NASA
Procedural
Requirements

NPR 8705.4B
Effective Date: November 01, 2024
Expiration Date: October 31, 2032

COMPLIANCE IS MANDATORY FOR NASA EMPLOYEES

Risk Classification for NASA Payloads

Responsible Office: Office of Safety and Mission Assurance

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Preface

P.1 Purpose

a. This directive describes (1) the criteria for Mission Directorates to define the risk tolerance class(es) for NASA missions and instruments, (2) the Agency-level assurance expectations that drive design and analysis, test philosophy, and common assurance practices, and (3) corresponding Safety and Mission Assurance (SMA) planning and implementation elements.

P.2 Applicability

a. This directive is applicable to NASA Headquarters and NASA Centers, including Component Facilities and Technical and Service Support Centers. This directive is applicable to the Jet Propulsion Laboratory (a Federally-Funded Research and Development Center) only to the extent specified in the NASA/Caltech Prime Contract.

b. This directive applies to NASA robotic programs and projects, including those flown on human vehicles, managed in accordance with NASA Procedural Requirements (NPR) 7120.5, NASA Space Flight Program and Project Management Requirements.

c. This directive does not apply to human vehicles, launch systems, and non-spaceflight aeronautical systems (e.g., airplanes), or as a result of foreign collaborations to on-orbit services or non-NASA missions provided to NASA. Applications of this directive to such instances is at the discretion of the responsible NASA Mission Directorate.

d. This directive does not apply to projects managed under NPR 7120.8, NASA Research and Technology Program and Project Management Requirements, or projects otherwise not managed under NPR 7120.5, though these projects may choose to impose the objectives from Appendix D in their project-level documentation.

e. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms “may” denotes a discretionary privilege or permission, “can” denotes statements of possibility or capability, “should” denotes a good practice and is recommended, but not required, “will” denotes expected outcome, and “are/is” denotes descriptive material.

f. In this directive, all document citations are assumed to be the latest version unless otherwise noted. Use of other versions of cited documents may be authorized by the responsible SMA Technical Authority (TA).

g. The requirements enumerated in this document are applicable to all new projects managed in accordance with NPR 7120.5 that are in Formulation Phase as of, or after the effective date of this document (see NPR 7120.5 for project phase definitions).

P.3 Authority

a. NASA Policy Directive (NPD) 8700.1, NASA Policy for Safety and Mission Success.

P.4 Applicable Documents and Forms

a. NPR 7120.5, NASA Space Flight Program and Project Management Requirements.

P.5 Measurement/Verification

Compliance by programs and projects with the requirements contained within this directive is verified as part of selected life-cycle reviews, and by assessments, reviews, and audits. Compliance with the requirements contained within this directive is also monitored by Centers, Mission Directorates, and the SMA TA.

P.6 Cancellation

NPR 8705.4A, Risk Classification for NASA Payloads, dated April 29, 2021.

Chapter 1. Introduction

1.1 Overview

1.1.1 This directive establishes four risk tolerance class(es) and the associated expectations corresponding to the acceptable risk and degree of uncertainty that a Mission Directorate assigns to a program or project.

1.1.2 These four distinct risk tolerance class(es) provide programs or projects with a uniform authoritative source of Agency-level assurance expectations from which managers, technical authorities, engineers, etc., can develop, communicate, and implement appropriate mission assurance and risk management strategies and requirements consistent with corresponding NASA assurance standards.

1.1.3 This directive also identifies programmatic and institutional SMA directives that do not vary by risk tolerance class and are implemented for each program or project.

1.2 Delegation of Responsibilities

1.2.1 Unless specifically prohibited, responsibilities and requirements may be designated. The stated role or actor remains accountable for its implementation and outcome.

1.2.2 Where an office or organization is stated as the actor of a requirement, the Official in Charge of that office or organization is responsible and accountable for the action and its outcome.

