Reference:

SOW-5.3-07

4. Use:

The Ground Software Test Reports are records of key software tests performed on one or more of the Ground Software systems. Key GSW tests requiring Software Test Reports will be identified in DRD SW-03. These test procedure results are provided for review following the test completion.

5. Preparation Information:

For each Key GSW Test identified in DRD SW-03, the Contractor shall deliver the Test Reports in two stages:

1) The initial Ground Software Test Report shall contain an overview of the test results, including:
    a) Overall evaluation of the software as shown by the test results
    b) Brief descriptions of remaining deficiencies, limitations, or constraints detected during testing
    c) Summary of discrepancies, problems, and deviations from test procedures
2) The final Software Test Report shall contain a detailed record of the test activities and results, and shall be written in accordance with NPR 7150.2A, SWE-118.

6. Applicable Documents:
    1) NPR 7150.2A, SWE-118, section 5.3.2

7. Reference Documents:
    N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-14

2. Title: GROUND SOFTWARE VERSION DESCRIPTION DOCUMENT

3. SOW/IPRD Reference:

SOW-5.3-08

4. Use:

The Ground Software VDD identifies and describes the versions of all of the Ground Software systems being delivered, the actual executable software, and accompanying documentation.

5. Preparation Information:

The GSW Version Description Document shall be prepared according to NPR 7150.2A, SWE-116, and shall be included with the GSW delivery.

For all firmware media, formatted and numbered drawings are required with assembly numbers assigned to all loaded chips and drawing notes used to identify specific loading and test procedures, markings, etc.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-116

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-15

2. Title: GROUND SOFTWARE USER'S GUIDE

3. SOW/IPRD Reference:

SOW-5.3-09

4. Use:

The Ground Software Users Guide contains all information required to install, operate, and maintain the GSW, including associated host and support hardware.

5. Preparation Information:

The Ground Software User's Guide shall include detailed user instructions for each of the GSW systems. These instructions shall be developed according to NPR 7150.2A, SWE-115, and shall include descriptions of installation, setup, and operation procedures for all of the GSW systems.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-115

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-16

2. Title: SOFTWARE TEST READINESS REVIEW DATA PACKAGE

3. SOW/IPRD Reference:

SOW-5.1-21
SOW-5.1-23

4. Use:

Review packages to be used to show that the Contractor has completed all development tasks for all project software deliverables and is ready to proceed with formal software acceptance testing. The Contractor shall conduct separate Software Test Readiness Reviews (SWTRRs) for FSW and GSW and simulator software.

5. Preparation Information:

The SWTRR shall show that the Contractor has adequately prepared for, and is ready to proceed with, formal software acceptance testing. Evidence used to demonstrate this readiness should include, at a minimum, the check-out of test procedures, test cases, and requirements traceability.

This design review package shall address, as a minimum:

1) Completed and approved Software Test Plans and Test Procedures
2) List of required test hardware and software systems, including simulators, emulators, and analysis tools
3) Status of software-related action items from prior project reviews
4) Status of action items from Software EPRs
5) Status of all Software Change Requests for the software to be tested (Flight Software or Ground Software)
6) Results from prior functional and interface software tests
7) Failure report summaries including status of action and rationale for closure

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-17

2. Title: SOFTWARE ACCEPTANCE REVIEW DATA PACKAGE

3. SOW/IPRD Reference:

SOW-5.1-22
SOW-5.1-24

4. Use:

The Software Acceptance Review (SWAR) is used to verify that the software under review is ready for final acceptance by the Project. The Contractor shall conduct separate SWARs for Flight Software and Ground Software and simulator software.

5. Preparation Information:

The Contractor shall conduct the SWAR to demonstrate that the software is complete, meets or exceeds all requirements, has been fully tested, verified, and validated, and has no outstanding change requests, failure reports, or other unresolved issues. Further, the SWAR also verifies that all supporting documentation is complete and in final form, and that required support equipment is calibrated and fully operational.

This design review package shall address, for the software being reviewed (Flight Software or Ground Software), as a minimum:

1) Status of all related DRDs
2) Software Acceptance Test Report
3) Status of all action items
4) Status of all Software Change Requests
5) Reports from all audits including status of all findings and action items
6) Status of all SW Failure Reports

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-18

2. Title: SIMULATOR SOFTWARE REQUIREMENTS SPECIFICATION

3. SOW/IPRD Reference:

SOW-5.5-09

4. Use:

The Simulator Software Requirements Specification (SIM SRS) specifies in detail the requirements for each CSCI within the simulator software, including functional and performance requirements and rationale, interface requirements, testing requirements, security, and safety requirements.

5. Preparation Information:

The SIM SRS shall be prepared in accordance with NPR 7150.2A, SWE-109, and shall include detailed requirements for all of the CSCIs identified in DRD SW-02 which are part of the simulator.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-109

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

SW-19 SIMULATOR SOFTWARE DESIGN DOCUMENT

3. SOW/IPRD Reference:

SOW-5.5-11

4. Use:

The Simulator Software Design Document (SIM SDD) is used to describe the architecture and components of the simulator software and explain how they will be structured and implemented in order to meet the simulator requirements specified in DRD SW-18.

5. Preparation Information:

The SIM SDD shall provide an overview of the processes used to create the Simulator Design, including:

1) 1) Design Methodology
2) 2) Design Overview
3) 3) Design Studies
4) 4) Design Issues

The SIM SDD shall include a simulator design overview that describes the overall structure of the simulator, the relationships between the various simulator components, internal and external interfaces, and dependencies among simulator entities and resources.
For each simulator component, the SIM SDD shall contain a Software Design Description in accordance with NPR 7150.2A, SWE-111.
The SIM SDD shall include a Requirements Traceability Matrix showing bi-directional traceability between the Simulator Requirements and the Simulator Design and test plan.

6. Applicable Documents:
1) NPR 7150.2A, SWE-111

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-20

2. Title: SIMULATOR SOFTWARE TEST PROCEDURES

3. SOW/IPRD Reference:

SOW-5.5-15

4. Use:

The Simulator Test Procedures provide identification of and detailed instructions for each of the software test procedures/scripts to be implemented.

5. Preparation Information:

For each of the tests identified in DRD SW-03, the Simulator Test Procedures shall include a detailed test description and a test procedure specification in accordance with NPR 7150.2A, SWE-114.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-114

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-21

2. Title: SIMULATOR SOFTWARE TEST REPORTS

3. SOW/IPRD Reference:

SOW-5.5-16

4. Use:

The Simulator Software Test Reports are records of key software tests performed on the simulator software or one of its subsystems. These test procedure results are provided for review following the test completion.

5. Preparation Information:

For each Simulator Tests identified in DRD SW-03, the Contractor shall deliver the Test Reports in two stages:

1) The initial Simulator Software Test Report shall contain an overview of the test results, including:
   a) Overall evaluation of the software as shown by the test results
   b) Brief descriptions of remaining deficiencies, limitations, or constraints detected during testing
   c) Summary of discrepancies, problems, and deviations from test procedures

2) The final Simulator Software Test Report shall contain a detailed record of the test activities and results, and shall be written in accordance with NPR 7150.2A, SWE-118.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-118

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-22

2. Title: SIMULATOR VERSION DESCRIPTION DOCUMENT

3. SOW/IPRD Reference:

SOW-5.5-18

4. Use:

The Simulator Version Description Document (SIM VDD) identifies and describes the simulator version being delivered, the actual executable software, and accompanying documentation.

5. Preparation Information:

The Simulator Version Description Document shall be prepared according to NPR 7150.2A, SWE-116, and shall be included with the Simulator delivery. If required, for all firmware media, formatted and numbered drawings are required with assembly numbers assigned to all loaded chips and drawing notes used to identify specific loading and test procedures, markings, etc.

