

# Ground Systems Standard Mission Assurance Requirements

Code 320 Controlled Document

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This is a Code 320 Mission Support Division document controlled under the Code 300 configuration management system. Requests for changes to this document are to be submitted electronically at <https://ossmacm.gsfc.nasa.gov/index.cfm>.

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Code 320

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## 1. Applicability

This document is to be used for developing a Mission Assurance Requirements (MAR) document for contracts related to GSFC managed ground system projects.

## 2. Configuration Control Board (CCB)

The Code 320 division chief chairs the Configuration Control Board (CCB) for this document. The CCB will consist of the division chief and technical and administrative personnel necessary for recommending the disposition of configuration change requests (CCRs). The division chief shall process CCRs per 300-PG-1410.2.1.

In processing CCRs, the division chief shall:

- Request support from technical and administrative personnel in formulating a disposition
- Present recommended dispositions to the Code 320 division chief for approval
- Prepare the signature folder with supporting documentation for the Code 300 configuration manager

The Code 320 division chief shall indicate approval of the document and CCRs by signature.

The Code 320 division office shall maintain CCB records.

## 3. Guidelines for Use

The Code 320 CSO (Chief Safety and Mission Assurance Officer) prepares the MAR using the contents of this document's appendices and project requirements. The MAR should conform to the project's configuration management system requirements. The MAR becomes a project-controlled document after its approval by Code 300 with the expectations that the CSO is a member of the CCB that controls changes to it and that the CSO will inform Code 320 management of significant changes.

The MAR will be part of the project procurement packages for ground systems. The MAR will consist of a narrative section derived from Appendix 1, an acronym list from Appendix 2, data item descriptions (DIDs) from Appendix 3, and the MAR response form from Appendix 4. Appendix 5 can be used to prepare a list of DIDs for the project's contract deliverable requirements list (CDRL).

The contents of Appendix 2 are the acronyms in Appendix 1. Modifications to the contents of Appendices 1 or 3 made during project MAR development may need to be reflected in the use of Appendix 2.

## Appendix 1 Ground System Mission Assurance Requirements

### Section 1. GENERAL

#### 1.1 Systems Safety and Mission Assurance Program

The developer shall prepare, document, and implement a Mission Assurance Implementation Plan (MAIP) in accordance with the Statement of Work (DID 1-1).

Note: The developer shall obtain MRB approval for the use of alternative processes, procedures, and standards that are proposed as alternatives to those specified by the government.

#### 1.2 Management

The developer shall designate a manager for safety and mission assurance (SMA) activities. The SMA manager shall not be responsible for project costs and schedules other than those pertaining to assurance activities. The SMA manager shall have direct access to senior management that is independent of project management and functional freedom and authority to interact with all elements of the project.

#### 1.3 Subcontractor Requirements Flowdown

The developer shall apply the requirements in this document to subcontractors to the extent necessary to ensure that delivered products meet performance requirements.

The developer shall establish a process for documenting, communicating, and reviewing requirements with subcontractors to ensure applicable mission assurance requirements are met.

The developer shall include a mapping of mission assurance requirements to subcontract requirements for each project subcontractor as an appendix to the MAIP. The mapping will include rationale for requirements that are not imposed.

The developer shall include the mission assurance requirements in the database hosting the system requirements

#### 1.4 Suspension of Work Activities

The developer shall direct the suspension of any work activity that presents a present hazard, imminent danger, or future hazard to personnel, property, or mission operations resulting from unsafe acts or conditions that are identified by inspection, test, or analysis.

#### 1.5 Contract Data Requirements List

The Contract Data Requirements List (CDRL) identifies Data Item Descriptions (DID) for deliverables.

The developer shall deliver data items per the requirements of the applicable DID. The developer shall perform work in accordance with the following definitions:

- Deliver for approval: The GSFC Project approves the deliverable within the specified period of time

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before the developer proceeds with the associated work.

- Deliver for review: The GSFC Project reviews the deliverable and provides comments with the specified period of time before the developer proceeds with the associated work. The developer can continue with the associated work while preparing a response to the GSFC comments unless directed to stop work.
- Deliver for information: For GSFC Project information only. The developer continues with the associated work.

The developer may combine deliverables if the requirements for the individual deliverables are addressed.

## 1.6 Surveillance

The developer shall grant access for National Aeronautics and Space Administration (NASA) and NASA assurance representatives to conduct an audit, assessment, or survey upon notice. The developer shall supply documents, records, equipment, and a work area within the developer's facilities.

Note: see Federal Acquisition Regulations (FAR) Parts 46.103, 46.104, 46.202-2, 46.4, and 46.5 for government quality assurance requirements at developer facilities. See FAR Part 52.246 for inspection clauses by contract type.

## 1.7 Risk Management

***Tailoring note: If a programmatic risk management activity that includes preparation and maintenance of a risk list is not included in the SOW, delete the following:***

The SMA manager shall participate as a voting member of the developer's programmatic risk management activity. The SMA manager shall:

- Identify and communicate mission risks
- Assess risks
- Assess implementation of the risk management plan

***Tailoring note: If a programmatic risk management activity that includes preparation and maintenance of a risk list is included in the SOW, then delete the following and the related DIDs:***

The developer shall document and implement a risk management plan (DID 1-2).

The developer shall prepare and maintain a risk list (DID 1-3).

## Section 2. QUALITY MANAGEMENT SYSTEM

### 2.1 General

The developer shall have a Quality Management System compliant with the requirements of ANSI/ISO/ASQC Q9001:2008, American National Standard Quality Management Systems-Requirements.

## 2.2 Supplemental Quality Management System Requirements

### 2.2.1 Control of Nonconforming Product

***Tailoring note: Consideration should be given to the use of particular terms and purposes of ARB and FRB with respect to the contract. A single board named either ARB or FRB may used to cover nonconforming product and failures throughout the period of contract performance. If a single board is used to replace either the ARB or FRB, then the requirements of 2.2.3 and 2.2.4 will have to be combined.***

The developer shall have documented closed loop systems for identifying, reporting, and correcting nonconformances. The system shall ensure that the adequacy of product corrective and preventive action is implemented to preclude recurrence

The developer's quality assurance organization shall determine the disposition for nonconforming products when products have been returned to a conforming state. Government concurrence is not required for these dispositions.

The developer's Material Review Board (MRB) shall be used to determine the disposition of nonconforming material when a return to a compliant state requires use of a repair process or is not achievable, feasible, or cost effective.

The developer's Anomaly Review Board (ARB) shall be used to investigate anomalies during system development.

The developer's Failure Review Board (FRB) shall be used to investigate failures in verification and validation tests, production tests, acceptance tests, and operations.

### 2.2.2 Material Review Board (MRB)

***Tailoring note: Consideration should be given to whether GSFC membership is required on MRBs and whether membership is voting or nonvoting. Consideration should be given to whether the definitions of major and minor nonconformances are included rather than being defined by the developer. Consideration should be given to whether either major or minor or no MRB actions need written government approval. If such reporting is not required, DID 2-1 is to be deleted. If the reporting requirements vary from the following paragraph, modifications will need to be made to the following and/or DID 2-1.***

The developer shall have a documented process for the establishment and operation of a Material Review Board (MRB) to process hardware non-conformances. The developer shall appoint a MRB chairperson from its mission assurance team. The MRB process shall incorporate a standard requirement for the determination of failure modes, root causes, and proposed corrective actions. The results shall be presented to the board within thirty days of the nonconformance's discovery, unless otherwise directed by the MRB. Where required, the developer will obtain government concurrence with the MRB action (DID 2-1).

The minimum required Material Review Board (MRB) members consists of:

- A developer representative responsible for design
- A developer representative responsible for product quality
- A government quality assurance representative

The MRB shall approve the following dispositions:

- Use as is — the product will be used-as-is with government written concurrence
- Repair — the product will be repaired using a process approved by the MRB
- Repair to Variation – the product will be repaired using a process approved by the MRB and with government written concurrence

The following dispositions do not require MRB concurrence or government concurrence and may be delegated to subcontractors and suppliers:

- Scrap – the product is not usable
- Return to Supplier – the product will be returned to the supplier
- Rework to Print – the product will fully conform to requirements
- Pre-authorized Standard Repairs – standard repairs that have received prior government approval for use and fall within the limits of this approval

The developer shall record and present as risks those nonconformances for which the MRB cannot determine a disposition.

### 2.2.3 Anomaly Reporting and Disposition

***Tailoring note: Consideration should be given to whether a voting or nonvoting government member is required on the ARB and whether minor anomalies should be reported.***

The developer shall have a documented process for anomaly reporting and disposition during system development.

The process will establish an anomaly review board (ARB) whose membership will include a government representative as a voting member with approval authority for proposed actions.

The process will require major anomalies to be submitted to the ARB and the government (DID 2-2). The developer will report major hardware anomalies beginning with the first application of power at the component level, major software anomalies beginning with software acceptance testing and when interfacing with hardware, and major mechanical system anomalies beginning with the first operation. Major anomalies are those that have resulted in hardware or software test failures and damage or potential damage to hardware. Examples of major anomalies are overvoltage or over current conditions, exceedance of test limits resulting in overstress, blown fuses, and unexpected system responses.

The process will require the developer shall prepare and submit residual risks for inclusion in the risk list.

The process will allow the developer to disposition minor anomalies with an appropriate subset of the ARB. Minor anomalies are those that have caused no damage to hardware. Examples of minor anomalies are those that can be resolved immediately, procedural errors, database problems, operator errors, and exceedance of test limits that do not affect the component under development.

Note: a component is defined as a functional subdivision of a subsystem and generally a self-contained combination of items performing a function necessary for the subsystem's operation.

### 2.2.4 Failure Review Board

***Tailoring note: Consideration should be given to whether GSFC membership is required on FRBs and whether membership is voting or nonvoting.***

The developer shall document and implement a failure review board (FRB) process to investigate failures in verification and validation tests, production tests, acceptance testing, and operational failures to determine the root causes, identify corrective actions, and evaluate corrective action effectiveness. The FRB membership may consist of project and non-project personnel but shall include the following:

- Chairperson who is a member of the project SMA team
- System integration and test representative
- Production operations representative
- Technical operations representative
- Reliability engineering representative
- Quality engineering representative
- Product quality tests representative

FRBs will analyze test failures on production units to determine failure mode(s), root cause(s), and corrective action(s) within 30 days of occurrence unless otherwise directed by the FRB.

The process will require written concurrence from the government for use-as-is (UAI) dispositions for product with non-conformances when the product is determined by the developer to be satisfactory for its intended use.

The process will not require government concurrence for the following dispositions:

- Scrap – Nonconforming product that is not usable for its intended use and cannot be reworked or repaired economically.
- Return to Supplier (RTS) – Nonconforming product that is dispositioned to be sent back to the vendor.

The process may delegate disposition authority to sub tier contractors or suppliers for scrap, return to supplier, rework to print and pre-authorized standard repairs.

The process will elevate a test failure that cannot be resolved by the FRB to the project's risk management board (RMB).

### 2.2.5 Quality Assurance Program

The developer shall document the quality assurance program in a Quality Assurance Plan.

The developer shall evaluate software processes and work products per Capability Maturity Model Integration (CMMI) Process and Product Quality Assurance (PPQA) practices for CMMI Level 3 process areas.

The developer shall identify and document noncompliance issues, communicate the results of quality assurance activities, maintain records, and ensure disposition of noncompliance.

## Section 3 SYSTEM SAFETY

### 3.1 General

The developer shall document and implement a system safety program in accordance with NASA Procedural Requirements NPR 8715.3 NASA General Safety Program Requirements, as applicable to ground segments. MIL-STD-882 can be used as guidance in developing a safety program.

The developer shall initiate the safety program in the concept phase of the design and continue implementing it throughout all phases of the project.

The developer shall incorporate two independent inhibits in the design (single failure tolerant if a system failure may lead to a critical hazard). A critical hazard is defined as a condition that may cause a severe injury or occupational illness to personnel or major property damage to facilities, systems, or ground hardware.

The developer shall document the system safety approach including hazard identification, hazard analysis, mishap risk assessment, system safety integration, hazard and risk communication, and risk acceptance.

The developer shall identify mishap risk mitigation measures including elimination of hazards through design selection, incorporation of safety or warning devices, and development of procedures and training.

The developer shall verify implementation of mishap risk reduction measures. The developer shall ensure review of hazards and acceptance of residual mishap risk by the developer and NASA.

### 3.2 System Safety Deliverables

#### 3.2.1 System Safety Program Plan

The developer shall document and implement a System Safety Program Plan (SSPP) that defines the system safety management and engineering tasks and activities, including ground stations, mission control centers, and user mission operations centers (DID 3-1). The purpose of the SSPP is to insure that hazards involving operations personnel, ground station facilities, and associated support equipment are identified, evaluated, and either eliminated, controlled, or managed to an acceptable level of risk. The SSPP will define the required safety documentation, roles and responsibilities, and applicable ground segment requirements from NPR 8715.3C NASA General Safety Program Requirements. The SSPP will define the scope of the safety evaluation with respect to system interfaces and designation of safety critical functions.

#### 3.2.2 Safety Requirements Compliance Checklist

The developer shall prepare a Safety Requirements Compliance Checklist to demonstrate that the ground system is in compliance with applicable safety requirements (DID 3-2).