1.3 Request for Relief

NPR 8715.3, Requesting Relief from Agency Mission Assurance Requirements, defines the process for requesting and granting relief from requirements within this directive and standards incorporated by reference herein. The Mission Directorate Associate Administrator (MDAA) is the authority when relief is from a requirement in this directive, and the Chief, SMA, is the approving authority.

Chapter 2. Roles and Responsibilities

2.1 Mission Directorate Associate Administrator

2.1.1 As stated in NPD 1000.3, The NASA Organization, the MDAA is responsible for defining, funding, evaluating, advocating, and overseeing the implementation of NASA programs and projects to ensure their outcomes meet schedule and cost constraints as well as performance requirements. As part of this responsibility, the MDAA operating or sponsoring the mission:

a. Establishes and documents the mission and instrument risk class(es) and associated SMA objectives for NASA missions and instruments with support from the Chief, SMA, and the Chief Engineer. The ultimate Mission and Instrument risk classification responsibility, however, resides with the MDAA or delegee.

> *Note: A constellation of spacecraft may be treated as one mission with a single risk classification. When individual elements of NASA missions and instruments have distinct mission objectives, the MDAA may designate different risk tolerance class(es) for the corresponding elements.*

b. Reviews for approval the project's formulation of SMA objectives consistent with the designated risk tolerance class(es) delineated in paragraph 3.2.

c. Ensures that program and project planning documents and corresponding implementation address general safety requirements that do not vary by risk class(es) delineated in paragraph 3.3.1.

2.1.2 As specified in NPR 8000.4, Agency Risk Management Procedural Requirements, programmatic authorities are accountable for risk acceptance decisions for their programs and projects throughout the program and project life cycle. The MDAA, via the NASA program offices, flow risk acceptance authority down to NASA project offices as defined in their program-level documentation.

2.2 NASA Project Manager

2.2.1 The NASA Project Manager is responsible for:

a. Establishing, documenting, and executing the project's SMA Plan specifying assurance plans, standards, methods, processes, and practices that address SMA objectives for the established risk class(es) established by the Mission Directorate and general safety requirements that do not vary by risk class(es) delineated in paragraphs 3.2 and 3.3.1, respectively.

b. Reporting execution status of the project's detailed implementation of assurance standards, methods, processes, and practices to the Mission Directorate, the Office of Safety and Mission Assurance (OSMA), and the Office of the Chief Engineer (OCE) at all Key Decision Points (KDPs), Life-Cycle Reviews (LCRs), and the Safety and Mission Success Review (SMSR).

c. Ensuring that contractor operations and designs are evaluated for consistency and compliance with the safety and health provisions provided in their contractor agreements.

Note: When the responsible Mission Directorate or NASA program office has not established a NASA project office, any responsibilities or requirements levied on the NASA Project Manager in this directive are levied on the NASA Program Manager.

2.3 The Chief, Safety and Mission Assurance

2.3.1 The Chief, SMA, as stated in NPD 1000.3, is responsible for advising the Administrator and other senior officials on matters related to risk, safety, and mission success. As part of this responsibility, the Chief, SMA:

a. Supports Mission Directorates in the development and review of the mission and instrument risk class(es) for NASA missions and instruments.

b. Reviews the project's formulation of SMA objectives consistent with the designated risk tolerance class(es).

c. Supports Mission Directorates in the implementation of SMA directives and requirements provided in this NPR and delineated in paragraph 3.3.1.

d. Exercises general oversight and coordinates Agency-wide implementation of this NPR.

2.4 The Chief Engineer

2.4.1 The Chief Engineer, as stated in NPD 1000.3, is responsible for advising the Administrator and other senior officials on matters related to technical readiness in execution of NASA programs and projects. As part of this responsibility, the Chief Engineer:

a. Supports Mission Directorates in the development and review of risk class(es) for NASA missions and instruments.

b. Reviews the project's formulation of SMA objectives consistent with the designated risk tolerance class(es).