6. Applicable Documents:
   1) NPR 7150.2A, SWE-116

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-23

2. Title: SIMULATOR USER'S GUIDE

3. SOW/IPRD Reference:

SOW-5.5-19

4. Use:

The Simulator Users Guide contains all information required to build, install, operate, and maintain the simulator, including detailed procedures and functionalities. This Guide shall provide this information for all operating environments (GSE, flight Instrument pre-delivery and pre-launch, on orbit, etc.) in which the simulator will be installed.

5. Preparation Information:

The User's Guide shall include, as a minimum:

1) An overview of the simulator software, including organization, operating environment, overview of operation, interfaces, operating modes, and security.
2) Build procedures, including required hardware and software tools, host environment, support equipment, facilities and environments, problem reporting, and contingencies
3) Procedures for installing software on simulators and test equipment
4) Operating procedures
5) Procedures for modifying and updating the simulator software if necessary in all intended operating environments , including required tools, testing and verification procedures, reviews, approvals, and responsible parties.

6. Applicable Documents:

1) NPR 7150.2A, SWE-115

7. Reference Documents:

N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: SW-24

2. Title: SIMULATOR INCREMENTAL SOFTWARE

3. SOW/IPRD Reference:

SOW-5.5-13

4. Use:

The Simulator Incremental Software provides early insight into the simulator development to support Engineering Peer Reviews (EPRs) and identify potential disconnects.

5. Preparation Information:

For each of the simulator code EPRs, the Simulator Incremental Software shall include the current source code, models, libraries, tables, databases, and executable code that comprise the simulator software.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

2.7 INTEGRATION AND TEST

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
IT-01	INSTRUMENT FABRICATION AND ASSEMBLY PLAN

3. SOW/IPRD Reference:

SOW-7.1-01

4. Use:

Documents the Contractor's plan for instrument fabrication and assembly. Used to understand the overall instrument fabrication and assembly approach and plan for appropriate levels of government insight and oversight.

5. Preparation Information:

The Instrument Fabrication and Assembly Plan shall describe the overall fabrication and assembly flow, including in-process inspections and engineering tests that the Contractor will implement to produce the flight Instrument. The plan shall address fabrication, assembly, inspection, and test starting at the major component, through subsystem, to the fully assembled instrument. The plan shall include, at a minimum:

1) Overview description of the instrument fabrication, assembly, inspection, and test flow;
2) Overview of Quality Assurance oversight;
3) Overview schedule of the instrument fabrication and assembly process with key milestones identified;
4) Detailed graphical flow charts illustrating the fabrication, assembly, inspection, and test flow;
5) Identification and source of each subcontracted item;
6) Description of the electronics fabrication and assembly process, including screening and engineering qualification tests such burn-in and thermal cycling;
7) Identification and description of planned in-process engineering tests and/or calibrations of each element;
8) Identification of the location and facilities for fabrication and assembly of each major component / subsystem through to the fully assembled instrument;
9) Identification of all GSE or Special Test Equipment (STE) that will be utilized through to the fully assembled instrument;

10) Identification of any special handling requirements, critical lifts, safety requirements, or contamination-prone fabrication / assembly / test conditions that may warrant additional precaution;
11) Identification of when contamination inspections are planned within the fabrication and assembly flow; and
12) Photographic and/or video plan throughout instrument fabrication and assembly.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

IT-02 ENVIRONMENTAL TEST AND VERIFICATION PLAN

3. SOW/IPRD Reference:

SOW-7.2-02

4. Use:

Documents the Contractor's plan for environmental testing and environmental verification of instrument hardware.

5. Preparation Information:

The Environmental Test and Verification Plan shall describe the overall environmental test and verification program that the Contractor will conduct to verify the flight instrument meets environmental requirements. The plan shall be developed in accordance with GSFC-STD-7000A Section 2.1.1.1.1. The plan shall include description of planned environmental tests of:

1) The Engineering Development Unit and/or Radiometric Test Model for flight qualification and risk reduction purposes;
2) Flight instrument subsystems; and
3) Flight instrument.

The plan shall contain the following additional items at a minimum:

1) An Environmental Test Matrix as per GSFC-STD-7000A Section 2.1.1.2.1;
2) An Environmental Verification Specification as per GSFC-STD-7000A Section 2.1.1.3;
3) A listing and rationale for Test-As-You-Fly exceptions at instrument-level testing;
4) Instrument subsystem and instrument-level test flow, including identification of calibration tests;
5) Identification of any instrument special handling requirements, critical lifts, safety requirements, or contamination-prone testing conditions that may warrant additional precaution;
6) Identification of when instrument contamination inspections are planned within the instrument-level test flow;
7) Photographic and/or video plan during environmental testing;
8) Description of any tailoring of tests prescribed by GSFC-STD-7000A and the test requirements in the RBI Instrument Performance Requirements Document;
9) Description of how test procedure deviations, test discrepancies, out-of-family results, anomalies, and failures will be handled.

6. Applicable Documents:
   1) GSFC-STD-7000A, *General Environmental Verification Standard for GSFC Programs and Projects*, April 2013.

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

IT-03 TEST PROCEDURES

3. SOW/IPRD Reference:

SOW-7.3-01

4. Use:

To define and provide detailed procedures for performance verification tests of instrument components, subsystems, and systems.

5. Preparation Information:

The Test Procedures shall be detailed, step-by-step procedural instructions for conducting functional / performance verification tests of instrument components, subsystems, and systems. Test procedures shall be developed for each test activity defined in the System Performance Verification Plan (DRD SE-03), Environmental Test and Verification Plan (DRD IT-02), and Life Test Plan for Mechanisms (DRD MA-26).

The procedures shall contain the following information, at a minimum:

1) Test Objectives including hardware to be tested

2) Test Methods and Sequence, including Test methods documented within a test procedure prior to start of test

3) Applicable Documents and Software

4) Required component / subsystem / Instrument configuration, including any differences from flight configuration

5) Test Equipment Configuration, including layout and interconnection of test equipment and articles including the grounding scheme. Location and identification of all measuring points on appropriate schematics and diagrams

6) Test Equipment and Facility Identification (Test equipment & tooling lists including type, range and accuracy for each item)

7) Test Instrumentation

8) Safety Provisions and Cautions, including Identification of hazardous and potentially hazardous situations and operations and abort conditions

9) Environmental and/or other conditions to be maintained, including contamination controls

10) Responsibilities and chain-of-command for test performance

11) Expected results and associated caution and warning levels.

12) Data Recording Requirements

13) Data Recording Forms and Tables

14) Accept/Reject Criteria

15) Note any test phases and profiles

16) List the requirements for the test procedure and test report development

17) Description of any necessary functional operations required during the test (i.e. a Comprehensive Performance Test performed at hot and cold plateaus during thermal vacuum testing)

18) Test parameters/specific data to be measured

19) Test limits and tolerances

20) Inspections points as applicable

21) Applicable requirements for Quality Assurance that apply to the specific procedure

22) Provisions allowed for modifying the test procedure during test (Redlines, Bluelines, etc.)

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: IT-04

2. Title: TEST REPORTS

3. SOW/IPRD Reference: SOW-7.3-03

4. Use:

To document and report the conduct, results, and conclusions from performance verification tests of instrument components, subsystems, and systems.