The developer shall document noncompliances to safety requirements waivers that shall be submitted for approval (see paragraph 3.2.6).

The developer shall document equivalent level of safety (ELS) certification for non-compliant designs or operational elements as waivers (see paragraph 3.2.6).

#### 3.2.3 Hazard Analyses

The developer shall address hazards in the hardware, software, ground support equipment (GSE), and support facilities to ensure that they meet applicable safety requirements standards. The safety analyses shall identify hazards to personnel, hardware, and facilities.

##### 3.2.3.1 Preliminary Hazard Analysis

The developer shall document Preliminary Hazard Analyses (PHA) to obtain an initial risk assessment and identify safety critical areas of the ground system (DID 3-3).

The developer will identify safety critical functions, provide an initial assessment of hazards associated with software, and identify recommended hazard controls and follow-on actions.

The developer shall evaluate hazards associated with the proposed design or function for severity, probability, and operational constraints based on the best available data, including mishap data from similar systems and other lessons learned.

The developer shall include safety provisions and alternatives needed to eliminate hazards or mitigate the residual risk to an acceptable level.

#### 3.2.3.2 Operations Hazard Analysis (OHA)

The developer shall perform and document an Operations Hazard Analysis (OHA) to demonstrate that hardware installation and system integration and test (I&T) activities comply with applicable safety requirements and that hazards associated with those activities are mitigated to an acceptable level of risk (DID 3-4).

The developer shall document in the OHA controls and methods of verifications for each hazard listed. The OHA process considers the timing and sequence of tasks with respect to the equipment/hardware/software design, human engineering provisions, assembly, test, and operating procedures, and the facility environments for each specific operation being performed.

#### 3.2.3.3 Software Safety Analysis

The developer shall identify hazards caused by software as a part of the hazard analysis process. See Section 5.2.2.

#### 3.2.4 Safety Assessment Report

The developer shall generate a Safety Assessment Report (SAR) to document the evaluation of the risk being assumed prior to ground station installation, I&T, operations, and maintenance (DID 3-5).

#### 3.2.5 Verification Tracking Log

The developer shall prepare, implement, and maintain a hazard Verification Tracking Log (VTL) (DID 3-6).

The developer shall complete individual closures prior to first use.

#### 3.2.6 Safety Waivers

The developer shall request waivers for variations from the applicable safety requirements per paragraph 1.13 of NPR 8715.3 (DID 3-7).

#### 3.2.7 Mishap Reporting and Investigation

The developer shall document a Pre-Mishap Plan that describes appropriate mishap and close call notification, reporting, recording, and investigation procedures per NPR 8621.1 NASA Procedures and Guidelines for Mishap Reporting, Investigating, and Recordkeeping and applicable requirements of NASA FAR Supplement Section H.8 1852.223-70 (DID 3-8). All accidents, test failures, or other mishaps or close calls shall be promptly investigated to determine the dominant root cause and corrective actions.

## Section 4 RELIABILITY, MAINTAINABILITY, AND AVAILABILITY (RMA)

***Tailoring note: The scope of this section should be tailored in accordance with the Statement of Work and the Period of Performance. The PRA and RMA engineering sections require tailoring per the classification requirements of NPR 8705.5 and project-specific requirements.***

### 4.1 RMA Program Plan

The developer shall document and implement a RMA Program Plan in accordance with the Statement of Work (DID 4-1). This plan shall outline the planning and implementation of Reliability, Maintainability and Availability responsibilities across the project.

### 4.2 Reliability, Maintainability and Availability Analysis

#### 4.2.1 RMA Performance Prediction

The developer shall submit the source code (input files or modeling files) used for the project's RMA models (DID 4-2).

#### 4.2.2 Reliability

The developer shall document and submit a Reliability Assessments and Predictions Report that shows compliance to reliability probability of success requirements within the System Requirements Document (SRD) (DID 4-3).

The report shall list reliability predictions for LRUs and software CSCs.

The report shall include justification for reliability predictions using one or more of the following sources for prediction:

- Telcordia SR-332 Issue 2
- MIL-HDBK-217, Reliability Prediction of Electronic Equipment, with updated failure rates, (e.g., "Handbook of 217 Plus", "MIL-HDBK-472") from the Reliability Information Analysis Center, or equivalent
- Test data at the 90% confidence level (with concurrence of project management)
- Vendor data with included methodology and source information
- The performance of similar items (with concurrence of project management)

The results of reliability assessments and predictions, particularly those impacting design or risk management decisions, shall be reported at project status reviews and at all milestone reviews.

#### 4.2.3 Maintainability

The developer shall, based on the definition of acceptable levels of performance in the SOW, define the following minimum acceptable maintainability parameters for all hardware and software:

- Diagnostic time to detect and isolate fault to the defective components/sub-systems/applications.
- Time required to implement the appropriate corrective action (e.g. replacing, integrating updates, restoring data, restoring to previous stable software version or establishing workaround procedures) to

defective components/sub-systems/applications that are necessary to return the affected components/sub-systems/applications to operational status.

- Time required to complete checkout and to restore operational status.

The developer shall develop and implement specific design criteria to facilitate maintenance or repair activities.

The developer shall include design for modularity, fault diagnostics, standardization, and commonality in the design criteria. The developer shall make accessible the design criteria for Government review at any time and present updates at all formal design reviews in conjunction with the PRA and RMA Program Plan.

The developer shall perform maintainability evaluations, including demonstration tests for critical hardware and software items as defined in FMECA CIL, and submit a Maintainability Demonstration Report to verify that preventive and corrective maintenance activities, such as, but not limited to, system and data level backups can be successfully executed (DID 4-4).

The developer shall provide a sparing plan, that takes into account the quantities and failure rates of line replaceable units, as well as logistics-related times such as replenishment times and processing times.

#### 4.2.4 Availability

The developer shall submit evidence that demonstrates compliance with the numerical availability requirements in the SOW (DID 4-5).

The developer shall substantiate availability analysis with:

- Measures of Failure Rate and Repair time for all hardware and software items.
- Measures and estimates of logistics downtime, administrative downtime, and preventive maintenance downtime, based on the concept of operations.
- Availability Block Diagrams, Predictions and Analyses addressing redundancies including hardware and software components to the LRU and CSC levels.
- Failover times of redundant strings/item.

#### 4.3 Failure Modes and Effects Criticality Analysis (FMECA) and Critical Items List (CIL)

The developer shall perform a FMECA that evaluates the failure effects for LRU and CSC failure modes (DID 4-6). The analyzed failure modes will be assigned a severity category of 1, 1R, 1S, 2, 2R, 3, and 4 per Table 4.1.

The developer shall identify critical components, which are defined as components involved in failure modes with severity categories of 1, 1R, 1S, 2, and 2R per Table 4.1, in a critical item list (CIL) (see DID 4-6)

The developer shall analyze single point failure modes that affect availability requirements to establish retention rationale and identify any potential mitigation actions to reduce impact to the system availability performance in response to the root cause of the failure evaluated.

The developer shall identify failure modes involving safety critical software and hardware.

Table 4.1 Severity Categories

Category	Severity	Description
1	Catastrophic/ Safety Critical	Catastrophic failure modes that may cause death or a permanent disabling injury or the destruction of a major system or facility on the ground or of the vehicle during the mission. Safety Critical failure modes that could result in a condition that may cause a severe injury or occupational illness to personnel or major property damage to facilities or systems.
1R		Failure modes of identical or equivalent redundant hardware or software elements that could result in Category 1 effects if all failed.
1S		Failure in a safety or hazard monitoring system that could cause the system to fail to detect a hazardous condition or fail to operate during such condition and lead to Category 1 consequences.
2	Critical	Failure modes that could result in loss of one or more mission objectives as defined by the GSFC project office.
2R		Failure modes of identical or equivalent redundant hardware or software that could result in Category 2 effects if all failed.
3	Significant	Failure modes that could cause degradation to mission objectives.
4	Minor	Failure modes that could result in insignificant or no loss to mission objectives

#### 4.4 Fault Tree Analysis

The developer shall perform qualitative fault tree analyses to address potential causes of safety catastrophic and safety critical failures (DID 4-7). The fault tree analyses shall be extended to include software contributions to loss of mission scenarios.

#### 4.5 Probabilistic Risk Assessment (PRA)

The developer shall perform a PRA per NPR 8705.5, Probabilistic Risk Assessment (PRA) Procedures for NASA Programs and Projects, and NPR 8715.3, NASA General Safety Program Requirements, (DID 4-8).

The developer shall include an action plan for the top cut sets for each initiating event selected for analysis.

The developer shall perform quantitative fault tree analysis (including software and hardware analysis) to address undesirable fault propagation scenarios/events as required by the PRA.

The developer shall support the generation and evaluation of risk and mitigating actions in support of the PRA.

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#### 4.6 Parts Stress Analysis

Component parts stress and derating analyses shall be performed for electrical, electronic, and electromechanical (EEE) parts for custom-built and the custom portion of modified COTS in accordance with SD-18, Parts Requirements & Application Guide or INST-EEE-002 (DID 4-9).

#### 4.7 Worst Case Analysis

Component worst-case analysis (WCA) shall be performed for custom-built and the custom portion of modified-off-the-shelf circuits (DID 4-10).

#### 4.8 Test and Operations

##### 4.8.1 RMA Performance Reporting

The developer shall document the analysis of test information, trend data, and failure investigations to assess reliability and identify potential or existing problem areas. The developer shall report the results per the monthly project status report (DID 4-11).

The developer shall track and report the operational availability metrics in comparison to the SOW requirements after system deployment and per the RMA plan.

##### 4.8.2 Reliability and Availability Growth

###### 4.8.2.1 Failure Reporting and Corrective Action System

***Tailoring note: consideration should be given to whether a government representative will be required as a participant in the FRACAS, whether that participation is voting or not, and at what level of testing the participation begins.***

The developer shall document and implement a Failure Reporting and Corrective Action System (FRACAS) that addresses failures, root cause determination, and corrective actions.

###### 4.8.2.2 Failure Trend Analysis

The developer shall evaluate failures to identify trends related to failure patterns. Examples of failure patterns include failures with common root cause, failures related to a common developer/supplier, and failures related to a design deficiency.

The developer shall report trend analysis data as part of the monthly project status report.

###### 4.8.2.3 Software Reliability Growth

The developer shall implement processes to assure software reliability as documented in the Software Assurance Approach section of the MAIP.

Software reliability growth shall be monitored in accordance with the guidelines of IEEE-STD-1633. The developer shall report qualitative growth evaluation in system readiness reviews.

## Section 5 SOFTWARE ASSURANCE

### 5.1 Applicable Software Definitions

When identifying, developing, verifying, and maintaining software, the developer shall apply the following definitions:

Software is defined as computer programs, procedures, scripts, rules, and associated documentation and data pertaining to the development and operation of a computer system. Software includes commercially available–off-the-shelf (COTS) software, government-off-the-shelf (GOTS) software, modified-off-the-shelf (MOTS) software, custom software, reused software, heritage software, auto generated code, and complex electronics that include microprocessors.

Mission-Critical Software - Software that can cause, contribute to, or mitigate the loss of capabilities that are essential to the primary mission objectives. The software reliability assessment and analysis is focused on failure modes specific to post-separation mission phases.

Safety-Critical Software - Software that can cause, contribute to, or mitigate human safety hazards or damage to flight hardware and facilities. The software safety assessment and analysis is focused on hazards specific to Integration and Test, launch, and up through spacecraft separation from the launch vehicle (except for International Space Station (ISS) payloads that have constant human presence) and re-entry/recovery (where applicable).

### 5.2 Software Assurance Program

The developer shall document and implement a Software Assurance Program that complies with the definitions in 5.1 and the following standards:

- NASA-STD-8739.8 NASA Standard for Software Assurance
- NASA-STD-8719.13 Software Safety Standard

The developer shall identify the person responsible for directing and managing the software assurance program and interfacing with government assurance personnel.

The developer shall document the software assurance program in a Software Assurance Plan (DID 5-1). The plan will address the disciplines of Software Quality, Software Safety, Software Reliability, Software Verification and Validation (V&V), and Independent Verification and Validation (IV&V) per Section 6 of NASA-STD-8739.8 and detail the role of assurance and their activities in ensuring quality products and processes for each discipline. The plan will include the software assurance processes, procedures, tools, and techniques to be used commensurate with the Software Classification Assessment. The plan will address software assurance the necessary collaboration between software assurance, system safety, system reliability, and software engineering.

#### 5.2.1 Software Quality

The developer shall evaluate software processes and work products as defined by NPR 7150.2 and commensurate with the software classification. The developer shall identify and document noncompliance issues, communicate the results of quality assurance activities, maintain records, and ensure disposition of noncompliances.

#### 5.2.2 Software Safety Analysis

The developer shall identify safety critical software per Section 4.1.1 of NASA-STD-8719.13 Software Safety Standard. For software that is safety critical, the developer shall perform Software Safety Analyses per NASA-

STD-8719.13 Standard for Software Safety to a) identify whether software can contribute to a hazard (for example, as a cause or control), b) identify specific software modules or functions associated with the hazard cause, c) identify hazard elimination and hazard control methodologies and associated software safety requirements, and d) verify that the inhibits and controls incorporated to eliminate or mitigate hazards are effective.