2.5 Project-Level SMA Technical Authority

2.5.1 Project-Level SMA TAs are individuals appointed by the Center SMA Director to exercise the TA role within projects.

Note: When there is no NASA Project Office, the Project-Level SMA is held at a Program Level and are individuals appointed by the Center SMA Director to exercise the TA role within projects.

2.5.2 The Project-Level SMA TA is responsible for assuring that the formulation and implementation of the project's SMA planning documents are technically sound and consistent with established risk class(es), associated SMA objectives, and general safety requirements that do not vary by risk class(es), delineated in paragraphs 3.2 and 3.3.1, respectively.

Chapter 3. Risk Classification Process and SMA Implementation

3.1 NASA Mission and Instrument Risk Classification

3.1.1 The MDAA establishes a set of Mission Directorate requirements reflecting the key objectives of the project for NASA missions and instruments (see NPR 7120.5).

3.1.2 The Mission Directorate designates the mission or instrument risk tolerance class as early in the formulation process as possible but no later than the KDP B Decision Memo.

> *Note: The risk of a particular instrument may be greater than risk of the mission, see note 2.1.1a.*

3.1.3 The risk tolerance class(es), further characterized in Appendix C, are:

3.1.3.1 Class A: The lowest risk tolerance that is driven by technical objectives. This would normally represent a very high priority mission with very high complexity, as described in Appendix C.

3.1.3.2 Class B: Low risk tolerance that is driven more by technical objectives than programmatic constraints. This would normally represent a high priority mission with high complexity, as described in Appendix C.

3.1.3.3 Class C: Moderate risk tolerance that is driven more by technical objectives than programmatic constraints. This would normally represent a medium priority mission with medium complexity, as described in Appendix C.

3.1.3.4 Class D: High risk tolerance that is driven more by programmatic constraints than technical objectives. This would normally represent a lower priority mission with a medium to low complexity, as described in Appendix C.

3.1.4 The MDAA shall designate and document mission and instrument risk tolerance class(es) using the guidance provided in Appendix C, including the justification for the selection, no later than KDP B Decision Memorandum/Selected Mission Statement, considering the guidance in Appendix C.

3.1.4.1 Such missions or instruments still document any SMA objectives in Appendix D imposed on the project by the sponsoring organization (e.g., Request for Proposal, Announcement of Opportunity (AO)) and their approach to satisfy those objectives in an Assurance Implementation Matrix (AIM) and Project Safety and Mission Assurance Plan as defined in paragraph 3.2.2.

3.1.4.2 Such missions or instruments are still subject to the SMA requirements and directives delineated in paragraph 3.3.1.

3.1.5 The MDAA may choose to not designate a mission or instrument risk tolerance class or to designate a mission or instrument at a higher risk tolerance than Class D if the Mission Directorate determines that mission or instrument has a higher risk tolerance than the risk tolerance class(es) described in paragraph 3.1.3.

3.1.5.1 Such missions or instruments still may document any SMA objectives in Appendix D imposed on the project by the sponsoring organization (e.g., Request for Proposal, AO) and their approach to satisfy those objectives in an AIM and Project Safety and Mission Assurance Plan as defined in paragraph 3.2.2.

3.1.5.2 Such missions or instruments are still subject to the SMA requirements and directives delineated in paragraph 3.3.1.

3.1.6 The MDAA, in consultation with the Chief, SMA, and the Chief Engineer, may change the risk classification for NASA missions and instruments in the Formulation Phase (see NPR 7120.5 for project phase definitions).

3.2 Project-Specific Implementation of the Mission or Instrument Risk Classification, SMA Objectives and Requirements

3.2.1 Appendix D identifies reference SMA objectives to be satisfied as a function of the designated risk tolerance class. Projects satisfy the objectives in Appendix D either using standards that have already been accepted by NASA and are identified in Appendix D, or using alternate approaches or standards proposed by the project and determined to be appropriate for the mission, risk tolerance class, and specified application by the Technical Authorities. This approach provides projects with the flexibility to propose tailored and innovative means of meeting the SMA objectives.