5. Preparation Information:

The Test Reports shall be detailed reports addressing the conduct and results of each test performed as prescribed by the System Performance Verification Plan (DRD SE-03), Environmental Test and Verification Plan (DRD IT-02), Life Test Plan for Mechanisms (DRD MA-26), and Test Procedures (DRD IT-03). The test reports shall contain the following, at a minimum:

1) The as-run test procedure(s), as an appendix or attachment;
2) Test identification and hardware configuration;
3) Facility description;
4) Identification of the applicable test plan, test procedures, and test requirements;
5) Dates of the testing;
6) Photographs of test setup;
7) Summary listing of test discrepancies, anomalies, failures, or out-of-family results;
8) Summary listing of any tailoring that was performed to the released test procedure during test execution;
9) Test results, to include:
    a) Identification of test results which confirmed the expected results as specified in the test plan / procedures or for which variations between actual and expected results were within specified tolerance;
    b) Identification of test results which differ from expected results beyond expected or acceptable limits – actual test values shall be shown;
    c) Identification of any planned test objective or requirement for which actual results were not obtained. Reasons for not meeting the objective/requirement shall be stated;

d) Identification of any false or aberrant results noted during the test or subsequent analyses.
e) For alignment test reports, data relating the position of the Instrument alignment target/cube to the instrument boresight (nadir pointing) and to the Instrument mounting surface datum(s).

10) Recommendations for subsequent actions shall be stated, based on the test results, to include:

a) Redesign of a particular component to enable the instrument to meet a specific requirement which was not fulfilled;
b) Revision of a system / subsystem specification in cases where the test results disclose ambiguity or conflicting requirements;
c) The performance of additional tests where results were not acceptable to fulfill objectives.

Initial submissions of Test Reports are to be at the Executive Summary level encompassing items 2 through 9 above. Final submissions are to be the full report.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: IT-05

2. Title: PACKAGING, HANDLING, STORAGE, AND TRANSPORTATION (PHS&T) PLAN AND PROCEDURES

3. SOW/IPRD Reference:

SOW-9.1-02

4. Use:

Provide the requirements, plans, instructions and procedures for safe and effective packaging, handling, storage, and transporting of flight Instrument, spares, and associated GSE throughout the contract.

5. Preparation Information:

This documentation shall discuss the plan and step-by-step procedures for packaging, handling, storage, and transportation of the Instrument, spares, and GSE. The plan and procedures shall be developed in accordance with NASA Policy Regulation (NPR) 6000.1H.

The documentation shall include:

1) Packaging Design
2) Environmental Requirements and Controls
3) Environmental Monitoring Devices and Data
4) Verification of Adequacy of Packaging
5) Reuse of Packaging
6) Package Marking and Labeling Requirements and Procedures
7) Unpacking instructions and procedures
8) Handling Instructions
    a) Requirements for special personnel, tools, equipment, special handling fixture(s), and containers
    b) Procedures and precautions to be taken to protect against shock, contamination, ESD, and other hazards;
    c) Procedures for installation and removal of instrument lifting hardware;
    d) Procedures for installation and removal of Instrument protective covers;
    e) Procedures for installation of “install before flight” items, and removal of “remove before flight” items;
    f) Instructions, precautions, and configuration for transport of the Instrument as part of the integrated observatory;
9) Preferred method of transportation;

10) Procedures for surveillance of transported items;

11) Instrument and GSE Storage at Spacecraft Integrator Facility

a) Preparation for storage
b) Environmental and facility requirements, including contamination and purge
c) Monitoring of critical functions during storage
d) GSE and testing requirements during storage
e) Impact of prolonged storage on Instrument operational lifetime
f) Removal from storage, including retesting requirements

6. Applicable Documents:
   1) NASA Policy Regulation 6000.1H, *Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: IT-06

2. Title: EGSE OPERATIONS MANUAL AND PROCEDURES

3. SOW/IPRD Reference:

SOW-6.3-04

4. Use:

To document and provide operating and maintenance instructions and procedures for Instrument Electrical Ground Support Equipment.

5. Preparation Information:

The EGSE Operations Manual and Procedures shall include, but not be limited to:

1) General overview of EGSE design, interfaces, and functionality, including functional block diagrams, schematics, drawings, and narratives that would enable an individual not familiar with the EGSE to operate it with minimum training;
2) EGSE Safety Precautions;
3) EGSE Resource requirements, such as electrical power, cooling, maximum cable length, grounding, uninterruptable power supply, etc.
4) Listing and identification of all EGSE components to the "box" level (e.g. computer, volt meter, power supply, oscilloscope, etc.) to include name, manufacturer, model number, serial number, manufacture date, metrology category, and calibration period;
5) EGSE cleaning instructions and maintenance for clean room compatibility;
6) Instructions and detailed procedures for verifying EGSE functionality prior to connecting to Instrument;
7) EGSE-to-Instrument connection instructions and detailed procedures;
8) EGSE operating instructions and detailed operating procedures where applicable;
9) EGSE maintenance instructions and detailed maintenance procedures where applicable;
10) Listing of known problems or unique operational characteristics;
11) Troubleshooting instructions;
12) Listing of all fuses or other overcurrent / overvoltage protection devices;
13) As an Appendix: EGSE-to-Instrument Interface Control Document;
14) As an Appendix: Operations and Maintenance Manuals for all commercial equipment used as components of the Instrument EGSE.

6. Applicable Documents:

N/A

7. Reference Documents:
N/A

2.8 CALIBRATION & VALIDATION

DATA REQUIREMENT DESCRIPTION

---

1. DRD Item No.: 2. Title:

CV-01 CALIBRATION SYSTEM REQUIREMENTS

---

3. SOW/IPRD Reference:

SOW-8.1-01

---

4. Use:

To document the calibration requirements to ensure that the Instrument will meet the requirements within Instrument Performance Requirements Document Section 4.

5. Preparation Information:

This report shall document the calibration requirements for the RBI. These requirements shall include the rationale, justification for inclusion as a requirement, method of verification of the requirement, and a description of the uncertainties (Type A or Type B) associated with the requirement.

The requirements shall be allocated and traced to the appropriate levels. Parent-Child requirements shall be identified and traced. The report shall identify differences between the ground and flight systems, describe and discuss these differences, and include the rationale for the differences and an analysis of equivalency. The report shall document requirements allocations that include the rationale and uncertainties associated with each calibration requirement.

The report shall include the Contractor's analysis of the Calibration Equation. To evaluate uncertainty in a radiometric measurement, the measurement equation for a linear system shall be used in the following manner. The system (radiance) responsivity is

$$(1)\ \mathcal{R} = \frac{Signal\ Out}{Input} = \frac{\Delta S}{\Delta L} = \frac{S_h - S_l}{L_h - L_l}$$

where "S" is a signal value and "L" is a radiance value, and "h" and "l" refer to higher and lower levels respectively. The calibration equation produces calibrated Instrument response, obtained by viewing one or more standards of known radiance levels,

$$(2)\ \mathcal{R}_c = \frac{S_{hc} - S_{lc}}{L_{hc} - L_{lc}}$$

A calibrated measurement of target, or scene, radiance, L_{ht}, is obtained from the measurement equation, also called the conversion equation, or sometimes the calibration equation.

$$(3)\ L_{ht} - L_{lt} = \frac{S_{ht} - S_{lt}}{\mathcal{R}_c} = \frac{S_{ht} - S_{lt}}{S_{hc} - S_{lc}}(L_{hc} - L_{lc}),$$

where L_{lt} is again a known radiance level. The measured value of target radiance is

$$(4)\ L_{ht} = \frac{S_{ht} - S_{lt}}{S_{hc} - S_{lc}}(L_{hc} - L_{lc}) + L_{lt}.$$

The uncertainty in the measured target radiance value, L_{ht}, is evaluated by applying the equation for the propagation of uncertainties, as in the following.