The developer shall incorporate the results from the Software Safety Analyses, including references to the associated software requirements, into hazard reports and delivered as part of the SAR.

### 5.2.3 Software Reliability Analysis

The developer shall include in the software plan processes and procedures to identify mission critical software and to design robust performance and fault tolerance into such components. The developer shall include details regarding the following:

- Integration of software into system-level and component reliability analysis, and identifying software components critical to the success of nominal operations
- Derivation and flowdown of software fault and failure management requirements from system-level and component reliability analysis
- Identification of mission critical software requirements and performance specifications
- Traceability and consistency between reliability analysis and the software design
- Provisions for high-fidelity validation of mission critical software

### 5.2.4 Verification and Validation

The developer shall review the software section of the Verification and Validation Plan/Test Plan and review and support walkthroughs of test procedures. The developer shall witness or review results of software testing, review software discrepancy reports, and review software delivery documentation. The developer shall document software discrepancy reports and participate in failure review boards to resolve outstanding software-related issues.

### 5.2.5 Independent Verification and Validation

***Tailoring note: include this paragraph only if IVV is required.***

The developer shall provide required information (i.e., access to software products and processes) to IV&V personnel and address corrective actions.

## 5.3 Reviews

In addition to the reviews specified in Section 8 and NPR 7150.2 (Section 4.3), the developer shall conduct the following:

- Software test readiness reviews
- Software acceptance reviews
- System level safety reviews

The developer shall provide advance notification, as well as the review materials, prior to all reviews.

#### 5.4 Government Furnished Equipment (GFE), Existing, and Purchased Software

The developer shall ensure that software provided as GFE, existing, and purchased software meets the functional, performance, and interface requirements and complies with licensing requirements. The developer shall ensure that the software meets applicable standards, including those for design, code, and documentation.

#### 5.5 Surveillance of Software Development, Maintenance, and Assurance Activities

The developer shall provide the following:

- Direct access to the software problem reporting system
- Electronic access to the software documentation (i.e., management plans, assurance plans, configuration management plans, requirements specifications, design documents, test plans, test cases, test procedures, test results, schedule, maintenance plans)
- Electronic access to the software review results
- Electronic access to source code
- Schedule of software development activities and critical milestones
- Schedule of assurance reviews, audits, and assessments of the developer's processes and products
- Access to the corrective actions from process and product audits
- Access to review action item status and resolution
- Access to monthly software measurement and metrics data prepared per the requirements of NPR 7150.2 NASA Software Engineering Requirements
- Access to requirements traceability matrices and data prepared per the requirements of NPR 7150.2 NASA Software Engineering Requirements
- Software Assurance Status Report (DID 5-2)

### Section 6 COMPONENT SELECTION AND CONTROL

#### 6.1 Component Control Plan

The developer shall document and implement a Component Control Plan (DID 6-1).

#### 6.2 Purchased Component Selection

The developer shall maintain a component list of EEE parts and components (DID 6-2).

#### 6.3 Commercially Available Off-the-shelf (COTS) Component Selection

The developer shall implement an approval process for COTS components to:

- Ensure that items are compliant with system requirements
- Eliminate or reduces duplicate hardware used across the project
- Support verification of common system requirements

#### 6.4 Previously Developed Products

The developer shall document the compliance of previously developed product with the system safety and mission assurance requirements (DID 6-4).

#### 6.5 Government Furnished Equipment (GFE)

The developer shall ensure that Components (Hardware and Software) provided as GFE are evaluated against program requirements for suitability.

#### 6.6 Project Component Problem and Status Reporting

***Tailoring note: consideration should be given to whether it is cost effective to address GIDEP Alerts and NASA problem advisories as part of the contract; since these alerts and advisories are concerned with military specification EEE parts, the decision should be made on the probable number of such parts expected in the system and the probable effect on availability, reliability, and maintenance.***

##### 6.6.1 Government-Industry Data Exchange Program (GIDEP)

The developer shall participate in GIDEP per the GIDEP Operations Manual S0300-BT-PRO-010 and GIDEP Requirements Guide S0300-BU-GYD-010 (Note: these documents are available through <http://www.gidep.org>).

##### 6.6.2 Disposition

The developer shall review the following, hereafter referred to collectively as Alerts, for affects on NASA products: GIDEP Alerts; GIDEP SAFE-ALERTS; GIDEP Problem Advisories; GIDEP Agency Action Notices; NASA Advisories and component issues as distributed by the project office.

The developer shall eliminate or mitigate the effects of Alerts on NASA products.

The developer shall report the disposition of Alerts (DID 6-5).

##### 6.6.3 Significant EEE Parts, Materials, and Safety Problems

The developer shall prepare and submit failure experience data and safety issue reports per the requirements of S0300-BT-PRO-010 and S0300-BU-GYD-010 whenever failed or nonconforming items that are available to other buyers are discovered (DID 6-6).

##### 6.6.4 Review Reporting

The developer shall report the status of NASA products that are affected by Alerts or by significant EEE parts, materials, and safety problems at program milestone reviews and readiness reviews (see Section 9). The developer shall include a summary of the review status for EEE parts and materials lists and of actions taken to eliminate or mitigate negative effects.

### 6.7 Spare Hardware Testing

The developer shall document and implement a program for testing of spare components and parts.

### 6.8 Diminishing Manufacturing Sources and Material Shortages (DMSMS)

The developer shall document and implement a program to identify and mitigate product availability risks arising from obsolescence, regulatory prohibitions, supplier loss, procurement lead times, or other supply disruptions through the project lifecycle. The program will adhere to the policies in NPD 7500.1

The developer shall report the DMSMS status at milestone reviews.

### 6.9 Custom Technology Devices

The developer shall document the quality assurance provisions necessary to control manufacture and acceptance of custom devices in procurement documentation.

### 6.10 Limited Life Items

The developer shall document and implement a program to identify and manage limited life items.

Identified limited-life items shall be controlled so as to identify when they are approaching their end of life.

### 6.11 Failure Reporting

Component root cause and corrective action evaluation shall be included in the Failure Reporting and Corrective Action System.

## Section 7. PRODUCTION CONTROLS

### 7.1 General

The developer shall implement a workmanship program to assure that electronic packaging technologies, processes, and workmanship meet mission objectives for quality and reliability per the requirements of the following standards:

- J-STD-001E - Requirements for Soldering Electrical and Electronic Assemblies
- IPC/WHMA-A-620A - Requirements and Acceptance for Cable and Wire Harness Assemblies
- IPC-2221 Generic Standard on Printed Board Design
- IPC-2222 Sectional Design Standard for Rigid Organic Printed Boards
- IPC-2223 Sectional Design Standard for Flexible Printed Boards
- IPC-2225 Sectional Design Standard for Organic Multichip Modules (MCM-L) and MCM-L Assemblies
- IPC A-600 Acceptability of Printed Boards (Class 2 requirements)
- IPC-6011 Generic Performance Specification for Printed Boards (Class 2 requirements)

- IPC-6012 Qualification and Performance Specification for Rigid Printed Boards (Class 2 requirements)
- IPC-6013 Qualification and Performance Specification for Flexible Printed Boards (Class 2 requirements)
- IPC-6015 Qualification and Performance Specification for Organic Multichip Module (MCM-L) Mounting and Interconnecting Structures
- IPC-6018 Microwave End Product Board Inspection and Test

The listed cable types shall be manufactured, at a minimum, per the workmanship classification standards listed below.

- COTS Ethernet, USB, and power cables shall be manufactured per IPC/WHMA-A-620A class 1. This includes cables built on-site that are comprised of COTS cable and connectors.
- COTS RF, coaxial, twinax, microwave, and multi-wire (D-sub) cables shall be manufactured per IPC/WHMA-A-620A class 2.
- NASA-STD-8739.5 Fiber Optic Terminations, Cable Assemblies, and Installation

Custom cable assemblies shall be manufactured per the following requirements:

- Custom cable assemblies with soldered connections shall be manufactured per IPC/WHMA-A-620A class 2.
- Custom cable assemblies without soldered connections shall be manufactured per IPC/WHMA-A-620A class 2.
- Custom Ethernet cables shall be manufactured per IPC/WHMA-A-620A class 1.
- NASA-STD-8739.5 Fiber Optic Terminations, Cable Assemblies, and Installation

Commercially available-off-the-shelf (COTS) material shall be procured from qualified vendors using commercially available vendor catalog item numbers that satisfy the design and workmanship standards specified in the design documentation.

The developer shall use the IPC-J-STD-001E (Class 2 Requirements) workmanship standard, for custom and custom portion of MOTS hardware. The Contractor may propose the use of similar, but not identical, workmanship standards, procedures and training, contingent upon Contracting Officer's Technical Representative (COTR) approval.

## 7.2 Personnel Certification for J-STD-001E

Operator or inspector certification will expire no more than two years after the certification date or after a six-month break in service. Recertification requires successful completion of retraining no more than three months after the expiration date.

The developer shall use a Certified IPC Instructor (CIT) for operator and inspector training. The training will be the IPC non-modular course or an IPC modular course that includes Modules 1 and 6 and one other module.

## 7.3 Design Qualification

The developer's S&MA shall validate design qualification that is not covered by the above standards.

#### 7.4 Electrostatic Discharge Control (ESD)

The developer shall prepare and implement an ESD control program that conforms to the requirements of ANSI/ESD S20.20, Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).

#### 7.5 Metrology and Calibration

The developer shall document and implement a metrology and calibration program that complies with one of the following standards for the calibration of measuring and test equipment:

- ANSI/NCSL Z540.1-1994 (R2002) Calibration Laboratories & Measuring & Test Equipment - General Requirements
- ANSI/NCSL Z540.3-2006 Requirements for the Calibration of Measuring and Test Equipment
- ISO 17025-2002 General requirements for the competence of testing and calibration laboratories

The developer shall limit the use of non-calibrated instruments to applications where substantiated accuracy is not required and for indication-only purposes in non-hazardous, non-critical applications.

Equipment used for tests shall be in current calibration and so noted with tags or stickers.

#### 7.6 Handling, Packaging, Transporting, and Storage

The developer shall document and implement a program that establishes the handling, packaging, transporting, and storage procedures for parts, materials, components and equipment. The program will address:

- Environmental controls, such as temperature, humidity and contamination as required.
- Measures and facilities to segregate and protect items routed to different locations (i.e., to the materials review crib, or to a laboratory for inspection, or returned to the manufacturer from unaccepted shipments).
- Facilities required for the interim storage of components or equipment.
- Protective packaging required for storage and transportation.
- Protective surfaces on which parts and materials are handled (i.e., test, assembly, inspection, and organizing kits).
- ESD control.
- Shipment data package requirements and vendor acceptance process reference.

### Section 8 TESTING, VERIFICATION AND VALIDATION

#### 8.1 Verification and Validation

The developer documents the process for monitoring, inspecting, evaluating, and auditing the Validation & Verification activities for the project in the Mission Assurance Implementation.

The developer shall ensure that appropriate peer reviews for correctness and completeness are conducted on all test procedures, test reports, and test plans at all levels of testing.

The developer's S&MA shall verify the readiness for test; including test plan, test procedures, test equipment, and test facility, in accordance with the developer's approved Quality Management System (QMS) prior to commencing testing.

The developer shall ensure that all defects and non-conformances are documented, dispositioned, analyzed and tracked to closure in its DR system.

The developer shall conduct reviews to ensure that all test results generated at each level of test for each unit(s) under test (UUT(s)) are reviewed and approved prior to moving to the next level of testing.

The developer's S&MA shall audit the Project's Validation & Verification activities (processes/products) and present the findings/updates periodically.

The developer shall test the ground system as it will be operated.

The developer shall base operational tests on a test environment that accurately reflects the planned mission environment. The following are examples of factors that should be considered when establishing the test environment.

- Network characteristics: Delay, noise, packet loss, loading, etc.
- RF: power, congestion, interference, frequency, shielding and required filtering
- Power: congestion, interference, frequency, shielding and required filtering, loading, grounding
- Processor loading
- Operator events: interface, emergency events, MOC changes, failover, off nominal conditions and combinations, boundary conditions, etc.
- Platform

## 8.2 Test Facility Readiness

The developer shall ensure that test equipment is calibrated per the metrology and calibration program.

## Section 9. SYSTEMS REVIEWS

### 9.1 System Reviews

The developer shall participate in the implementation of the Systems Review Program (SRP) as required by GSFC-STD-1001 Criteria for Flight and Flight Support Systems Lifecycle Reviews.

The developer shall provide a review agenda, presentation materials, and a copy of reference materials at the reviews (DID 9-1).

The developer shall submit responses to review action items (DID 9-2).

### 9.2 Peer Reviews

The developer shall prepare and implement an engineering peer review program that covers the design, development, and testing of hardware and software (DID 9-3).

Section 10. ACCEPTANCE DATA PACKAGE

The developer shall submit an end item acceptance data package (DID 10-1).