3.2.2 As early as possible (no later than System Requirements Review (SRR)/System Design Review (SDR)/Mission Definition Review (MDR)), the NASA Project Manager shall formulate and obtain MDAA approval and Chief, SMA, and Chief Engineer concurrence of SMA objectives consistent with the designated risk tolerance class(es), or anticipated risk tolerance class (es) if formal designation is pending, and reference SMA objectives in Appendix D. The objectives should be documented via an AIM (see Appendix E) appended to the (Preliminary) Project Safety and Mission Assurance Plan (see NPR 7120.5). In lieu of the AIM, the MDAA may invoke a standardized Mission Assurance Requirements document. If the Project Manager wishes not to follow the MDAA-invoked standardized Mission Assurance Requirements document, they must submit an AIM.

> *Note: SPD-39, The Science Mission Directorate (SMD) Standard Mission Assurance Requirements Payload Classification: D, is an example of a standardized Mission Assurance Requirements document.*

3.2.3 No later than SRR/SDR (or other timeframe as tailored per NPR 7120.5, Appendix C), the NASA Project Manager, with concurrence from the Project-Level SMA TA, shall establish, document, and begin implementing the project’s (baseline) SMA Plan:

3.2.3.1 Detailing project-specific assurance plans, standards, methods, processes, and practices consistent with the approved AIM or standardized Mission Assurance Requirements document, as applicable;

3.2.3.2 Detailing project-specific assurance plans, standards, methods, processes, and practices per host Center requirements and consistent with the SMA directives and requirements that do not vary by risk tolerance class(es) delineated in paragraph 3.3.1;

3.2.3.3 Addressing life cycle safety-relevant functions and activities, including but not limited to: procurement, management, design and engineering, design verification and testing, software design, software verification and testing, manufacturing, manufacturing verification and testing, operations, and preflight;

3.2.3.4 Containing data and information to support each section of the SMA Plan, for each major milestone review, including the SMSR and;

3.2.3.5 Containing trending and metrics utilized to display progress and to predict growth towards SMA goals and requirements.

3.2.4 The NASA Project Manager shall obtain Project-level SMA TA and relevant Center Institutional Safety Discipline Leads' concurrence on changes to the SMA Plan. Note: Any requirements called out through documents referenced in paragraph 3.3.1 are also subject to the "Request for Relief" process delineated in paragraph 1.3.

3.2.5 At LCRs, KDPs, and the SMSR, the NASA Project Manager shall report actual and planned departures from the AIM and baseline SMA Plan documents to the Mission Directorate and to OSMA.

3.3 General SMA Requirements

3.3.1 Refer to the following documents for NASA missions and instruments regardless of risk tolerance class:

a. NPR 8621.1, NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping.

b. NPR 8705.6, Safety and Mission Assurance (SMA) Audits, Reviews, and Assessments, Chapter 3. Safety and Mission Success Review (SMSR).

c. NPR 8715.3, Requesting Relief from Agency Mission Assurance Requirements.

d. NPR 8715.5, Range Flight Safety Program.

e. NPR 8715.6, Orbital Debris Mitigation.

f. NPR 8715.7, Payload Safety Program, and NASA-STD-8719.24, Payload Safety Requirements and Annex.

g. NPR 8715.24, Planetary Protection Provisions for Robotic Extraterrestrial Missions.

h. NPR 8715.26, Nuclear Flight Safety.

i. NASA-STD-8739.8, Software Assurance and Software Safety Standard.

j. NPR 8735.1, Exchange of Problem Data Using NASA Advisories and the Government-Industry Data Exchange Program (GIDEP).

3.3.2 Centers and Mission Directorates may develop and update derived policies, standards, and guidelines to expand upon the requirements referenced in the documents and specified sections in paragraph 3.3.1 of this directive for the unique needs of their respective projects. Projects may further be subject to Center-level safety and health requirements.