The combined standard uncertainty of a measurement result y, designated by $u_c(y)$, is the positive square root of

$$(5)\quad u_c^2(y) = \sum_{i=1}^{N}\left(\frac{\partial f}{\partial x_i}\right)^2 u^2(x_i) + 2\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\frac{\partial f}{\partial x_i}\frac{\partial f}{\partial x_j}u(x_i, x_j)$$

where, y = f(x1, x2, …, xN), and u(xi, xj) is the estimated covariance associated with xi and xj. Equation (5) is known as the law of propagation of uncertainty. The partial derivatives with respect to the xi terms are often called the sensitivity coefficients (Ref. NIST Tech Note 1297).

The combined calibration uncertainty is obtained by applying equation (5) to equation (2). The combined measurement uncertainty of the target, or scene, is obtained by applying equation (5) to equation (4). It may be necessary to apply equation (5) to the individual elements of the calibration and measurement equations as well, since each of them may depend on multiple parameters. Various corrections, such as nonlinearity correction, may be included and the uncertainties associated with them included in a similar manner.

The report shall contain a description of the calibration equation and all of the variables listed above. Variables shall be shown in tabular form with descriptions, assumptions, and other information adequate for independent analysis and verification. The report shall include detailed descriptions of each analysis approach. Any supplementary information necessary to understand the analysis shall be included as an integral part of the analysis.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
CV-02	RELATIVE SPECTRAL RESPONSE (RSR) COMPONENT MEASUREMENTS AND SYSTEM RSR ANALYSIS

3. SOW/IPRD Reference:

SOW-8.2-03; SOW-8.2-04

4. Use:

To provide the measurements of relative spectral response of Instrument components and the estimated system RSR.

5. Preparation Information:

The provided component data shall include:

1) The description of method used to obtain data including any sampling scheme used in obtaining the calibration data (the method description should include a statement about the traceability of the data to a standard reference or standard laboratory calibration results)
2) The calibration data of the Instrument(s) used to measure the RSR or a statement of the status of the calibration of the Instrument(s) used to measure the RSR.
3) The wavelength sampling used to obtain the data.
4) The environmental conditions such as temperature/humidity, the optical/geometrical setup such as the incidence angle, and f/# (the ratio of effective focal length to entrance pupil diameter) at which the RSR of spectral filter data are measured, and any other related transmissive elements in the system optical path, at which the data are measured and how the data are adjusted (if applicable) to account for operational temperatures, incident angle, and f/#.
5) A description of any other adjustments to the data.
6) An estimate of the uncertainty of the measured data, including added RSR variations due to the method used for collecting the response data; for example, short circuit currents vs. digital number obtained directly from FPA electronics.

The system RSR estimate shall include:

1) The methodology used to convolve the component measurements to estimate the system RSR.
2) A spreadsheet of the estimated RSR of each spectral channel which contains the convolution of the component-level RSRs and any adjustments made to the data.

3) An accuracy estimate of the RSR in each channel and the basis of the estimate, which shall include a discussion of the entire range of expected on-orbit operations conditions including the variation in the total power levels illuminating the detectors.

The required wavelength measurement resolution and uncertainty for each channel are shown in Table 1. The transmittance of the optical train shall be known in these ranges with an uncertainty of ≤ 1 % of peak response. The measurements shall be provided to the Government in the form of digital tables containing measurements at least at every 0.01 μm from 0.3 μm to 1.0 μm, every 0.1 μm from 1.0 μm to 5.0 μm, every 0.2 μm from 5.0 μm to 20.0 μm, and every 1.0 μm from 20.0 μm to 100.0 μm.

Table 1 - Required wavelength measurement resolution and uncertainty for each channel.

Wavelength Resolution and Uncertainty, μm	Wavelength Range	
	Lower Bound, μm	Upper Bound, μm
0.01	0.30	1.00
0.1	1.0	5.0
0.2	5.0	20.0
1.0	20.0	100.0

Uncertainty in relative spectral response shall include at least radiometric and wavelength positioning uncertainties. Uncertainties shall be reported in accordance with the Instrument Performance Requirements Document section 4.2.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: CV-03

2. Title: FLIGHT CALIBRATION SOURCES

3. SOW/IPRD Reference:

SOW-8.2-02

4. Use:

To analyze and document the Instrument in-flight calibration sources.

5. Preparation Information:

The report shall contain documentation of the trades performed to select the optimal in-flight calibration sources for the Instrument. The report shall include the rationale, advantages and disadvantages, the decision matrix that led to the final selection, and a full description of each calibration source. The stability, reliability, and longevity of the sources shall be addressed. The Technology Readiness Level (TRL) of each source shall be assessed. The TRL maturity process, if required, for each source shall be described and include cost, schedule, and risk assessments to bring the source to at least TRL 8 by Instrument delivery. The space flight heritage of the calibration sources shall be documented.

The report shall contain, as appendices, the full specification of each calibration source.

6. Applicable Documents:
   1) NPR 7123.1B Appendix E, *NASA Systems Engineering Processes and Requirements, Technology Readiness Levels*
   2) NPR 7120.8 Appendix J, *NASA Research and Technology Program and Project Management Requirements, Technology Development Terminology*

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
CV-04	GROUND CALIBRATION SOURCES AND PARAMETERS REPORT

3. SOW/IPRD Reference:

SOW-8.2-02

4. Use:

This deliverable provides the Government with detailed insight into Instrument calibration by documenting the characteristics and functional performance requirements of all sources and targets to be used for Instrument ground calibration.

5. Preparation Information:

The Ground Calibration Sources and Parameters Report shall provide detailed descriptions of all sources and targets used for radiometric, spatial, and temporal ground calibration of the Instrument. The report shall describe, at a minimum, for each source:

1) Description of design, operational range, and capabilities;
2) Historical usage and performance (if applicable);
3) Detailed description of radiometric output;
4) Usage methodology in the context of performing the overall Instrument calibration;
5) Methods of achieving NIST traceability;
6) Performance necessary to meet Instrument calibration uncertainty requirements;
7) Key parameters and limits that will indicate the source / target is operating within specification and is suitable for use for Instrument calibration.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: CV-05

2. Title: CALIBRATION AND VALIDATION PLAN

3. SOW/IPRD Reference:

SOW-8.1-02

4. Use:

Documents the plan for Instrument ground calibration and in-flight calibration.

5. Preparation Information:

The Calibration and Validation Plan shall describe the approach for characterizing, calibrating, and validating the spectral, spatial, radiometric, optical, polarization, and geometric performance of the Instrument. This plan shall include On-Orbit and ground calibration and validation requirements and references to the operations documents that describe these calibration and validation procedures. The plan shall include any calibration / characterization work performed at subsystem levels of assembly as well as at the Instrument level.

The plan shall address logistical aspects of necessary calibrations describing facilities and activities to be used. Facilities and equipment needs shall be identified giving availability, location, acquisition costs, and all other pertinent information. Performance of specific calibration activities, Instrument flight system configurations, and schedules shall be specified. The Calibration Plan shall address the following additional items:

1) Establish a program that fully integrates pre-flight and flight calibrations, and critical component, subsystem, and system tests that determine the value of constants or parameters which are needed for data reduction or calibration corrections;
2) Clearly satisfy calibration requirements;
3) Define the points in each test sequence at which calibration is to be conducted and in what detail the calibration will be conducted;
4) Calibrate in terms of traceable physical standards, physical standard processes or NIST-maintained services and materials;
5) Wherever possible, use more than one calibration technique to verify Instrument calibration uncertainty;
6) Illustrate feasibility of determining post-launch calibration using a ground calibration network. Show preparations to integrate data results of validation efforts into the performance records;
7) Analyze sensitivity in terms of Instrument mathematical models.