**Appendix 2. Acronym List**

ANSI	American National Standards Institute
ARB	Anomaly Review Board
ASQC	American Society for Quality Control
CDRL	Contract Data Requirements List
CIL	Critical Items List
CMMI	Capability Maturity Model Integration
COTS	Commercially Available Off-the-Shelf
CSC	Computer Software Component
DID	Data Item Description
DMSMS	Diminishing Manufacturing Sources and Material Shortages
DR	Discrepancy Report
EEE	Electrical, Electronic, and Electro-mechanical
ESD	Electro-static Discharge
FAR	Federal Acquisition Requirements
FMECA	Failure Modes and Effects Criticality Analysis
FRB	Failure Review Board
GFE	Government Furnished Equipment
GIDEP	Government-Industry Data Exchange Program
GOTS	Government Off-the-Shelf
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
I&T	Integration and Test
IPC	Association Connecting Electronics Industries
IV&V	Independent Verification and Validation
LRU	Line Replaceable Unit
MAIP	Mission Assurance Implementation Plan
MOC	Mission Operations Center
MOTS	Modified Off-the-Shelf
MRB	Material Review Board
NASA	National Aeronautics and Space Administration
NPR	NASA Procedural Requirement
OHA	Operations Hazard Analysis
PHA	Preliminary Hazard Analysis
PPQA	Process and Product Quality Assurance
PRA	Probabilistic Risk Assessment
RMA	Reliability, Maintainability, and Availability
RMB	Risk Management Board
SAR	Safety Assessment Report
SMA	Safety and Mission Assurance
SOW	Statement of Work
SRP	System Review Program
SSPP	System Safety Program Plan
UUT	Unit Under Test
V&V	Verification and Validation
VTL	Verification Tracking Log
WCA	Worst Case Analysis

### Appendix 3. Data Item Descriptions

#### DID 1-1 MISSION ASSURANCE IMPLEMENTATION PLAN

Title: Mission Assurance Implementation Plan	DID No.: 1-1
MAR Paragraph: 1.1	
Use: Documents the developer's plan for implementing a system safety and mission assurance program.	
Reference Documents:	
Place/Time/Purpose of Delivery:  - Delivered to the Project Office sixty (60) days after contract award for information	
Preparation Information:  The MAIP shall cover: - Hardware and software that is designed, built, or provided by the developer and its subcontractors, or furnished by the government, from project initiation through mission operations - The ground system that interfaces with flight equipment to the extent necessary to assure the integrity and safety of flight items  The MAIP shall include a traceability matrix for the mission assurance requirements	

## DID 1-2 RISK MANAGEMENT PLAN

Title: Risk Management Plan	DID No.: 1-2
MAR Paragraph: 1.7	
Use: Defines the process by which the developer identifies, evaluates, and mitigates the risks associated with program, project, and/or mission goals	
Reference Documents:  - NPR 8000.4, Risk Management Procedures and Guidelines	
Place/Time/Purpose of Delivery:  - Deliver to the Project Office sixty (60) days after contract award for approval.	
Preparation Information:  The Risk Management Plan shall include: <ul style="list-style-type: none"> <li>- Description of contract requirements</li> <li>- Purpose and Scope</li> <li>- Assumptions, Constraints, and Policies</li> <li>- Reference Documents and Standards</li> <li>- Risk Management Process Summary (Philosophy, Integration)</li> <li>- Risk Management Organization <ul style="list-style-type: none"> <li>- Roles and Responsibilities</li> <li>- Risk Management Review Board</li> <li>- Standard Practices</li> <li>- Communication</li> </ul> </li> <li>- Risk Attributes that will be used to classify risks <ul style="list-style-type: none"> <li>- As a minimum attributes shall be defined for safety, cost, schedule, and technical or performance areas</li> </ul> </li> <li>- Risk buy-down chart (waterfall chart)</li> <li>- Criteria for prioritization of risks</li> <li>- Mitigation plan content</li> <li>- Process Details <ul style="list-style-type: none"> <li>- Baselines</li> <li>- Database (Use, Access, Updates, Responsibilities, etc.)</li> <li>- Identifying Risks</li> <li>- Analyzing Risks</li> <li>- Planning, Actions</li> <li>- Tracking (metrics and their use)</li> <li>- Control</li> <li>- Documentation and Reporting</li> </ul> </li> </ul>	

## DID 1-3 RISK LIST

Title: Risk List	DID No.: 1-3
MAR Paragraph: 1.7	
Use: Defines the documentation and reporting of risk items.	
Reference Documents: <ul style="list-style-type: none"><li>- NPR 8000.4, Agency Risk Management Procedural Requirements</li></ul>	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"><li>- Deliver updated list to the Project Office monthly beginning with PDR for review.</li></ul>	
Preparation Information: Prepare Top Risk List and Risk Data Charts per GSFC-STD-0002.	

## DID 2-1 REPORTING OF MRB ACTIONS

*Note: Retain this DID only if required by paragraph 2.2.2.*

Title: Reporting of MRB Actions	DID No.: 2-2
MAR Paragraph: 2.2.2	
Use: Report MRB actions to the project office.	
Reference Documents:  <ul style="list-style-type: none"> <li>- SAE AS9100 Quality Systems - Aerospace - Model for Quality Assurance in Design, Development, Production, Installation and Servicing</li> </ul>	
Place/Time/Purpose of Delivery:  <ul style="list-style-type: none"> <li>- Major MRB actions: Deliver to the project office within five (5) working days of MRB action for approval.</li> <li>- Minor MRB actions: Deliver to the project office within five (5) working days of MRB action for review.</li> </ul>	
Preparation Information:  The developer shall document the MRB action per the developer's MRB system form.	

## DID 2-3 MAJOR ANOMALY REPORT

Title: Major Anomaly Report	DID No.: 2-3
MAR Paragraph: 2.2.3	
Use:  Document anomalies, investigative activities, rationale for closure, and corrective and preventive actions.	
Reference Documents:  <ul style="list-style-type: none"> <li>- SAE AS9100 Quality Systems - Aerospace - Model for Quality Assurance in Design, Development, Production, Installation and Servicing</li> </ul>	
Place/Time/Purpose of Delivery:  <ul style="list-style-type: none"> <li>- Deliver initial submission to the project office within 24 hours of occurrence for information.</li> <li>- Deliver notice of a change in status within 24 hours of occurrence for information.</li> <li>- Deliver the proposed closure to the project office prior to closure for approval.</li> </ul>	
Preparation Information:  Document anomalies, changes in status, or proposed closure to identify the following information: <ul style="list-style-type: none"> <li>- Identification of project, system, or sub-system</li> <li>- Identification of failed item (e.g., assembly, sub-assembly, or part)</li> <li>- Description of item</li> <li>- Identification of next higher assembly</li> <li>- Description of anomaly, including activities leading up to anomaly, if known</li> <li>- Names and contact information of individuals involved in anomaly</li> <li>- Date and time of anomaly</li> <li>- Status of item</li> <li>- Contact information for personnel who originated the report</li> <li>- Date of original submission</li> <li>- Anomaly cause</li> <li>- Corrective actions implemented</li> <li>- Retesting performed and results</li> <li>- Other items affected</li> </ul>	

## DID 3-1 SYSTEM SAFETY PROGRAM PLAN

Title: System Safety Program Plan	DID No.: 3-1
MAR Paragraph: 3.2.1	
<p>Use:</p> <p>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.</p>	
<p>Reference Documents:</p> <ul style="list-style-type: none"> <li>- NPR 8715.3 NASA General Safety Program Requirements</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver preliminary plan to the Project Office at SRR for information.</li> <li>- Deliver final plan to the Project Office forty-five (45) days prior to PDR for information.</li> </ul>	
<p>Preparation Information:</p> <p>The developer shall prepare a SSPP that describes the development and implementation of a system safety program that complies with the ground segment requirements of NPR 8715.7, the launch service provider, and launch range safety. The developer shall:</p> <ul style="list-style-type: none"> <li>- Define the roles and responsibilities of personnel</li> <li>- Define the required documentation, applicable requirements documents, and completion schedules for analyses, reviews, and safety packages</li> <li>- Address support for Safety Reviews, Safety Working Group Meetings and TIMs</li> <li>- 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.</li> <li>- Address compliance with the launch range safety requirements</li> <li>- Include a safety review process that meets the requirements of NASA-STD-8715.3 NASA General Safety Program Requirements</li> <li>- 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</li> </ul>	

## DID 3-2 SAFETY REQUIREMENTS COMPLIANCE CHECKLIST

Title: Safety Requirements Compliance Checklist	DID No.: 3-2
MAR Paragraph: 3.2.2	
<p>Use:</p> <p>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.</p> <p>Note: the developer shall submit safety waivers for non-compliant design elements per paragraph 3.2.7 and DID 3-7.</p>	
<p>Reference Documents:</p> <ul style="list-style-type: none"> <li>- NASA-STD 8719.24 (with Annex), NASA Expendable Launch Vehicle Payload Safety Requirements</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver Preliminary version to the Project Office forty-five (45) days prior to PDR for approval.</li> <li>- Deliver Final version to the Project Office forty-five (45) days prior to CDR for approval.</li> </ul>	
<p>Preparation Information:</p> <p>The developer shall prepare a compliance checklist of all design, test, analysis, and data submittal requirements. The following shall be included:</p> <ul style="list-style-type: none"> <li>- Criteria and requirement.</li> <li>- System</li> <li>- Indication of compliance, noncompliance, or not applicable</li> <li>- Rationale for indications other than compliant</li> <li>- Resolution</li> <li>- Reference</li> <li>- Copies of Range Safety and NASA approved non-compliances, including waivers and equivalent levels of safety certifications</li> </ul>	

## DID 3-3 PRELIMINARY HAZARD ANALYSIS

Title: Preliminary Hazard Analysis	DID No.: 3-3
MAR Paragraph: 3.2.3.1	
<p>Use:</p> <p>The Preliminary Hazard Analysis (PHA) is used to obtain an initial risk assessment and identify safety critical areas of a concept or system. It is based on the best available data, including mishap data from similar systems and other lessons learned. The developer shall evaluate hazards associated with the proposed design or function for severity, probability, and operational constraints. The developer shall identify safety provisions and alternatives that are needed to eliminate hazards or reduce their associated risk to an acceptable level.</p>	
<p>Reference Documents:</p> <ul style="list-style-type: none"> <li>- MIL-STD-882E, Standard Practice for System Safety, Appendix B</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Submit the PHA with the Preliminary SAR (DID 3-5) to the Project Office for review.</li> </ul>	
<p>Preparation Information:</p> <p>The PHA shall consider the following for identification and evaluation of hazards as a minimum:</p> <ul style="list-style-type: none"> <li>• Hazardous components</li> <li>• Safety related interface considerations among various elements of the system, including consideration of the potential contribution by software</li> <li>• Environmental constraints, including the operating environments</li> <li>• Operating, test, maintenance, built-in-tests, diagnostics, and emergency procedures</li> <li>• Facilities, real property installed equipment, support equipment</li> <li>• Safety related equipment, safeguards, and possible alternate approaches</li> <li>• Malfunctions to the system, subsystems, or software</li> </ul>	

## DID 3-4 OPERATIONS HAZARD ANALYSIS

Title: Operations Hazard Analysis and Hazard Verification Tracking Log	DID No.: 3-4
MAR Paragraph: 3.2.3.2	
Use: The Operations Hazard Analysis (OHA) shall demonstrate that hazards related to the operation of hardware and test equipment during integration and test activities have been addressed with respect to facility safety requirements.	
Reference Documents:  - GSFC 500-PG-8715.1.2 AETD Safety Manual (for operations at GSFC)	
Place/Time/Purpose of Delivery:  - Deliver the OHA to the Project Office forty-five (45) days prior to Critical Design Review for review.	
Preparation Information:  The OHA shall include the following information:  - Introduction – a summary of the major findings of the analysis and the proposed corrective actions and definitions of special terms, acronyms, and abbreviations. - System Description – a description of system hardware and configuration, with a list of subsystem components and schedules for integration and testing - Analysis of Hazards - List of real or potential hazards to personnel, equipment, and property during I&T processing - The following information shall be included for each hazard: - System Component/Phase – the phase and component with which the analysis is concerned; e.g., system, subsystem, component, operating/maintenance procedure, or environmental condition. - System Description and Hazard Identification, Indication: - A description of expected results from operating the component/subsystem or performing the operating/maintenance action - A complete description of the actual or potential hazard resulting from normal actions or equipment failures; indicate whether the hazard will cause personnel injury and equipment damage. - A description of crew indications that include means of identifying the hazard to operating or maintenance personnel. - A description of the safety hazards of software controlling hardware systems where the hardware effects are safety critical. - Effect on System – the detrimental effects of an uncontrolled hazard on the system - Risk Assessment. - Caution and Warning Notes – a list of warnings, cautions, procedures required in operating and maintenance manuals, training courses, and test plans - Status/Remarks – the status of actions to implement hazard controls. - References (e.g., test reports, preliminary operating and maintenance manuals, and other hazard analyses)	