3.3.3 The Chief, SMA, will consult on the tailoring of requirements in those areas with the Associate Administrator, Administrator, or other authorities as appropriate.

Appendix A. Definitions

Acceptable risk. A level of risk, referring to a specific item, system or activity, that, when evaluated with consideration of its associated uncertainty, satisfies pre-established risk criteria.

Approving authority. The person or organization responsible for oversight of the requirement and authorized to grant relief from the requirement. [source NPR 8715.1, NASA Safety and Health Programs]

Assurance Implementation Matrix. A documented planned implementation consistent with the mission or instrument risk classification(s) and SMA objectives in Class A to Class D.

Breadboard. A low-fidelity unit that demonstrates function only, without respect to form or fit. It often uses commercial and/or ad hoc components and is not intended to provide definitive information regarding operational performance.

Concurrence. A documented agreement by a management official that a proposed course of action is acceptable.

Critical item. A critical item is one which, if defective or fails, causes a catastrophic event affecting the public, NASA workforce, high-value assets, or mission success. Reliability considerations apply to determination of criticality for cases where loss of multiple units of the item in question is required for the catastrophic event to be realized, and the units are of the same design and build lot and have a common failure mode relevant to the critical function (e.g., fasteners, capacitors).

Critical process. A critical process is an activity performed by NASA, suppliers, or NASA services suppliers during mission development, launch preparations, launch, commissioning, operations, and decommissioning that if defective or fails to achieve the intended results directly contributes to or causes a catastrophic event affecting the public, NASA workforce, high-value assets, or mission success.

Decision memorandum. The document that summarizes the decisions made at KDPs or, as necessary, in between KDPs. The decision memorandum includes the Agency Baseline Commitment (if applicable), Management Agreement cost and schedule, unallocated future expenses, and schedule margin managed above the project, as well as life-cycle cost and schedule estimates, as required.

Deviation. A documented authorization releasing a program or project from meeting a requirement before the requirement is put under configuration control at the level the requirement will be implemented.

Engineering unit. A high fidelity unit that demonstrates critical aspects of the engineering processes involved in the development of the operational unit. Engineering test units are intended to closely resemble the final product (hardware/software) to the maximum extent possible and are built and tested so as to establish confidence that the design will function in the expected environments. In some cases, the engineering unit can become the final product, assuming proper traceability has been exercised over the components and hardware handling.

Fault. An undesired system state and/or the immediate cause of failure (e.g., maladjustment, misalignment, defect, or other). The definition of the term "fault" envelopes the word "failure," since faults include other undesired events such as software anomalies and operational anomalies.

Fault tolerance. The built-in ability of a system to provide continued correct operation in the presence of a specified number of faults or failures.

Flight Acceptance. Flight hardware or software that is tested to the levels that demonstrate the desired qualification level margins. Sometimes this means testing to failure. This unit is never used operationally.

Flight unit. The actual end item that is intended for deployment and operations. It is subjected to formal functional and acceptance testing.

Flight spare. The spare end item for flight. It is subjected to formal acceptance testing. It is identical to the flight unit.

Graceful degradation. Ability of a systems or component to work to maintain limited functionality even when a large portion of it has been destroyed or rendered inoperative. The purpose of graceful degradation is to prevent catastrophic failure.

Launch constraint. Bounding conditions limiting or restricting aspects of launch related operations.

Life-cycle cost. The total of the direct, indirect, recurring, nonrecurring, and other related expenses both incurred and estimated to be incurred in the design, development, verification, production, deployment, prime mission operation, maintenance, support, and disposal of a project, including closeout, but not extended operations. The Life-Cycle Cost (LCC) of a project or system can also be defined as the total cost of ownership over the project or system's planned life cycle from Formulation (excluding Pre-Phase A) through Implementation (excluding extended operations). The LCC includes the cost of the launch vehicle.