The plan shall address Validation activities including, but not limited to:

8) Descriptions of independent measurement and analysis approaches to be used in experiment validation and how comparisons are to be made between the validation and Instrument derived data products.
9) Descriptions of how the Instrument calibrations/validation will be compared to in-flight Instrument calibration/validation.
10) Estimates of validation data product accuracy and precision requirements such that the data will be useful for this investigation.
11) Estimates of frequency, duration, location, and any appropriate special observing conditions required for data validation measurements.

The Plan shall incorporate the following information at a minimum:

12) A description of planned tests and analyses including:

    a) What is being tested or analyzed and how it relates to Instrument performance
    b) The expected test or analysis results, and how these results will be documented,
    c) The integration levels for test or analysis models, i.e. part, subassembly, assembly, and Instrument
    d) The environmental conditions for tests, e.g. ambient, thermal-vacuum, on-orbit
    e) The sampling methods and their statistical validity
    f) The operational phase of testing, i.e. pre-launch, or commissioning
    g) The theoretical basis for the test or analysis, i.e., how the test is performed, how the data are reduced and the method rationale supported by fundamental physics principles and equations
    h) The resolution, precision and accuracy of the results and relation to the expected results
    i) The test configuration, i.e., equipment, test equipment calibration, and test setup
    j) The description of test or analysis results usage, i.e. processing algorithms that use test or analysis results or calibration parameters generated by the test or analysis

13) A test and analysis schedule and flow chart
14) How test/analysis results are to be made available to the Government
15) Description of COTS and custom analysis tools
16) A description of the On-Orbit Calibration capabilities of the Instrument, including their design, characterization techniques, and operational implementation. This shall include a description of any necessary calibration data that must be collected during normal operations.
17) Reference Standards and their calibration traceability
18) Support data requirements
19) Tests to be conducted for calibrating the radiometric response of the Instrument
20) Updates and model inputs from AM-19, AM-20, and AM-21
21) A description of diffuser contamination management activities

6. Applicable Documents:
   N/A
7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: CV-06

2. Title: CALIBRATION/VALIDATION PROCEDURES

3. SOW/IPRD Reference:

SOW-8.4-01

4. Use:

To verify that the planned procedures meet the goals of the Calibration/Validation Plan.

5. Preparation Information:

For each test in the Calibration/Validation Plan, the Calibration/Validation test procedure for each test shall include:

1) Test Objectives, a description of the test, and a description of the measurements to be made.
2) Test Methods
3) Assumptions
4) Identification of appropriate standards.
5) Applicable Documents and Software, recording version numbers in effect
6) Associated algorithms and supporting analyses required
7) Required Instrument Configuration, including any differences between pre-flight and flight configurations
8) Facility requirements and configurations, including Mechanical and Electrical Test Equipment Configuration, including layout and interconnection of test equipment and articles including the grounding scheme. Location and identification of all measuring points on appropriate schematics and diagrams
9) Test Equipment Identification, including the Sources to be used and the criteria for an acceptable source
10) Test Instrumentation
11) Calibration reference requirements
12) Safety Provisions and Cautions, including Identification of hazardous and potentially hazardous situations and operations, alarm limits, and emergency shut-off and abort conditions and procedures
13) Environmental and/or other conditions to be maintained, including contamination controls
14) Personnel responsibilities and chain-of-command for test performance
15) Expected results in telemetry and associated caution and warning levels.
16) Program Quality Requirements

17) Stimuli sources and associated and associated levels
18) Test durations
19) Test configurations
20) Sequence of events
21) Trending of performance characteristics during verification testing
22) Step-by-step instructions
23) Data Recording/Output Format Requirements
24) Data Recording Forms and Tables
25) Analysis techniques
26) Expected results
27) Pass/Fail Criteria
28) Test Termination Procedure
29) Organizations to witness calibration test.

For each Analysis in the Calibration/Validation Plan, the analysis procedure shall include:

30) Analysis Objectives, i.e. short description of the item or items being validated by this analysis
31) Analysis Methods including the analysis level of depth (i.e., 1st order, 2nd order, etc…)
32) Assumptions
33) Applicable Documents and Software
34) Associated algorithms and software tools
35) Required analysis mode/model configuration(s)
36) List of input data that will be used and related test IDs that were used to acquire the data
37) List of external reference sources of input data and/or model used in analysis (e.g., DEM, SOLAR spectral radiance model)
38) List of fixed analysis parameters and set points
39) List of adjustable analysis parameters and set points that may vary between runs.
40) Equipment requirements
41) Program Quality Requirements
42) Sequence of events
43) Step-by-step description of the data analysis procedure/algorithm
44) Description of any statistical sampling method being used
45) Data Recording/Output Format Requirements
46) Data Recording Forms and Tables
47) Expected results
48) Pass/Fail Criteria

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: CV-07

2. Title: CALIBRATION/VALIDATION REPORTS AND SUMMARIES

3. SOW/IPRD Reference:

SOW-8.4-02

4. Use:

To provide results of Instrument calibration/validation tests for Government review. To provide summaries at a higher level to serve as Instrument calibration references for current and future users of the JPSS data set.

5. Preparation Information:

All Calibration/Validation Reports shall include at a minimum:

1) Identification of article or component tested or being validated with date of test or related analysis and the relevant Test/Analysis ID and run number
2) Performance trends during and between each planned test
3) List of uncertainty levels for each input data in analysis or test measurements
4) If a given test or analysis have more than one configuration, identify the test or analysis configuration selected.
5) A report of problems or failures with tests, procedures, or analyses
6) Anomalies and deviations from plans or procedures and their resolution/status
7) Test or analysis results, including:
    a) The calibration parameters to be used
    b) A comparison of results with expectations and requirements
    c) An interpretation of the results
8) Lessons Learned and proposed improvements, as applicable

Initial Submission: This report shall be at the Executive Summary level and provide an initial assessment to ensure that the quality of the data collected during Instrument calibration is satisfactory to produce the required calibration products to verify Instrument performance requirements. This report shall include but not be limited to the following:

9) An assessment of data collected during calibration. A description of all anomalies found in the calibration data. The estimated impact of any anomalies on the final Instrument calibration and a plan and schedule for resolution of any issue(s).

10) Quick look analysis of calibration data to verify that the gain stability of each radiometric channel as a function of Instrument temperature is consistent with the Instrument performance requirements.
11) Quick look analysis of calibration data to verify that the stability of the Internal Calibration Sources of the Instrument as a function of environmental testing and as a function of Instrument temperature are consistent with Instrument performance requirements.
12) Analysis of calibration data to assess the linearity of the Instrument sensor channels.

Final Submission:

The final report shall provide all calibration results necessary to demonstrate the Instrument meets radiometric performance requirements and to perform the in-flight radiometry as required of the Instrument.

The report shall contain, as a minimum, the following:

1) Identification of applicable revisions of the Calibration Plan and calibration procedures used during the calibration tests;
2) Description of Calibration test flow;
3) Calibration test descriptions;
4) Calibration sources and certification status;
5) Software utilized;
6) Calibration results;
7) A copy of the as-run calibration procedure(s) as an appendix;
8) A copy of any failure or nonconformance reports with disposition action.
9) Any supporting analyses/modeling that establishes that the achieved test results satisfy Instrument performance requirements.

The Calibration Report shall contain or identify the custodian and location of the following information, as required:

1) End-item nomenclature and identification.
2) Identification of any articles removed and/or replaced during calibration.
3) List of authorized calibrations or recalibrations not completed in accordance with approved procedures.
4) Measured data, disc-file identification, strip chart recordings, plots, tables, and other data formats of the raw data for the calibrated article and for equipment, as appropriate.
5) Calibration data and characterization data for equipment whose output is required to interpret/analyze the data.
6) Summary of the data analysis technique.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

2.9 ON-ORBIT

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: OO-01

2. Title: INSTRUMENT CONCEPT OF OPERATIONS DOCUMENT

3. SOW/IPRD Reference:

SOW-10.1-01

4. Use:

Defines an early concept of operations to guide instrument design and communicate the operations concept to LaRC and JPSS.