## DID 3-5: SAFETY ASSESSMENT REPORT

Title: Safety Assessment Report	DID No.: 3-5
MAR Paragraph: 3.2.4	
Use: The Safety Assessment Report (SAR) documents the comprehensive evaluation of the risk being assumed prior to testing or operation.	
Reference Documents:  - NPR 8715.3 NASA General Safety Program Requirements	
Place/Time/Purpose of Delivery:  - Deliver the Preliminary SAR to the Project Office thirty (30) days prior to PDR for review. - Deliver the Intermediate SAR to the Project Office thirty (30) days prior to CDR for review. - Deliver the Final SAR to the Project Office thirty (30) days prior to PSR for approval.	
Preparation Information:  The SAR will identify safety features of the hardware, software, and system design as well as procedural, hardware, and software related hazards that may be present. This includes specific procedural controls and precautions that should be followed. The SAR will include the following information: - The safety criteria and methodology used to classify and rank hazards, including assumptions upon which the criteria or methodologies were based or derived - The results of hazard analyses and tests used to identify hazards in the system including: - Those hazards that still have a residual risk and the actions that have been taken to reduce the associated risk to a level contractually specified as acceptable - Results of tests conducted to validate safety criteria, requirements, and analyses - Hazard reports documenting the results of the hazard analyses to include a list of all significant hazards along with specific safety recommendations or precautions required to ensure safety of personnel, property, or the environment. NOTE: Identify whether or not the risks may be expected under normal or abnormal operating conditions. - Any hazardous materials generated by or used in the system - The conclusion, including a signed statement, that all identified hazards have been eliminated or their associated risks controlled to levels contractually specified as acceptable and that the system is ready to test, operate, or proceed to the next phase	

## DID 3-6: VERIFICATION TRACKING LOG

Title: Verification Tracking Log	DID No.: 3-6
MAR Paragraph: 3.2.5	
<p>Use:</p> <p>Provides documentation of a Hazard Control and Verification Tracking process as a closed-loop system to ensure that safety compliance has been satisfied in accordance to applicable launch range safety requirements.</p>	
<p>Reference Documents:</p> <p><b><i>Tailoring note: delete non-applicable documents</i></b></p> <ul style="list-style-type: none"> <li>- NASA-STD 8719.24 (with Annex), NASA Expendable Launch Vehicle Payload Safety Requirements</li> <li>- KHB 1700.7, Space Shuttle Payload Ground Safety Handbook</li> <li>- RSM-93, WFF Range Safety Manual for Goddard Space Flight Center (GSFC)</li> <li>- CSG-RS-10A-CN Centre Spatial Guyanais (CSG) Safety Regulations Vol. 1: General Rules</li> <li>- CSG-RS-21A-CN CSG Safety Regulations Vol. 2 Pt. 1: Specific Rules: Ground Installations</li> <li>- CSG-RS-22A-CN CSG Safety Regulations Vol. 2 Pt. 2: Specific Rules: Spacecraft</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <p><b><i>Tailoring note: delete non-applicable requirements:</i></b></p> <ul style="list-style-type: none"> <li>- The Verification Tracking Log (VTL) that identifies hazard controls that are not verified as closed shall be delivered to the Project Office with the final SAR (DID 3-5) for review.</li> <li>- Regular updates to this log shall be provided to the Project Office for review until all hazard controls are verified as closed.</li> </ul> <p>Note: the developer shall close items with the appropriate verification rationale (e.g., test reports, analysis reports, procedure step references, etc.) prior to first use or to passing through an operational constraint.</p>	
<p>Preparation Information:</p> <p>The 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 specific test/analysis/inspection reports with a summary of the pertinent results. Results of these tests/analyses/inspections shall be available for review and submitted in accordance with the contract schedule and applicable launch site range safety requirements.</p> <p>The VTL shall contain the following information in tabular format:</p> <ul style="list-style-type: none"> <li>- Hazard Report number</li> <li>- Safety Verification number</li> <li>- Description (Identify procedures/analyses by number and title)</li> <li>- Constraints on Launch Site Operations</li> <li>- Independent Verification Required (e.g., mandatory inspection points)</li> <li>- Scheduled Completion Date</li> <li>- Completion Date</li> <li>- Method of Closure</li> </ul>	

## DID 3-7 SAFETY WAIVER

Title: Safety Waiver	DID No.: 3-7
MAR Paragraph: 3.2.6	
<p>Use:</p> <p>A Safety Waiver documents a safety requirement that cannot be met and the rationale for approval of a waiver, as defined in NPR 8715.3. Note: a waiver request for relief from a SMA requirement may require Range Safety concurrence.</p>	
Reference Documents:	
Place/Time/Purpose of Delivery:	
<ul style="list-style-type: none"> <li>- Deliver to the Project Office within thirty (30) days of identifying the need for a waiver for approval.</li> </ul>	
Preparation Information:	
<p>The developer shall include the following information from the review of a waiver request:</p> <ul style="list-style-type: none"> <li>- A statement of the specific safety requirement and its associated source document name and paragraph number for which a waiver is requested.</li> <li>- A technical justification for the waiver.</li> <li>- Analyses to show the mishap potential of the proposed alternate requirement, method, or process as evaluated against the specified requirement.</li> <li>- An assessment of the risk involved in accepting the waiver, including a list of all associated hazards and/or FMEA/FMECA/CILs; when it is determined that there are no hazards, the basis for such determination should be provided.</li> <li>- A narrative on possible ways of reducing hazards severity and probability and existing compliance activities.</li> <li>- Starting and expiration dates for waiver, if applicable.</li> </ul>	

## DID 3-8: PRE-MISHAP PLAN

Title: Pre-Mishap Plan	DID No.: 3-8
MAR Paragraph: 3.2.7	
Use: <ul style="list-style-type: none"> <li>- Provides a plan for procedures to be followed to respond to and control a mishap or a close call that may have personnel or hardware safety implications, or may cause flight or GSE hardware damage.</li> <li>- Provide the Project Office and NASA with information on any mishaps, incidents, and close calls related to the developer's efforts.</li> </ul>	
Reference Documents: <ul style="list-style-type: none"> <li>- NPR 8621.1, NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping</li> </ul>	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"> <li>- Deliver to the Project Office forty-five (45) days prior to mission CDR for approval.</li> </ul>	
Preparation Information: <p>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.</p>	

## DID 4-1 RELIABILITY, MAINTAINABILITY, AND AVAILABILITY PROGRAM PLAN

Title: Reliability, Maintainability, and Availability Program Plan	DID No.: 4-1
MAR Paragraph: 4.1	
Use: <ul style="list-style-type: none"> <li>Planning and implementation of activities relevant to the reliability, maintainability, and availability program.</li> </ul>	
Reference Documents: <ul style="list-style-type: none"> <li>- NPD 8720.1, NASA Reliability and Maintainability (R&amp;M) Program Policy</li> <li>- NASA-STD-8729.1, Planning, Developing and Managing an Effective Reliability and Maintainability (R&amp;M) Program.</li> <li>- NPR 8705.4 Risk Classification for NASA Payloads</li> <li>- NPR 8705.5 PRA Procedures for NASA Programs and Projects</li> </ul>	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"> <li>- Deliver draft plan to the Project Office sixty (60) days after contract award for information.</li> <li>- Deliver final plan to the Project Office thirty (30) days prior to the Systems Requirements Review for information.</li> <li>- Deliver activity reports related to implementation of the plan at milestone reviews beginning with the Systems Requirements Review for information.</li> </ul>	
Preparation Information: <p>The Reliability, Maintainability, and Availability Program Plan shall include:</p> <ul style="list-style-type: none"> <li>- A discussion of how the developer intends to implement and comply with project requirements.</li> <li>- Charts and statements describing organizational responsibilities and functions conducting each task to be performed as part of the program plan.</li> <li>- A summary (matrix or other brief form) that indicates for each requirement, the organization responsible for generating and implementing the necessary documents.</li> <li>- Identify the approval, oversight, or review authority for each task.</li> <li>- Narrative descriptions, time or milestone schedules, and supporting documents describing the execution and management plan for each task.</li> <li>- Documentation, methods, procedures, and reporting specific to each task in the plan.</li> </ul>	

## DID 4-2: RMA PERFORMANCE PREDICTION REPORT

Title: RMA Report	DID No.: 4-2
MAR Paragraph: 4.2.1	
Use: To provide the source code for RMA performance prediction.	
Reference Documents:	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"><li>- Deliver preliminary report to the Project Office thirty (30) days prior to PDR for review.</li><li>- Deliver updated report to the Project Office thirty (30) days prior to CDR for review.</li><li>- Deliver updated final report to the Project Office thirty (30) days prior to MOR for review.</li></ul>	
Preparation Information: The RMA report will consist of the models and relevant source code, such as input files or modelling files.	

## DID 4-3: RELIABILITY ASSESSMENTS AND PREDICTIONS REPORT

Title: RMA Assessments and Predictions Report	DID No.: 4-3
MAR Paragraph: 4.2.2	
Use: To show compliance with the probability of success requirements.	
Reference Documents:	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"><li>- Deliver initial report to the Project Office thirty (30) days prior to PDR for review.</li><li>- Deliver updated report to the Project Office at project status reviews and milestone systems reviews.</li></ul>	
Preparation Information:  The report will list reliability predictions for LRUs and software CSCs. The report shall include justifications for reliability predictions per a recognized source.  The report will include evidence that demonstrates compliance with the numerical availability requirements.	

## DID 4-4: MAINTAINABILITY DEMONSTRATION REPORT

Title: Maintainability Demonstration Report	DID No.: 4-4
MAR Paragraph: 4.2.3	
<p>Use:</p> <p>To verify that preventive and corrective maintenance activities, such as, but not limited to, system and data level backups can be successfully executed.</p>	
Reference Documents:	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver initial report to the Project Office thirty (30) days prior to CDR for review.</li> <li>- Deliver updated report to the Project Office at project status reviews and milestone systems reviews.</li> </ul>	
<p>Preparation Information:</p> <p>The report will identify maintainability evaluations, including demonstration tests for critical hardware and software items as defined in FMECA CIL, to verify that preventive and corrective maintenance activities, such as, but not limited to, system and data level backups can be successfully executed.</p> <p>The report will identify the sparing plan that supports the maintainability program.</p>	

## DID 4-5 AVAILABILITY DEMONSTRATION REPORT

Title: Availability Demonstration Report	DID No.: 4-5
MAR Paragraph: 4.2.4	
<p>Use:</p> <p>To verify that preventive and corrective maintenance activities, such as, but not limited to, system and data level backups can be successfully executed.</p>	
Reference Documents:	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver initial report to the Project Office thirty (30) days prior to PDR for review.</li> <li>- Deliver updated report to the Project Office at project status reviews and milestone systems reviews.</li> </ul>	
<p>Preparation Information:</p> <p>The report shall substantiate availability analysis with:</p> <ul style="list-style-type: none"> <li>- Measures of Failure Rate and Repair time for all hardware and software items.</li> <li>- Measures and estimates of logistics downtime, administrative downtime, and preventive maintenance downtime, based on the concept of operations.</li> <li>- Availability Block Diagrams, Predictions and Analyses addressing redundancies including hardware and software components to the LRU and CSC levels.</li> <li>- Failover times of redundant strings/item.</li> </ul>	

## DID 4-6 FMEA/FMECA

Title: FMEA/FMECA	DID No.: 4-6
MAR Paragraph: 4.3	
<p>Use:</p> <p>Used to evaluate design against requirements, to identify single point failures and hazards, and to identify modes of failure within a system design for the early mitigation of potential catastrophic and critical failures.</p>	
<p>Reference Documents</p> <ul style="list-style-type: none"> <li>- GSFC Flight Assurance Procedure, FAP P-322-208, Performing a Failure Mode and Effects Analysis</li> <li>- NPR 8705.4 Risk Classification for NASA Payloads</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver preliminary FMEA/FMECA to the Project Office thirty (30) days before PDR for review.</li> <li>- Deliver updated FMEA/FMECA to the Project Office thirty (30) days prior to CDR and each subsequent milestone review.</li> </ul>	
<p>Preparation Information:</p> <p>The FMEA/FMECA Report shall include the following:</p> <ul style="list-style-type: none"> <li>- A discussion of the approach of the analysis, methodologies, assumptions, results, conclusions, and recommendations.</li> <li>- Objectives</li> <li>- Level of the analysis</li> <li>- Ground rules</li> <li>- Functional description</li> <li>- Functional block diagrams</li> <li>- Reliability block diagrams</li> <li>- Equipment analyzed</li> <li>- Data sources used</li> <li>- Problems identified</li> <li>- Single-point failure analysis, to include the root cause, mitigation, and retention rationale for those with severity categories 1, 1R, 1S,2 or 2R.</li> <li>- Corrective actions</li> <li>- Work sheets identifying failure modes, causes, severity category, and effects at the item, next higher level, and mission level, detection methods, and mitigating provisions.</li> <li>- Critical Items List (CIL) for severity categories 1, 1R, 1S, 2, and 2R, including item identification, cross-reference to FMEA/FMECA 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.</li> </ul>	

## DID 4-7: FAULT TREE ANALYSIS

Title: Fault Tree Analysis (FTA)	DID 4-7
MAR Paragraph: 4.4	
<p>Use:</p> <p>Used to assess mission 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 mission success and provides an informed basis for assessing system risks.</p>	
<p>Reference Documents</p> <ul style="list-style-type: none"> <li>- NASA Fault Tree Handbook with Aerospace Applications (<a href="http://www.hq.nasa.gov/office/codeq/doctree/fthb.pdf">http://www.hq.nasa.gov/office/codeq/doctree/fthb.pdf</a>)</li> <li>- NPR 8705.4 Risk Classification for NASA Payloads</li> <li>- NPR 8715.3 NASA General Safety Program Requirements</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver preliminary qualitative mission FTA report to Project Office thirty (30) days prior to PDR for review.</li> <li>- Deliver final qualitative mission FTA report to Project Office thirty (30) days prior to CDR for approval.</li> <li>- Deliver qualitative mission FTA report to Project Office within thirty (30) days of updates/changes for approval.</li> <li>- Deliver quantitative FTA report to Project Office in support of pivotal event analysis as part of each PRA report for approval.</li> </ul>	
<p>Preparation Information:</p> <p>The mission FTA Report shall contain:</p> <ul style="list-style-type: none"> <li>- Analysis ground rules including definitions of undesirable end states</li> <li>- References to documents and data used</li> <li>- Fault tree diagrams</li> <li>- Results and conclusions</li> </ul> <p>Note: Separate FTA reports are not required for fault trees generated in support pivotal event analysis in the PRA report.</p>	