Mission. A major activity required to accomplish an Agency goal or to effectively pursue a scientific, technological, or engineering opportunity directly related to an Agency goal. Mission needs are independent of any particular system or technological solution.

Protoflight. Cases when a qualification unit is not developed (due to cost or schedule constraints). The protoflight unit is intended for flight or deployment and operations. A limited set of qualification and tests are performed on the prototype to preserve its ability to function and life expectancy. Full acceptance testing is performed.

Project plan. The document that establishes the project's baseline for Implementation, signed by the responsible program manager, Center Director, project manager, and the MDAA, if required.

Proof of concept. Analytical and experimental demonstration of hardware/software concepts that may or may not be incorporated into subsequent development and/or operational units.

Risk. The potential for shortfalls with respect to achieving explicitly established and stated objectives. As applied to programs and projects, these objectives are translated into performance requirements, which may be related to mission execution domains (safety, mission success, cost, and schedule) or institutional support for mission execution. Risk is operationally characterized as a set of triplets:

The scenario(s) leading to degraded performance with respect to one or more performance measures (e.g., scenarios leading to injury, fatality, destruction of key assets; scenarios leading to exceedance of mass limits; scenarios leading to cost overruns; scenarios leading to schedule slippage).

The likelihood(s) (qualitative or quantitative) of those scenarios.

The consequence(s) (qualitative or quantitative severity of the performance degradation) that would result if those scenarios were to occur.

Uncertainties are included in the evaluation of likelihoods and identification of scenarios.

Risk appetite. Amount and type of risk that an organization is willing to pursue or retain.

Risk classification. A stakeholder's declaration of tolerance for risk based on factors such as priority, national significance, technological challenge, and resources available, used to recommend a set of activities and level of scrutiny for maintaining the level of risk.

Risk tolerance. The acceptable level of variance in performance relative to the achievement of objectives. It is generally established at the program, objective, or component level. In setting risk tolerance levels, management considers the relative importance of the related objectives and aligns risk tolerance with risk appetite.

Single point failure. An independent element of a system (hardware, software, or human), the failure of which would result in loss of mission objectives, hardware, or crew as defined for the specific application or project.

Submitting Authority. The person or organization seeking relief from a requirement. [source NPR 8715.1]

Tailoring. The process used to adjust or seek relief from a prescribed requirement to accommodate the needs of a specific task or activity (e.g., program or project).

Waiver. A written authorization to depart from a specific directive requirement.

Appendix B. Acronyms

AOA	Analysis of Alternatives
AO	Announcement of Opportunity
EEE	Electronics, Electrical, and Electromechanical
FMEA	Failure Modes and Effects Analysis
FRB	Failure Review Board
IV&V	Independent Verification and Validation
KDP	Key Decision Point
LCC	Life-Cycle Costs
LCR	Life-Cycle Review
MAR	Mission Assurance Requirements
MDAA	Mission Directorate Associate Administrator
MDR	Mission Definition Review
MMOD	Micrometeoroids and Orbital Debris
M&P	Materials and Processes
NASA-STD	NASA Standard
NEPP	NASA Electronic Parts and Packaging
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NSPM	National Security Presidential Memorandum
OSMA	Office of Safety and Mission Assurance
QA	Quality Assurance
QMS	Quality Management System
PRA	Probabilistic Risk Assessment
R&M	Reliability and Maintainability
SCD	Source Control Drawing
SDR	System Design Review
SMA	Safety and Mission Assurance
SMD	Science Mission Directorate
SMSR	Safety and Mission Success Review
SNS	Space Nuclear System

SPF	Single Point Failure
SRR	System Design Review
TA	Technical Authority

Appendix C. Risk Classification Considerations for Class A – Class D NASA Missions and Instruments

C.1 This appendix provides considerations for designating a mission or instrument risk tolerance class. These considerations constitute a structured approach for identifying a hierarchy of risk tolerances commensurate with the four risk tolerance class(es) defined in Chapter 3.