5. Preparation Information:

The Instrument Concept of Operations Document (ICOD) shall provide an early concept for how the RBI and on-board calibration system will operate on-orbit. The ICOD shall emphasize user functionality and provide a context for RBI Level 2 requirements. The ICOD shall:

1) Review the mission and goals of the JPSS and CERES programs and address how the RBI performance and operations will meet these goals
2) Describe all RBI space-based and ground-based external interfaces and, where available, cite reference documents that describe these interfaces
3) Compare RBI design and operations to legacy CERES instruments and operations and justify any differences in terms of meeting JPSS mission and CERES program goals, including data continuity with CERES legacy instrument
4) Describe the concepts for different modes of RBI operation, for example, Earth radiation measurements, calibration with internal targets and calibration with external targets

6. Applicable Documents:
N/A

7. Reference Documents:
1) P417-R-CONOPS-0008, *GOES-R Series Concept of Operations (CONOPS)*

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.: 2. Title:

OO-02 INSTRUMENT USER'S MANUAL

3. SOW/IPRD Reference:

SOW-10.1-02

4. Use:

The report is intended to provide readers not familiar with the Instrument with a complete understanding of the Instrument without recourse to another document or drawing. The document is not meant to be an engineering working document but a reference document for RBI Instrument data users including: Observatory operators, Government personnel, scientists, Observatory contractor personnel, and the general public.

The Launch and Early Orbit Procedure section is required to coordinate the launch operation.

The Instrument On-Orbit Procedures section contains the complete set of procedures required for operating the Instrument on-orbit, both during and following commissioning and including routine and contingency operations.

The Recommended Steps for On-orbit Commissioning section of the document provides recommended steps for activating, calibrating and testing (functionally and performance) the instrument on-orbit; and determining how its on-orbit performance will be verified. This section of the document will guide the Government test team in developing an on-orbit commissioning plan.

5. Preparation Information:

The Instrument User's manual shall provide a non-proprietary description of the system, subsystems, functions and operations (with emphasis on how the system operates), with illustrations, block diagrams and circuitry descriptions. The Instrument to spacecraft interface shall be described. Physical details (mechanical, electrical, thermal, optical train & detectors, etc.), information on the software design, interfaces, instrument modes and states, commands and telemetry, and performance characteristics shall be provided by inclusion or by reference. The report shall be a self-contained document in that a reader not familiar with the Instrument can obtain a reasonably complete understanding of the Instrument and its operation without recourse to another document or drawing. The document is not meant to be an engineering working document but a reference document for Government personnel, scientists, Observatory contractor personnel, and the general public of RBI Instrument data users.

The Instrument User's Manual shall characterize Instrument performance with respect to: relative spectral response; radiometric accuracy, sensitivity, and stability; and line-of-sight accuracy. Each Manual shall provide pre-flight test results characterizing performance and a flight performance evaluation with updates at major milestones. The document shall describe the Instrument modes of operation and the equipment, methods, accuracies, and concepts of operation for in-flight calibration of radiometric response and line-of-sight. The document shall include a description of the data format and packet structure.

Constraints shall be discussed as appropriate and in context; e.g., if critical commands must be enabled prior to sending, this should be discussed in the command and data handling (C&DH) section.

The Instrument User's Manual shall cover the life of the instrument from launch pad through decommissioning.

The Instrument Launch and Early Orbit Procedure section of the document shall contain Instrument tasks required to support the Instrument state of health monitoring and operational events during the launch phase of the mission. These procedures are applicable from launch vehicle-Observatory separation until the JPSS Observatory is configured for on-orbit operation prior to the start of the on-orbit system test activities.

The procedure shall include:

1) Detailed flight time line
2) Survival heater configurations (when they need to be turned on), set points, etc.
3) Script of each communication event including required actions and responses

The Instrument On-Orbit Procedures section of the document shall provide a detailed set of operations procedures for operating the Instrument. It shall provide detailed operating procedures for each instrument mode, including overview/purpose, prerequisites, applicable mission phases, affected systems/subsystems, flowcharts, commands/mnemonics/parameter values, telemetry mnemonics/verification values, constraints (e.g., time-spacing between commands) and cautions, associated contingencies, duration (if known) and start time (if known). These procedures shall include:

1) Normal on-orbit command and control operations
2) Instrument State-of-Health Monitoring and management
3) Instrument mode transition and mode operations
4) Contingency and recovery procedures
5) Calibration procedures
6) Procedures for adjusting Instrument parameters
7) Instrument procedures for satellite reconfigurations

The Recommended Steps for On-orbit Commissioning section of the document shall provide a detailed set of recommended operations procedures for activating, testing, and calibration/validation of the instrument during on-orbit commissioning. The Government will develop an on-orbit commissioning plan for the RBI for initialization and validation of the Instrument during the pre-operational check-out period. This section of the Instrument User's Manual shall include all the information necessary to develop this on-orbit commissioning plan, including:

1) A summary of the initialization and verification methodology
2) Procedure numbers of the Instrument On-Orbit Test Procedures to be used during initialization and verification
3) A matrix or list of any Instrument requirements, with associated acceptance criteria, to be verified on-orbit which is cross-referenced to the appropriate Instrument On-Orbit Test Procedures or Calibration/Validation Procedures
4) A schedule of initialization and verification activities, including start times and durations
5) Step-by-step commands to be issued and expected Instrument response after each step; including possible contingencies and responses
6) Observatory and Instrument configuration before and after procedures are executed
7) Constraints to operations
8) Cautions and warnings

Note the following is not intended to be a table of contents. The specific information below does not have to be in the order or groupings given here, but are provided to ensure expected content is included in the deliverable.

Specific information shall include, but is not limited to, the items below:

1) Sensor overview including science mission
    a) Channel Wavelengths / Frequencies and Resolutions
    b) Scan pattern
    c) FOV/footprint on the Earth
    d) Scan period
    e) Scan patterns
2) Subsystem/Component Overview (The purpose of this section is to inform the reader of overall subsystem information, however it should cover in detail those aspects that are monitored or changeable by the operator.)
    a) Mechanical
        i) Include diagrams of motors and information about bearings and lubricants, because electro-mechanical devices are notorious troublemakers
    b) Electrical
    c) Nominal operating power ranges
    d) Thermal
        i) Locations of all heaters and their relationship (location relative) to thermistors
        ii) Heater set points
        iii) Nominal operating temperature ranges
    e) Optical / RF / energy path through the system
        i) Detector layout (if appropriate)
        ii) Calibration targets/sources
    f) Flight Software
        i) Functional description
            (1) Simplified flowchart if practical

ii) Fault Protection
(1) What it monitors
(2) What it does in response to 'violations' of monitored information
iii) Description and discussion of uploadable and downloadable tables including how to know when an update is needed
iv) Fault codes (or where to find)
v) Response to fault codes (or where to find)

3) Sensor Modes

a) Description of and how to recognize each mode
b) Allowable Transitions
c) Recommended Transitions
d) Indicate what transitions can occur autonomously versus by command
e) Table of major components and their status (e.g., ON/OFF) for each mode
f) Table of telemetry available in each mode
g) Activities allowable in each mode (e.g., loads and/or dumps)

4) Flight model-specific signatures

a) 'Features' of the specific flight model being documented
b) Differences with existing/operating sensors should be explicitly pointed out

5) Interfaces

a) Sensor Internal
b) Spacecraft External

i) Point-to-point telemetry and commands
ii) Survival heater locations, set points and relationship to thermistors (if not covered under sensor thermal subsystem)

c) Databus interactions (1553 or SpaceWire)
d) Timing, clocks and synchronization
e) Average and peak data rate
f) Average and peak power consumption

6) Command and Data Handling

a) APIDs
b) Telemetry Rates
c) Packet descriptions
d) Description on on-board stored commanding and macro capabilities
e) Critical commands
f) Database

i) Flight Telemetry Limits 'philosophy', (i.e., how did the Contractor 'choose' the flight limits. E.g., Did the Contractor take the 'tested to' maximum and add margin? Did the Contractor take the 'Qual' limits and add margin? Etc. If a limits philosophy requirement is defined elsewhere, it supersedes this guidance.