## DID 4-8: PROBABILISTIC RISK ASSESSMENT

Title: Probabilistic Risk Assessment	DID No.: 4-8
MAR Paragraph: 4.5	
<p>Use:</p> <p>To provide a structured and disciplined approach to: analyzing system risk; supporting management decisions; improving safety, operations, performing maintenance and upgrades; improving performance; reducing costs.</p>	
<p>Reference Documents:</p> <ul style="list-style-type: none"> <li>- NPR 8705.4 Risk Classification for NASA Payloads</li> <li>- NPR 8705.5 Technical Probabilistic Risk Assessment (PRA) Procedures for Safety and Mission Success for NASA Programs and Projects</li> <li>- NPR 8715.3 NASA General Safety Program Requirements</li> <li>- PRA Procedures Guide for NASA Managers and Practitioners (<a href="http://www.hq.nasa.gov/office/codeq/doctree/praguide.pdf">http://www.hq.nasa.gov/office/codeq/doctree/praguide.pdf</a>)</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver a PRA plan to the Project Office sixty (60) days after contract award for review (Note: PRA may be stand-alone document or included as part of the Reliability Program Plan (RPP), Risk Management Plan (RMP), etc. The PRA Plan shall meet requirements delineated in DID 4-1).</li> <li>- Deliver interim PRA to the Project Office thirty (30) days prior to PDR for review.</li> <li>- Deliver updated interim PRA to the Project Office thirty (30) days prior to CDR for review.</li> <li>- Deliver updated interim PRA to the Project Office thirty (30) days prior to MOR for review.</li> <li>- Deliver final PRA to the Project Office thirty (30) days prior to FOR for approval.</li> </ul>	
<p>Preparation Information:</p> <p>The PRA shall be performed in accordance with NPR 8705.5 and include the following:</p> <ul style="list-style-type: none"> <li>- The objective and scope of the PRA</li> <li>- End-states-of-interest to the decision-maker,</li> <li>- Definition of the mission phases and success criteria,</li> <li>- Initiating event categories,</li> <li>- Top level scenarios,</li> <li>- Initiating and pivotal event models (e.g., fault trees and phenomenological event models), including assessments of common cause failure modes</li> <li>- Data development for probability calculations,</li> <li>- Integrated model and quantification to obtain risk estimates,</li> <li>- Assessment of uncertainties,</li> <li>- Summary of results and conclusions, including a ranking of the lead contributors to risk.</li> </ul>	

## DID 4-9: PARTS STRESS ANALYSIS

Title: Parts Stress Analysis	DID No.: 4-9
MAR Paragraph: 4.6	
<p>Use:</p> <p>Provides EEE parts stress analyses for verifying circuit design conformance to derating requirements; demonstrates that environmental operational stresses on parts comply with project derating requirements.</p>	
<p>Reference Documents</p> <ul style="list-style-type: none"> <li>- GSFC EEE-INST-002 &lt;<a href="http://nepp.nasa.gov/DocUploads/FFB52B88-36AE-4378-A05B2C084B5EE2CC/EEE-INST-002_add1.pdf">http://nepp.nasa.gov/DocUploads/FFB52B88-36AE-4378-A05B2C084B5EE2CC/EEE-INST-002_add1.pdf</a>&gt;</li> <li>- NASA Parts Selection List &lt;<a href="http://nepp.nasa.gov/npsl/index.htm">http://nepp.nasa.gov/npsl/index.htm</a>&gt;</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver Parts Stress Analysis Report to Project Office forty-five (45) days prior to CDR for review.</li> <li>- Deliver revisions to Parts Stress Analysis Report to the Project Office within thirty (30) days of changes for review.</li> </ul>	
<p>Preparation Information:</p> <p>The Parts Stress Analysis Report shall contain:</p> <ul style="list-style-type: none"> <li>- Analysis ground rules</li> <li>- Reference documents and data used</li> <li>- Results and conclusions including: <ul style="list-style-type: none"> <li>o Design trade study results</li> <li>o Parts stress analysis results impacting design or risk decisions</li> </ul> </li> <li>- Analysis worksheets; the worksheets at a minimum shall include: <ul style="list-style-type: none"> <li>o Part identification (traceable to circuit diagrams)</li> <li>o Assumed environmental (consider all expected environments)</li> <li>o Rated stress</li> <li>o Applied stress (consider all significant operating parameter stresses at the extremes of anticipated environments)</li> <li>o Ratio of applied-to-rated stress</li> </ul> </li> </ul>	

## DID 4-10: WORST CASE ANALYSIS

Title: Worst Case Analysis	DID No.: 4-10
MAR Paragraph: 4.7	
Use: Demonstrate design margins in electronic and electrical circuits, optics, and electromechanical and mechanical items.	
Reference Documents  <ul style="list-style-type: none"> <li>- NPD 8720.1, NASA Reliability and Maintainability (R&amp;M) Program Policy.</li> <li>- NASA-STD-8729.1, Planning, Developing and Managing an Effective R&amp;M Program.</li> <li>- NPR 8705.4, Risk Classification for NASA Payloads</li> </ul>	
Place/Time/Purpose of Delivery:  <ul style="list-style-type: none"> <li>- Deliver Worst Case Analysis Report to Project Office thirty (30) days prior to CDR for review.</li> <li>- Deliver revisions to Worst Case Analysis Report to Project Office within thirty (30) days for review.</li> </ul>	
Preparation Information:  <p>The Worst Case Analysis Report shall include the following:</p> <ul style="list-style-type: none"> <li>- Address worst case conditions performed on each component.</li> <li>- Discuss how each analysis includes the mission life.</li> <li>- Discuss consideration of critical parameters at maximum and minimum limits.</li> <li>- The effect of environmental stresses on the operational parameters being evaluated.</li> </ul>	

## DID 4-11: RMA PERFORMANCE REPORTING

Title: RMA Performance Reporting	DID No.: 4-11
MAR Paragraph: 4.8.1	
Use: Used to document the analysis of test information, trend data, and failure investigations to assess reliability and identify problem areas.	
Reference Documents:	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"><li>- Deliver initial report to Project Office thirty (30) days prior to CDR for review.</li><li>- Deliver updates to the Project Office at the monthly project status meeting for review.</li></ul>	
Preparation Information: <p>The RMA Performance Report shall include the following:</p> <ul style="list-style-type: none"><li>- Analysis of test results</li><li>- Trend data</li><li>- Failure investigations</li><li>- Metrics regarding system performance against SOW requirements for reliability and availability</li></ul>	

## DID 5-1: SOFTWARE ASSURANCE PLAN

Title: Software Assurance Plan	DID No.: 5-1
MAR Paragraph: 5.2	
<p>Use:</p> <p>Documents the developers' Software Assurance roles and responsibilities and surveillance activities to be performed as outlined in the NASA Software Assurance Standard.</p>	
<p>Reference Documents:</p> <ul style="list-style-type: none"> <li>- NASA-STD-8739.8, NASA Standard for Software Assurance</li> <li>- NASA-STD-8719.13, NASA Software Safety Standard</li> <li>- IEEE Standard 730-2002, Software Quality Assurance Plans</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver preliminary plan to the Project Office thirty (30) days prior to SRR for information.</li> <li>- Deliver baseline plan to the Project Office fifteen (15) days prior to PDR for information.</li> <li>- Deliver updates to the Project Office fifteen (15) days prior to implementation for information.</li> </ul>	
<p>Preparation Information:</p> <p>The Software Assurance Plan (SAP) shall address the following:</p> <ul style="list-style-type: none"> <li>- Purpose</li> <li>- Scope</li> <li>- Reference documents and definitions</li> <li>- Assurance Organization and Management</li> <li>- Assurance Activities by discipline <ul style="list-style-type: none"> <li>o Software Quality (process and product)</li> <li>o Software Safety</li> <li>o Software Reliability</li> <li>o Software Verification and Validation</li> <li>o Independent Verification and Validation (if applicable)</li> </ul> </li> <li>- Assurance Activities for Complex Programmable Logic Devices (See note below)</li> <li>- Assurance tools, techniques, and methodologies</li> <li>- Software Assurance Program Metrics</li> <li>- Problem Reporting and Corrective Action</li> <li>- Assurance records, collection, maintenance, and retention</li> <li>- Training</li> <li>- Risk Management</li> <li>- Requirements Compliance Matrix (NASA-STD-8739.8 Appendix C)</li> <li>- SAP Change procedure and history</li> </ul>	

## DID 5-2: SOFTWARE ASSURANCE STATUS REPORT

Title: Software Assurance Status Report	DID No.: 5-2
MAR Paragraph: 5.5	
<p>Use:</p> <p>Software Assurance Status Report provides information regarding the developer's assurance activities, accomplishments, significant problems, and future plans.</p>	
<p>Reference Documents:</p> <ul style="list-style-type: none"> <li>- NASA-STD-8739.8, NASA Standard for Software Assurance</li> <li>- NASA-STD-8719.13, NASA Software Safety Standard</li> <li>- NPR 7150.2, NASA Software Engineering Requirements</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Deliver to Project Office monthly beginning sixty (60) days after contract award for information.</li> </ul>	
<p>Preparation Information:</p> <p>Separately, or as part of the Project Monthly Status Reports, the developer shall status the following software assurance activities:</p> <ul style="list-style-type: none"> <li>- Organization and key personnel changes</li> <li>- Assurance accomplishments and resulting software assurance metrics (e.g., number of planned vs. actual audits/assessments, number of open vs. closed corrective actions resulting from audits)</li> <li>- Subcontractor assurance accomplishments</li> <li>- Trends in software quality metric data (e.g., total number of software problem reports, including the number of problem reports that were opened and closed in that reporting period)</li> <li>- Significant problems or issues</li> <li>- Plans for upcoming software assurance activities</li> <li>- Recommendations and lessons learned</li> </ul>	

## DID 6-1 COMPONENT CONTROL PLAN

Title: Component Control Plan	DID No.: 6-1
MAR Paragraph: 6.1	
Use:	
Reference Documents:	
Place/Time/Purpose of Delivery:	
Preparation Information:	

## DID 6-2 PURCHASED COMPONENT SELECTION

Title: Purchased Component Selection	DID No.: 6-2
MAR Paragraph: 6.2	
Use:	
Reference Documents:	
Place/Time/Purpose of Delivery:	
Preparation Information:	

## DID 6-3 COMMERCIALY AVAILABLE OFF-THE-SHELF (COTS) COMPONENT SELECTION

Title: Commercially Available Off-the-shelf (COTS) Component Selection	DID No.: 6-3
MAR Paragraph: 6.3	
Use:	
Reference Documents:	
Place/Time/Purpose of Delivery:	
Preparation Information:	

## DID 6-4 PREVIOUSLY DEVELOPED PRODUCT – COMPLIANCE WITH REQUIREMENTS

Title: Previously Developed Product – Compliance with Requirements	DID No.: 6-4
MAR Paragraph: 6.4	
Use: Documents the compliance of previously developed product with the system safety and mission assurance requirements of the MAR.	
Reference Documents:  - MAR	
Place/Time/Purpose of Delivery:  - Delivered to the Project Office thirty 30 days after the identification of previously developed product for approval.	
Preparation Information:  The document shall identify the system safety and mission assurance requirements that apply to the previously developed product through a requirements compliance matrix for the product's specific characteristics and its development. The document shall address all areas of noncompliance through the submission of waiver requests to the relevant requirements.	

## DID 6-5 GIDEP ALERT AND NASA ADVISORY DISPOSITIONS

Title: GIDEP Alert and NASA Advisory Dispositions	DID No.: 6-5
MAR Paragraph: 6.6.2	
<p>Use:</p> <p>Document the developer'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, equipment, and software used in NASA products.</p>	
<p>Reference Documents:</p> <ul style="list-style-type: none"> <li>- GIDEP Operations Manual (S0300- BT-PRO-010)</li> <li>- GIDEP Requirements Guide (S0300-BU-GYD-010)</li> </ul>	
<p>Place/Time/Purpose of Delivery:</p> <ul style="list-style-type: none"> <li>- Provide disposition of existing Alerts to the Project Office within 30 days of identification of potential use or use of an EEE part, material, equipment, or software for review.</li> <li>- Provide disposition of new Alerts to the Project Office for EEE parts, materials, equipment, or software already approved for use within 30 days of Alert release date for review.</li> </ul>	
<p>Preparation Information:</p> <p>The developer shall submit:</p> <ul style="list-style-type: none"> <li>- A completed GSFC Form 4-37, "Problem Impact Statement Parts, Materials and Safety", GSFC Form 4-37A "Problem Impact Statement Safety-Related Documents", or equivalent developer form, for each Alert.</li> </ul> <p>Note: Use-as-is dispositions for parts, materials, equipment, or software directly impacted by an Alert require thorough documentation, including documented concurrence from discipline areas contributing to the response and supporting objective evidence, such as thermal, or worst case circuit stress, or environmental stress analyses.</p>	

## DID 6-6 SIGNIFICANT PARTS, MATERIALS, AND SAFETY PROBLEMS

Title: Significant parts, materials, and safety problems	DID No.: 6-6
MAR Paragraph: 6.6.3	
Use: Document the developer's identification of significant parts, material, and safety problems and the developer's actions as required by the GIDEP manual regarding the decision to prepare an Alert, including the type of Alert that is applicable.	
Reference Documents: <ul style="list-style-type: none"><li>- GIDEP Operations Manual (S0300- BT-PRO-010)</li><li>- GIDEP Requirements Guide (S0300-BU-GYD-010)</li></ul>	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"><li>- Deliver to the Project Office within thirty (30) days of identification for review.</li></ul>	
Preparation Information: The developer shall submit relevant information (e.g., failure analyses, test reports, root cause and corrective action evaluations).	