C.2 The considerations provided are to be treated holistically with each taken into account to most appropriately designate a mission or instrument risk tolerance class based on the applicable mission criteria. The considerations provided in the table below are not definitive, nor is any specific mission criterion alone intended to be the ultimate driver to designating a mission or instrument risk tolerance class. For example, a mission with a 10-year mission lifetime could potentially be characterized as a Class C mission given that other mission consideration factors fall more in line with a Class C mission. As another example, a mission with a 2-month mission lifetime could potentially be characterized as a Class A mission given that other mission consideration factors fall more in line with a Class A mission considerations. Ultimately, the mission or instrument risk tolerance class is designated by the Mission Directorate in accordance with paragraph 3.1.3.

C.3 Other considerations for designating a mission or instrument risk tolerance class may exist that are not explicitly expressed in this appendix (e.g., alternate research or reflight opportunities, launch constraints).Table C-1 Mission and Instrument Risk Classification Considerations

Table C-1 Mission and Instrument Risk Classification Considerations

Priority (Relevance to Agency Strategic Plan, National Significance, Significance to the Agency and Strategic Partners)	Very High: High: Medium: Low:	Class A Class B Class C Class D
Primary Mission Lifetime	Long, > 5 Years: Medium, 5 Years > – > 3 Years: Short, 3 Years > – > 1Years: Brief, < 1 Year:	Class A Class B Class C Class D
Complexity and Challenges (Interfaces, International Partnerships, Uniqueness of Instruments, Mission Profile, Technologies, Ability to Reservice, Sensitivity to Process Variations)	Very High: High: Medium: Medium to Low:	Class A Class B Class C Class D

Life-Cycle Cost	High: Medium to High: Medium: Medium to Low:	Class A Class B Class C Class D

Appendix D. Program and Project SMA Objectives for Class A – Class D

D.1 Appendix D provides program and project SMA objectives that:

D.1.1 Vary according to risk tolerance class over a continuum of design and management controls, systems engineering processes, mission assurance requirements, and risk management processes to be satisfied in project-specific mission assurance implementation and;

D.1.2 Do not vary according to risk tolerance class and requires that MDAAs, Program and Project, pursue the “request for relief” process associated with the originating directive (that which includes the pertinent “shall” statement), delineated in paragraph 1.3, to potentially grant any deviations and/waivers to prescribed referenced standards (i.e., Payload and Range Safety, Nuclear Flight Safety, Orbital Debris Mitigation, and Planetary Protection).

D.2 The expectation is that individual projects may mix and match components from different mission or instrument risk tolerance class(es) to meet the intent of the mission’s overall classification and avoid being more or less conservative than the overall risk tolerance class and mission requirements dictate.

Table D-1 Objectives and Risk Class Expectations

<table>
<tr><th>SMA Area</th><th>CLASS A</th><th>CLASS B</th><th>CLASS C</th><th>CLASS D</th></tr>
<tr><td rowspan="2">SMnge Safety</td><td colspan="4">Objectives:
(1) Protect people and assets (e.g., payload, range) from hazards associated with payloads that will fly on uncrewed launch vehicles;
Accepted Standard:
NPR-8715.5;
NPR-8715.7;
NASA-STD-8719.24.
Note: Any deviations/waivers to above standards subject to request for relief process referenced in paragraph 1.3.</td></tr>
<tr><td>Expected Results:
Safeguard people and assets from hazards that will fly on uncrewed launch vehicles.
Provide ongoing insight and status during subsequent LCRs by addressing corresponding risks</td><td>Expected Results:
Same as Class A</td><td>Expected Results:
Same as Class A</td><td>Expected Results:
Same as Class A</td></tr>
</table>