7) Science

a) Algorithms

b) On-board data processing

8) Overview of ROPs
   a) Purpose and short summary of functionality
9) Normal Operations
   a) On-Orbit Activation Sequence (could be a ROP or series of ROPs) including timing as determined from testing, e.g., cool-down is expected to take x minutes or x hours or x days
   b) Cal/Val Activities
   c) On-Orbit Maintenance Activities
      i) Constraints/configurations for Maneuvers DELTA-V and DELTA-I maneuvers
   d) Trending Recommendations (health and safety and science performance parameters)
      i) Nominal values
      ii) Frequency of trending
      iii) Limits
   e) Special Activities (e.g., C/V maneuvers, mid-mission out-gassing)
   f) Table and/or FSW Loads
10) Contingency Operations and Troubleshooting
   a) Red/yellow limit responses
   b) Document common or 'expected' anomalies and their response
   c) Redundancy and redundancy management
   d) Diagnostic modes/activities/data and when appropriate to use

6. Applicable Documents:
   N/A

7. Reference Documents:
   N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
OO-03	INSTRUMENT COMMAND TELEMETRY, SCIENCE AND ENGINEERING DATA DESCRIPTION

3. SOW/IPRD Reference:

SOW-10.1-03

4. Use:

Establishes the command and telemetry definitions for the RBI. The Instrument Command Telemetry, Science and Engineering Data Description will be used within the JPSS Missions Operation Element to operate, control, and monitor the RBI.

5. Preparation Information:

The Instrument Command Telemetry, Science, and Engineering Data Description shall be in a format/language compatible with the Spacecraft Contractor and Mission Operations Element and approved by the Government. The telemetry and command database shall contain

1) All commands required to operate, monitor, and control the RBI
2) All telemetry parameters required to operate, monitor and control the RBI
3) Instrument command and telemetry identifiers

The government prefers the telemetry information be provided in two volumes. Volume 1 shall provide at least, but not be limited to, the following:

1) Detailed listing of all telemetry assignments and Parameter IDs.
2) Key parameters necessary for description of the telemetry requirements as a part of the list.
3) Summary quantifying the number and type of telemetry assignments for each subsystem and the number of spares remaining.
4) Description of telemetry interfaces, telemetry format, telemetry requirements data, and caution and warning levels. Note: Modal Limits are based on sensor configuration (e.g., subsystem X is not on, therefore subsystem x limits are not checked. Heater Y is on, so limits are ABC. Heater Y is off, so limits are CDE, etc…)
5) Descriptive information necessary for interpretation of the telemetry requirements.
6) Listing of telemetry assignments that confirm commands.
7) Schematic reference for each telemetry assignment.
8) Data format, to include: detailed bit definitions, command, meta and ancillary data definitions for all telemetry and command data (command and telemetry list), detailed data format and content of the specific Instrument data and ancillary data files as stored on the

flight data recorder and specific detailed data formats and outputs of the flight data recorder for Instrument and ancillary data transferred via the Instrument mission data downlink interfaces.

Volume 2, a description of commands, shall provide at least, but not be limited to, the following:

1) Detailed listing of all serial and digital commands
2) Key parameters necessary for description of the commands as part of this listing
3) Summary quantifying the number of types of commands used by each subsystem and by each unit and the number of spares remaining
4) Description of command input, command verification, command rate and filler (no-op) commands.
5) Description of command requirements data and information necessary for interpretation.
6) Listing of commands verified by telemetry and the telemetry verifiers.
7) Schematic reference for each command.

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

DATA REQUIREMENT DESCRIPTION

1. DRD Item No.:	2. Title:
OO-04	CONSTRAINTS, RESTRICTIONS, AND WARNINGS/ALERTS DOCUMENT

3. SOW/IPRD Reference:

SOW-10.1-04

4. Use:

The Instrument Constraints, Restrictions, and Warnings/Alerts Document provides the operating constraints and restrictions for the RBI, including conditions and cautions associated with sensor/satellite activities and commands.

5. Preparation Information:

The Instrument Constraints, Restrictions, and Warnings/Alerts Document shall include:

- Operating constraints for each Instrument operational mode and activity
- Operating restrictions for each Instrument operational mode and activity
- Any warning or alert conditions for Instrument operational activities

1) Constraints shall be categorized into the following four types:
   a) Constraint – consequence of violation is Damage/Loss of Mission.
   b) Restriction – consequence of violation is Reduced Capability.
   c) Limitation – consequence of violation is Loss of Mission Data.
   d) Warning/Alert – procedural notes.
2) Constraints shall be grouped into the following three types:
   a) Test Only
   b) On-Orbit Only
   c) Shared (applies to test and on-orbit)
3) Each constraint, restriction, limitation and alert should contain:
   a) Title
   b) Description (Concise statement of the constraint, i.e. ‘Do not do XYZ’, ‘Always do XYZ’, ‘Y must always follow X’)
   c) Source (usually ROPs, C&T handbook, etc – where the reader can go for more information)
   d) Impact of Violation (If X, then Y.)
   e) Recommended Action

6. Applicable Documents:
N/A

7. Reference Documents:
N/A

Acronyms

ABPL	As-built Parts List
ADPL	As-designed Parts List
AETD	Applied Engineering and Technology Directorate
AFRB	Anomaly & Failure Review Board
ANSI	American National Standards Institute
ARB	Anomaly Review Board
ASCII	American Standard Code for Information Interchange
ASIC	Application-Specific Integrated Circuit
ASME	American Society of Mechanical Engineers
ASNT	American Society of Non-Destructive Testing
ATP	Authority to Proceed
AVI	Audio Video Interleave
BCR	Baseline Change Request
BOE	Basis of Estimate
BOL	Beginning of Life
C&DH	Command and Data Handling
C/V	Calibration/Validation
CA	Control Account
CAD	Computer-Aided Design
CAF	Conductive Anodic Filament
CAM	Control Account Manager
CAP	Control Account Plan
CCA	Circuit Card Assemblies
CCB	Configuration Control Board
CCR	Contract Change Request
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CD-ROM	Compact Disk-Read Only Memory
CERES	Clouds and the Earth’s Radiant Energy System
CI	Configuration Item
CIIL	Configuration Item Identification List
CIL	Critical Items List
CL	Closed Loop
CM	Configuration Management
CO	Contracting Officer
COC	Certificate of Conformance
CONOPS	Concept of Operations
ContractPAM	Contractor Product Assurance Manager
COR	Contracting Officer’s Representative
COTS	Commercial off the Shelf
CPR	Contract Performance Reports
CPU	Central Processing Unit
CR	Change Request
CSCI	Computer software configuration items