## DID 9-1 SYSTEMS REVIEW MATERIALS

Title: Systems Review Materials	DID No.: 9-1
MAR Paragraph: 9.1	
Use: To provide the systems review team with the materials used to conduct the review.	
Reference Documents <ul style="list-style-type: none"><li>- Project Systems Review Plan</li><li>- GSFC-STD-1001 Criteria for Flight and Flight Support Systems Lifecycle Reviews</li></ul>	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"><li>- Provide the review agenda to the Project Office fourteen (14) days prior to commencement of the review for information.</li><li>- Provide the review presentation materials to the Project Office seven (7) days prior to the review for information.</li><li>- Provide review related reference materials to the Project Office at the review for information.</li></ul>	
Preparation Information: See the guidelines presented in the reference documents.	

## DID 9-2 ACTION ITEM RESPONSES

Title: Action Item Responses	DID No.: 9-2
MAR Paragraph: 9.1	
Use: To respond to action items resulting from the review.	
Reference Documents <ul style="list-style-type: none"><li>- Project Systems Review Plan (provided by Project Office)</li><li>- GSFC-STD-1001 Criteria for Flight and Flight Support Systems Lifecycle Reviews</li></ul>	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"><li>- Provide an action item closure plan to the Project Office thirty (30) days after end of review for approval</li></ul>	
Preparation Information:  See the guidelines presented in the related documents.	

## DID 9-3 ENGINEERING PEER REVIEW PROGRAM

Title: Engineering Peer Review Program	DID No.: 9-3
MAR Paragraph: 9.2	
Use: To define the plan for conducting the developer's engineering peer review program.	
Reference Documents <ul style="list-style-type: none"><li>- GPR 8700.6 Engineering Peer Reviews</li></ul>	
Place/Time/Purpose of Delivery: <ul style="list-style-type: none"><li>- Provide to the Project Office sixty (60) days after contract award for review.</li></ul>	
Preparation Information: See the guidelines presented in the reference document.	

## DID 10-1 END ITEM ACCEPTANCE DATA PACKAGE

Title: End Item Acceptance Data Package	DID No.: 10-1
MAR Paragraph: 10	
Use: The End Item Acceptance Data Package documents the design, fabrication, assembly, test, and integration of the hardware and software being delivered and is included with the end item delivery.	
Reference Documents:	
Place/Time/Purpose of Delivery:  - Provide the End Item Acceptance Data Package to the Project thirty (30) days prior to end item delivery for approval.	
Preparation Information:  The developer prepares the End Item Acceptance Data Package as part of design development and implementation such that it is completed prior to delivery. The following items shall be included: <ul style="list-style-type: none"> <li>- Appropriate approval signatures (e.g., developers quality representative, product design lead, government Representative, etc.)</li> <li>- As-built configuration</li> <li>- Final assembly and test Work Order</li> <li>- Major anomaly reports</li> <li>- Acceptance testing procedures and reports</li> <li>- Trend data</li> <li>- Anomaly/problem failure reports with root cause and corrective action dispositions</li> <li>- As-built EEE parts and components list</li> <li>- As-built materials list</li> <li>- Limited life items, including data regarding the life remaining</li> <li>- As-built final assembly drawings</li> <li>- Waivers</li> <li>- Certificate of Compliance which were signed by management</li> </ul>	

**Appendix 4. MAR Response Form**

*Note: Delete one of the two entries in paragraph 3.3.3 and DID 3.7 of this table to correspond with the tailoring selection made for Paragraph 3.3.3 of the MAR.*

- Enter *Yes* or *No* regarding compliance with the requirements.
- A response of *Yes* indicates full compliance with the requirements. The Comment column should be used as required to indicate how compliance will be achieved, e.g., through an equivalent procedure.
- A response of *No* indicates less than full compliance with the requirements and requires an entry in the Comment column to explain the deviation from full compliance.

Paragraph or DID	Title	Comply Y / N	Comment (Required for <i>No</i> )
1 General			
1.1	Systems Safety and Mission Assurance Program		
1.2	Management		
1.3	Subcontractor Requirements Flowdown		
1.4	Suspension of Work Activities		
1.5	Contract Data Requirements List		
1.6	Surveillance		
1.7	Risk Management		
DID 1-1	Mission Assurance Implementation Plan		
DID 1-2	Risk Management Plan		
2 Quality Management System			
2.1	General		
2.2	Supplemental Quality Management System Requirements		
2.2.1	Control of Nonconforming Product		
2.2.2	Material Review Board		
2.2.3	Anomaly Reporting and Disposition		
2.2.4	Failure Review Board		
2.2.5	Quality Assurance Program		
DID 2-1	Reporting of MRB Actions		

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Paragraph or DID	Title	Comply Y / N	Comment (Required for No)
DID 2-2	Anomaly Report		
<b>3 System Safety</b>			
3.1	General		
3.2	System Safety Deliverables		
3.2.1	System Safety Program Plan		
3.2.2	Safety Requirements Compliance Checklist		
3.2.3	Hazard Analyses		
3.2.3.1	Preliminary Hazard Analysis		
3.2.3.2	Operations Hazard Analysis (OHA)		
3.2.3.3	Software Safety Analysis		
3.2.4	Operating and Support Hazard Analysis		
3.2.4	Safety Assessment Report		
3.2.5	Verification Tracking Log		
3.2.6	Safety Waivers		
3.2.7	Mishap Reporting and Investigation		
DID 3-1	System Safety Program Plan		
DID 3-2	Safety Requirements Compliance Checklist		
DID 3-3	Preliminary Hazard Analysis		
DID 3-4	Operations Hazard Analysis		
DID 3-5	Safety Assessment Report		
DID 3-6	Verification Tracking Log		
DID 3-7	Safety Waivers		
DID 3-8	Pre-Mishap Plan		
<b>4 Reliability, Maintainability, and Availability (RMA)</b>			
4.1	RMA Program Plan		
4.2	Reliability, Maintainability, and Availability Analysis		
4.2.1	RMA Performance Prediction		
4.2.2	Reliability		
4.2.3	Maintainability		
4.2.4	Availability		

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Paragraph or DID	Title	Comply Y / N	Comment (Required for <i>No</i> )
4.3	Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)		
4.4	Fault Tree Analysis		
4.5	Probabilistic Risk Assessment (PRA)		
4.6	Parts Stress Analysis		
4.7	Worst Case Analysis		
4.8	Test and Operations		
4.8.1	RMA Performance Reporting		
4.8.2	Reliability and Availability Growth		
4.8.2.1	Failure Reporting and Corrective Action System		
4.8.2.2	Failure Trend Analysis		
4.8.2.3	Software Reliability Growth		
DID 4-1	RMA Program Plan		
DID 4-2	RMA Performance Prediction		
DID 4-3	Reliability Assessments and Predictions Report		
DID 4-4	Maintainability Demonstration Report		
DID 4-5	Availability Compliance Report		
DID 4-6	FMECA and CIL		
DID 4-7	Fault Tree Analysis		
DID 4-8	PRA		
DID 4-9	Parts Stress Analysis		
DID 4-10	Worst Case Analysis		
DID 4-11	RMA Performance Report		
<b>5 Software Assurance (Flight and Ground Segments)</b>			
5.1	Applicable Software Definitions		
5.2	Software Assurance Program		
5.2.1	Software Quality		
5.2.2	Software Safety Analysis		

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Paragraph or DID	Title	Comply Y / N	Comment (Required for No)
5.2.3	Software Reliability Analysis		
5.2.4	Verification and Validation		
5.2.5	Independent Verification and Validation		
5.3	Reviews		
5.4	Government Furnished Equipment (GFE), Existing, and Purchased Software		
5.5	Surveillance of Software Development, Maintenance, and Assurance Activities		
DID 5-1	Software Assurance Plan		
DID 5-2	Software Assurance Status Report		
<b>6 Component Selection and Control</b>			
6.1	Component Control Plan		
6.2	Purchased Component Selection		
6.3	Commercially Available Off-the-shelf (COTS) Component Selection		
6.4	Previously Developed Products		
6.5	Government Furnished Equipment (GFE)		
6.6	Project Component Problem and Status Reporting		
6.6.1	Government-Industry Data Exchange Program (GIDEP)		
6.6.2	Disposition		
6.6.3	Significant EEE Parts, Materials, and Safety Problems		
6.6.4	Review Reporting		
6.7	Spare Hardware Testing		
6.8	Diminishing Manufacturing Sources and Material Shortages (DMSMS)		

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Paragraph or DID	Title	Comply Y / N	Comment (Required for No)
6.9	Custom Technology Devices		
6.10	Limited Life Items		
6.11	Failure Reporting		
DID 6-1	Component Control Plan		
DID 6-2	Purchased Component Selection		
DID 6-3	COTS Component Selection		
DID 6-4	Previously Developed Product – Compliance with Requirements		
DID 6-5	GIDEP Alert and NASA Advisory Dispositions		
DID 6-6	Significant Parts, Materials, and Safety Problems		
<b>7 Production Controls</b>			
7.1	General		
7.2	Personnel Certification for J-STD-001E		
7.3	Design Qualification		
7.4	Electrostatic Discharge Control (ESD)		
7.5	Metrology and Calibration		
7.6	Handling, Packaging, Transporting, and Storage		
<b>8 Testing, Verification, and Validation</b>			
8.1	Verification and Validation		
8.2	Test Facility Readiness		
<b>9 System Performance Verification</b>			
9.1	System Reviews		
9.2	Peer Reviews		
DID 9-1	Systems Review Materials		
DID 9-2	Action Item Responses		
DID 9-3	Engineering Peer Review Program		
<b>10 Acceptance Data Package</b>			
10.1	Acceptance Data Package		
DID 10-1	Acceptance Data Package		

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**Appendix 5. Data Item Description List**

<b>DID #</b>	<b>MAR Paragraph</b>	<b>Title</b>	<b>Due</b>	<b>Purpose</b>
1-1	1.1	Mission Assurance Implementation Plan	<ol style="list-style-type: none"> <li>1. 60 days after contract award</li> <li>2. Updates thirty (30) days prior to implementation</li> </ol>	Information
1-2	1.7	Previously Developed Product – Compliance with Requirements	30 days after identification of previously developed product	Approval
2-1	2.2.2	Reporting of MRB Actions	<ol style="list-style-type: none"> <li>3. Major MRB actions: within five (5) working days of MRB action</li> <li>4. Minor MRB actions: within five (5) working days of MRB action</li> </ol>	<ol style="list-style-type: none"> <li>1. Approval</li> <li>2. Review</li> </ol>
2-2	2.2.2	Request for a Waiver	Within five (5) working days of identifying the need for a waiver	Approval
2-3	2.2.3	Major Anomaly Report	<ol style="list-style-type: none"> <li>1. Initial submission to the project office within 24 hours of occurrence</li> <li>2. Notice of a change in status within 24 hours of occurrence</li> <li>3. Proposed closure to the project office prior to closure</li> </ol>	<ol style="list-style-type: none"> <li>1. Information</li> <li>2. Information</li> <li>3. Approval</li> </ol>
3-1	3.3.1	System Safety Program Plan	<ol style="list-style-type: none"> <li>1. Preliminary to the Project Office at SRR.</li> <li>2. Final to the Project Office forty-five (45) days prior to PDR</li> <li>3. Updates thirty (30) days prior to implementation</li> </ol>	Information
3-2	3.3.2	Safety Requirements Compliance Checklist	<ol style="list-style-type: none"> <li>1. Preliminary to the Project Office forty-five (45) days prior to PDR.</li> <li>2. Deliver Final to the Project Office forty-five (45) days prior to CDR.</li> </ol>	Approval
3-3	3.3.3.1	Preliminary Hazard Analysis	<p>As a part of the Preliminary ISAR (DID 3-7)</p> <p><b>OR</b></p> <p>As a part of the SDP I (DID 3-7)</p>	Approval