CWBS	Contract Work Breakdown Structure
DA	Days After
DACA	Days After Contract Award
DDD	Displacement Damage Dose
DM	Data Manager
DMAR	Delegate Mission Assurance Representative
DO	Drawing Object
DOORS	Dynamic Object Oriented Requirements System
DP	Days Prior
DRD	Data Requirement Description
DSCC	Defense Electronics Supply Center
DT	Drawing Tree
DTM	Detailed Thermal Model
DWF	Design Web Format
E	Electronic
EAC	Estimate at Completion
EDU	Engineering Development Unit
EEE	Electrical, Electronic, and Electromechanical
EGSE	Electrical Ground Support Equipment
EIA	Electronic Industries Alliance
EIDP	End Item Data Package
ELDRS	Enhanced Low Dose Rate Sensitivity
ELV	Expendable Launch Vehicle
EMC	Electromagnetic Capability
EMI	Electromagnetic Interference
EOL	End of Life
EPR	Engineering Peer Review
ERB	Earth Radiation Budget
ESD	Electrostatic Discharge Control
eSRS	Electronic Subcontract Reporting System
EVM	Earned Value Management
EVMS	Earned Value Management System
FAR	Federal Acquisition Regulation
FBD	Functional Block Diagram
FCA	Functional Configuration Audit
FMEA	Failure Modes and Effects Analysis
FPA	Focal Plane Array
FPGA	Field-Programmable Gate Array
FRB	Failure Review Board
FSC	Federal Supplier Code
FSW	Flight Software
FTA	Fault Tree Analysis
FVTS	Flight Vehicle Test Suite
GEVS	GSFC Environmental Verification Specifications
GFE	Government Furnished Equipment
GFP	Government Furnished Property

GIDEP	Government-Industry Data Exchange Program
GIRD	General Interface Requirements Document
GMIP	Government Mandatory Inspection Point
GOLD	Goddard Open Learning Design
GOTS	Government-Off-the-Shelf
GovtCO	Government Contracting Officer
GovtPAM	Government Product Assurance Manager
GovtQE	Government Quality Engineer
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
GSW	Ground Software
H&S	Hardness and Survivability
HFSM	High-Fidelity Structural Model
HQ	Head Quarters
I&T	Integration and Test
I/O	Input/Output
IBR	Integrated Baseline Review
ICD	Interface Control Document
ICDR	Instrument Critical Design Review
ICOD	Instrument Concept of Operations Document
IDL	Indentured Drawing List
IMAR	Instrument Mission Assurance Requirements
IMS	Integrated Master Schedule
IPDR	Instrument Preliminary Design Review
IPER	Instrument Pre-Environmental Review
IPRD	Instrument Performance Requirements Document
IPSR	Instrument Pre-Ship Review
ISAR	Instrument Safety Assessment Report
ISR	Instrument System Review
ISR	Individual Subcontracting Reports
ISRR	Instrument Systems Requirements Review
IT	Information Technology
ITAR	International Traffic in Arms Regulations
IV&V	Independent Verification and Validation
JGIID	JPSS General Instrument Interface Document
JPEG	Joint Photographic Experts Group
JPSS	Joint Polar Satellite System
KNPR	Kennedy NASA Procedural Requirements
KSC	Kennedy Space Center
L1RD	Level 1 Requirements Document
LaRC	Langley Research Center
LPR	Langley Procedural Requirements
LTS	Lower Tier Supplier
M&P	Materials and Processes
MA	Mission Assurance
MAIP	Mission Assurance Implementation Plan

MCM	Multichip Modules
MEL	Master Equipment List
MGSE	Mechanical Ground Support Equipment
MICD	Mechanical Interface Control Document
MIP	*Mandatory Inspection Point*
MIUL	Materials Identification and Usage List
MOTS	Modified off the Shelf
MPCB	Materials and Processes Control Board
MPE	Materials and Processes Engineer
MPEG	Moving Picture Experts Group
MPSR	Monthly Project Status Review
MRB	Material Review Board
MRR	Manufacturing Readiness Review
MSS	Mission System Specification
MUA	Materials Usage Agreement
NASA	National Aeronautics and Space Administration
NCCCO	National Commission for the Certification of Crane Operators
NCR/CAS	Non-Compliance Report/Corrective Action System
NDE	Non-destructive Evaluation
NDT	Non-Destructive Test
NFAR	NASA FAR
NFS	NASA FAR Supplement
NIST	National Institute of Standards and Technology
NLT	No Later Than
NPD	NASA Policy Directive
NPP	NPOESS Preparation Project
NPR	NASA Procedural Requirement
NSOF	NOAA Satellite Operations Facility
NSPAR	Non-Standard Parts Approval Requests
O&SHA	Operating and Support Hazard Analyses
OCI	Organizational Conflict of Interest
ODA	Orbital Debris Assessment
OHA	Operations Hazard Analysis
PAM	Product Assurance Manager
PAPL	Project Approved Parts List
PCB	Parts Control Board
PCM	Project Control Milestones
PCP	Parts Control Program
PDF	Portable Document Format
PDR	Preliminary Design Review
PER	Pre-Environmental Testing Review
PHA	Preliminary Hazard Analyses
PHS&T	Packaging, Handling, Storage and Transportation
PIL	Parts Identification List
PM	Project Management
PMB	Performance Measurement Baseline

PMR	Program Management Review
PPE	Project Parts Engineer
PRA	Probabilistic Risk Assessment
PSA	Parts Stress Analysis
PSR	Pre-Ship Review
PSRR	Pre Ship Readiness Review
PSWG	Payload Safety Working Group
PWB	Printed Wiring Board
QE	Quality Engineer
QSS	Quality Status Stamp
R&M	Reliability and Maintainability
RAD	Requirements Allocation Document
RBI	Radiation Budget Instrument
RF	Radio Frequency
RFI	Radio Frequency Interference
RMP	Risk Management Plan
ROSM	Reduced-Order Structural Model
RPP	Reliability Program Plan
RSDO	Rapid Spacecraft Development Office
RSR	Relative Spectral Response
RTM	Radiometric Test Model
S&MA	Safety and Mission Assurance
S/C	Spacecraft
SA	Software Assurance
SACO	System Architecture and Concepts of Operations
SAP	Software Assurance Plan
SAR	System Acceptance Review
SAR	Safety Assessment Report
SCD	Source Control Drawings
SCM	Software Configuration Management
SDD	Software Detailed Design
SDF	Software Development Folders
SDP	Software Development Plan
SE	Systems Engineering
SEE	Single Event Effects
SEL	Single Event Latch-up
SEMP	Systems Engineering Management Plan
SEN	Software Engineering Notebook
SEU	Single Event Upset
SI	Système Internationale
SIRD	System Interface Requirement Document
SIS	Spacecraft Interface Simulator
SOW	Statement of Work
SPMM	Sensor Performance Math Model
SPVP	System Performance Verification Plan
SQAP	Software Quality Assurance Plan

SRA	Software Reliability Analysis
SRR	System Requirements Review
SRS	Software Requirements Specification
SSPP	System Safety Program Plan
SSR	Summary Subcontractor Report
STD	Standard
STE	System Test Equipment
STE	Special Test Equipment
STOP	Structural Thermal Optical Performance
SW	Software
SWAR	Software Acceptance Review
SWE	Software Engineering Requirement
SWTRR	Software Test Readiness Review
TAA	Technical Assistance Agreement
TBD	To Be Determined
TEC	Thermoelectric Cooling Chip
TID	Total Ionizing Dose
TIM	Technical Interchange Meeting
TIRD	Technical Interface Requirement Document
ToR	Terms of Reference
TPM	Technical Performance Measures
TPR	Technical Progress Reports
TRL	Technology Readiness Level
TRR	Test Readiness Review
UIID	Unique Instrument Interface Document
V&V	Verification and Validation
VDD	Version Description Document
VET	Veteran’s Employment Reports
VPN	Virtual Private Network
VTL	Verification Tracking Log
WBS	Work Breakdown Structure
WCA	Worst Case Circuit Analysis