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<b>DID #</b>	<b>MAR Paragraph</b>	<b>Title</b>	<b>Due</b>	<b>Purpose</b>
3-4	3.3.3.2	Operations Hazard Analysis	Deliver the OHA and Hazard Verification Tracking Log to the Project Office forty-five (45) days prior to Systems Integration Review or Pre-Environmental Review	Approval
3-5	3.3.3.3	Safety Hazard Analysis on Critical Lift Equipment	<ol style="list-style-type: none"> <li>1. Deliver the analysis to the project office thirty (30) days prior to use in a critical lift for approval.</li> <li>2. Deliver a revised analysis to the project office fifteen (15) days prior to use in a critical lift for approval.</li> </ol>	Approval
3-6	3.3.3.4	Operating and Support Hazard Analysis <i>Delete non-applicable requirement</i>	<ol style="list-style-type: none"> <li>1. As a part of the Intermediate &amp; Final ISARs (DID 3-7)</li> <li>2. As a part of the SDP II &amp; SDP III (DID 3-7)</li> </ol>	Approval
3-7	3.3.4	Instrument Safety Assessment Report <i>Delete non-applicable requirement</i>	<ol style="list-style-type: none"> <li>1. Preliminary ISAR 30 days prior to instrument PDR</li> <li>2. Intermediate ISAR 30 days prior to instrument CDR</li> <li>3. Deliver the Final ISAR 30 days prior to instrument PSR</li> </ol>	Approval
3-7	3.3.4	Safety Data Package <i>Delete non-applicable requirement</i>	<ol style="list-style-type: none"> <li>1. SDP I 45 days prior to Mission PDR</li> <li>2. SDP II 45 days prior to Mission CDR</li> <li>3. SDP III 90 days prior to shipment</li> </ol>	Approval
3-8	3.3.5	Verification Tracking Log	<ol style="list-style-type: none"> <li>1. Hazard controls not verified as closed with the final ISAR (DID 3-7)</li> <li>2. Hazard controls not verified as closed with the SDP III DID (3-7)</li> <li>3. Regular updates provided until all hazard controls are verified as closed.</li> </ol>	Review

DID #	MAR Paragraph	Title	Due	Purpose
3-9	3.3.6	Hazardous Procedures for Payload I&T and Pre-Launch Processing	<ol style="list-style-type: none"> <li>1. I&amp;T hazardous procedures to Project Office 7 days before first use</li> <li>2. Launch Range Hazardous Procedures to the Project Office 60 days prior to first use</li> <li>3. Launch Range Hazardous Procedures to Range Safety forty-five (45) days prior to first use (after NASA approval)</li> </ol>	Approval
3-10	3.3.7	Safety Waivers	Within thirty (30) days of identifying the need for a waiver	Approval
3-11	3.3.8	Input to Orbital Debris Assessment Report (ODAR) and End of Mission Plan (EOMP)	<ol style="list-style-type: none"> <li>1. Deliver preliminary ODAR inputs to the Project Office fifteen (15) days prior to mission PDR for <b>information</b>.</li> <li>2. Deliver ODAR interim inputs to the Project Office sixty (60) days prior to mission CDR for <b>information</b>.</li> <li>3. Deliver the final/updated ODAR and EOMP inputs to the Project Office 90 days prior to PSR for <b>information</b>.</li> </ol>	Information
3-12	3.3.9	Pre-Mishap Plan	45 days prior to mission PDR	Approval
3-13	3.3.10	Range Safety Forms <i>Delete non-applicable requirement</i>	<ol style="list-style-type: none"> <li>1. With Final ISAR (DID 3-7)</li> <li>2. With SDP III (DID 3-7)</li> </ol>	Review
4-1	4.1	Reliability Program Plan	<ol style="list-style-type: none"> <li>1. Sixty (60) days after contract award</li> <li>2. Final plan 30 days prior to the Systems Requirements Review</li> <li>3. Activity reports at milestone reviews beginning with the Systems Requirements Review</li> </ol>	<ol style="list-style-type: none"> <li>1. Information</li> <li>2. Information</li> <li>3. Information</li> </ol>

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<b>DID #</b>	<b>MAR Paragraph</b>	<b>Title</b>	<b>Due</b>	<b>Purpose</b>
4-2*	4.2	Probabilistic Risk Assessment	<ol style="list-style-type: none"> <li>1. Deliver a PRA plan to the Project office sixty (60) days after contract award</li> <li>2. Deliver interim PRA to the Project Office thirty (30) days prior to PDR.</li> <li>3. Deliver updated interim PRA to the Project Office thirty (30) days prior to CDR.</li> <li>4. Deliver updated interim PRA to the Project Office thirty (30) days prior to MOR.</li> <li>5. Deliver final PRA to the Project Office thirty (30) days prior to FOR.</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Review</li> <li>3. Review</li> <li>4. Review</li> <li>5. Approval</li> </ol>
4-2	4-2	Input to the Probabilistic Risk assessment (PRA)	<ol style="list-style-type: none"> <li>1. Deliver preliminary heritage information, including the percent applicable, to the Project Office sixty (60) days after contract award.</li> <li>2. Deliver updated heritage information, including the percent applicable heritage to the subject mission, to the Project Office thirty (30) days to prior major milestone reviews beginning with the SRR.</li> <li>3. Deliver product information and process information for elements within the scope of the Mission PRA to the Project Office thirty (90) days prior to the PDR and thirty (30) days prior to subsequent major milestone reviews.</li> </ol>	Information
4-3	4.3	FMEA/FMECA and Critical Items List	<ol style="list-style-type: none"> <li>1. Preliminary FMEA/FMECA thirty (30) days before PDR</li> <li>2. Final FMEA/FMECA thirty (30) days prior to CDR</li> <li>3. Updated FMEA/FMECA and CIL thirty (30) days prior to each subsequent milestone review leading up to Launch</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Approval</li> <li>3. Approval</li> </ol>

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<b>DID #</b>	<b>MAR Paragraph</b>	<b>Title</b>	<b>Due</b>	<b>Purpose</b>
4-5	4.4	Fault Tree Analysis	<ol style="list-style-type: none"> <li>1. Preliminary qualitative FTA report thirty (30) days prior to PDR</li> <li>2. Final qualitative FTA report thirty (30) days prior to CDR</li> <li>3. Updated qualitative FTA report thirty (30) days of updates/changes</li> <li>4. Final quantitative FTA report in support of pivotal event analysis as part of each PRA report</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Approval</li> <li>3. Approval</li> <li>4. Approval</li> </ol>
4-6	4.5	Parts Stress Analysis	<ol style="list-style-type: none"> <li>1. Forty-five (45) days prior to CDR</li> <li>2. Revisions within thirty (30) days</li> </ol>	Review
4-7	4.6	Worst Case Analysis	<ol style="list-style-type: none"> <li>1. Thirty (30) days prior to CDR</li> <li>2. Revisions within thirty (30) days</li> </ol>	Review
4-8	4.7	Reliability Assessments and Predictions	<ol style="list-style-type: none"> <li>1. Methodology thirty (30) days prior to System Requirements Review</li> <li>2. Initial report thirty (30) days prior to PDR</li> <li>3. Final report thirty (30) days prior to CDR</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Review</li> <li>3. Approval</li> </ol>
4-9	4.8	Limited-Life Items List	<ol style="list-style-type: none"> <li>1. Thirty (30) days prior to PDR</li> <li>2. Updates to the Project Office within thirty (30) days of changes</li> </ol>	Approval
5-1	5.2	Software Assurance Plan	<ol style="list-style-type: none"> <li>1. Preliminary plan to the Project Office thirty (30) days prior to SRR</li> <li>2. Baseline plan to the Project Office fifteen (15) days prior to PDR</li> <li>3. Updates to the Project Office fifteen (30) days prior to implementation</li> </ol>	Information
5-2	5.5	Software Assurance Status Report	<ol style="list-style-type: none"> <li>1. Monthly beginning sixty (60) days after contract award</li> </ol>	Information
7-1	7.1	Risk Management Plan	Sixty (60) days after contract award	Approval
7-2	7.2	Risk List	Monthly beginning with PDR	Review

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<b>DID #</b>	<b>MAR Paragraph</b>	<b>Title</b>	<b>Due</b>	<b>Purpose</b>
8-1	8.1	Systems Review Materials	<ol style="list-style-type: none"> <li>1. Agenda fourteen (14) days prior to commencement of the review</li> <li>2. Presentation materials seven (7) days prior to the review</li> <li>3. Reference materials at the review</li> </ol>	Information
8-2	8.1	Action Item Responses	Thirty (30) days after end of review	Approval
8-3	8.2	Peer Review Program	Sixty (60) days after contract award	Review
9-1	9.1	System Performance Verification Plan	<ol style="list-style-type: none"> <li>1. Preliminary plan thirty (30) days prior to PDR</li> <li>2. Final plan thirty (30) days prior to CDR</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Approval</li> </ol>
9-2	9.2	Environmental Verification Plan	<ol style="list-style-type: none"> <li>1. Preliminary plan thirty (30) days prior to PDR</li> <li>2. Final plan thirty (30) days prior to CDR</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Approval</li> </ol>
9-3	9.3	System Performance Verification Matrix	Updated matrix included in the data packages for the Integrated Independent Reviews beginning with PDR	Review
9-4	9.4	Environmental Test Matrix	Updated matrix included in the review data package for milestone reviews beginning with PDR.	Review
9-5	9.5	Verification Reports	<ol style="list-style-type: none"> <li>1. Preliminary verification report within seventy-two (72) hours of test completion</li> <li>2. Final verification report within thirty (30) days of test completion</li> </ol>	Information
9-6	9.6	System Performance Verification Report	<ol style="list-style-type: none"> <li>1. Updated reports with the review data package at milestone reviews, beginning with CDR</li> <li>2. Final report within thirty (30) days after completion of on-orbit checkout</li> </ol>	Information
10-1	10.3	ESD Control Plan	Thirty (30) days prior to PDR	Review
11-1	11.1	Parts Control Plan	Thirty (30) days after contract award	Approval
11-2	11.2	Parts Control Board	Thirty (30) days after contract award	Approval
11-3	11.3.1	Parts Identification List	Ten (10) business days prior to the PCB meeting	Approval
11-4	11.3.2	Project approved Parts List	Ten (10) business days prior to the PCB meeting at which they will be presented	Approval

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<b>DID #</b>	<b>MAR Paragraph</b>	<b>Title</b>	<b>Due</b>	<b>Purpose</b>
11-5	11.3.3	As designed Parts List	Ten (10) business days prior to the PCB meeting at which they will be presented	Approval
11-6	11.3.4	As Built Parts List	Ten (10) business days prior to the PCB meeting at which they will be reviewed	Review
12-1	12.1	Materials & Processes Selection, Control, and Implementation Plan	Sixty (60) days after contract award	Approval
12-2	12.2	Life Test Plan for Lubricated Mechanisms	<ol style="list-style-type: none"> <li>1. Plan thirty (30) days prior to PDR</li> <li>2. Report thirty (30) days after acceptance test completion</li> </ol>	<ol style="list-style-type: none"> <li>1. Approval</li> <li>2. Review</li> </ol>
12-3	12.3	Materials Usage Agreement	<ol style="list-style-type: none"> <li>1. New MUAs thirty (30) days prior to CDR</li> <li>2. Revised MUAs within thirty (30) days of identification</li> </ol>	<ol style="list-style-type: none"> <li>1. Approval</li> <li>2. Approval</li> </ol>
12-4	12.4	Materials Identification and Usage List	<ol style="list-style-type: none"> <li>1. Thirty (30) days prior to PDR</li> <li>2. Thirty (30) days prior to CDR</li> <li>3. Updates to the Project Office within thirty (30) days of identification</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Approval</li> <li>3. Review</li> </ol>
12-5	12.5	Nondestructive Evaluation Plan	<ol style="list-style-type: none"> <li>1. Thirty (30) days prior to PDR</li> <li>2. Thirty (30) days prior to CDR</li> <li>3. Updates thirty (30) days after identification</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Approval</li> <li>3. Approval</li> </ol>
12-6	12.6	Printed Wiring Boards Test Coupons	As soon as practicable	Approval
13-1	13.1	Contamination Control Plan	<ol style="list-style-type: none"> <li>1. Plan thirty (30) days before PDR</li> <li>2. Plan thirty (30) days before the CDR</li> <li>3. Final thermal vacuum bakeout results provided within thirty (30) of completion</li> <li>4. Contamination certificate of compliance with End Item Acceptance Data Package</li> </ol>	<ol style="list-style-type: none"> <li>1. Review</li> <li>2. Approval</li> <li>3. Review</li> <li>4. Review</li> </ol>

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<b>DID #</b>	<b>MAR Paragraph</b>	<b>Title</b>	<b>Due</b>	<b>Purpose</b>
15-1	15.4	GIDEP Alert and NASA Advisory Dispositions	<ol style="list-style-type: none"> <li>1. Provide disposition of existing Alerts to the Project Office within 30 days of identification of potential use or use of an EEE part or material for review.</li> <li>2. Provide disposition of subsequent Alerts to the Project Office regarding EEE parts or materials already approved for use within 30 days for review.</li> </ol>	Review
15-2	15.4	Significant Parts, Materials, and Safety Problems	Within thirty (30) days	Review
16-1	16	End Item Acceptance Data Package	Thirty (30) days prior to end item delivery	Approval

\* Delete one of the two per the related tailoring in the narrative

**CHANGE HISTORY LOG**

<b>Revision</b>	<b>Effective Date</b>	<b>Description of Changes</b>
-	09/11/2014	Baseline Issue – CCR-D-0087