	and associated risk mitigation and contingency plans, as applicable, commensurate with the lowest level of risk tolerance.			
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Reliability, Maintainability, and Fault Tolerance (including SPFs)	**Objectives:** (1) Establish the reliability, maintenance, maintainability, and fault tolerance approach(es) (e.g., single-string, Do No Harm, graceful degradation, active / passive block redundancy, functional redundancy, preventative maintenance, condition-based maintenance, fault avoidance, fault tolerance, fault management) to address mission success performance and safety requirements over the mission lifetime; and (2) Identify corresponding Reliability and Maintainability (R&M) methods (e.g., FMEA, Fault Tree Analysis, Critical Items List, Critical Item Control Plan) in NASA-STD-8729.1, NASA Reliability and Maintainability (R&M) Standard for Spaceflight and Support Systems and/or alternative standards being used to capture, analyze, mitigate, or control faults and failures, including Single Point Failures (SPFs), in the Assurance Implementation Matrix (See Appendix E) and/or SMA plans; and (3) Provide ongoing insight and status during subsequent LCRs by addressing corresponding risks and associated risk mitigation and contingency plans, as applicable, commensurate with the mission type and mission or instrument risk tolerance class(es). **Accepted Standard:** NASA-STD-8729.1; NPR 7123.1, NASA Systems Engineering Processes and Requirements, Appendix G.			
	Expected Results: Fault tolerance and graceful degradation designed and implemented addressing all critical items or processes whose failure would result in failure to meet mission objectives, injury to personnel, or collateral	**Expected Results:** Fault tolerance and graceful degradation designed and implemented addressing mission success criteria and critical risks where failure would result in injury to personnel or collateral damage.	**Expected Results:** Fault tolerance and graceful degradation designed and implemented addressing, at the discretion of the Program and Project, mission success criteria. Fault tolerance	**Expected Results:** Fault tolerance and graceful degradation designed and implemented for critical risks where failure would result in injury to personnel or collateral damage.

	or collateral damage. Establish R&M requirements and associated analysis and verification methods for all applicable R&M objectives. Formally document assumptions and rationale for any objectives in NASA-STD-8729.1 not being addressed.	Establish R&M requirements and associated analysis and verification methods for all applicable R&M objectives. Formally document assumptions and rationale for any objectives in NASA-STD-8729.1 not being addressed	Fault tolerance and graceful degradation designed and implemented addressing critical risks where failure would result in injury to personnel or collateral damage. Address selected R&M objectives (i.e., requirements and associated analysis and verification methods) for critical items or processes whose failure would result in failure to meet mission objectives. Address R&M objectives (i.e., requirements and associated analysis and verification methods for critical items or processes where failure would result in injury to personnel or collateral damage.)	damage. Address R&M objectives for critical items or processes whose failure would result in injury to personnel or collateral damage.
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Environmental Test Program Verification and Validation	**Objectives:** Establish a qualification, flight acceptance, and protoflight test program to verify and validate performance in an operational, simulated operational, or relevant space environment. Include an approach to utilizing breadboards, proof of concept models, engineering units, qualifications units, flight unit, and flight spare units.			

	Accepted Standard: Refer to Center and/or Development organization Standards and/or Best Practices.			
	Expected Results: Safeguard people and assets from hazards that will fly on uncrewed launch vehicles. Provide ongoing insight and status during subsequent LCRs by addressing corresponding risks and associated risk mitigation and contingency plans, as applicable, commensurate with the lowest level of risk tolerance.	**Expected Results:** Complete system verification and validation testing. Qualification and flight acceptance test program for development and flight units. Flight spare units are flight acceptance tested if designated for flight. Protoflight test program for primary and secondary structures is acceptable. End-to-end testing of critical functions using flight software wherever possible; otherwise, use of qualified software simulators.	**Expected Results:** Complete system verification and validation testing. Mixed qualification, flight acceptance, and protoflight test programs for development and flight units. Flight spare units are flight acceptance or protoflight tested if designated for flight. Protoflight test program for primary and secondary structures is acceptable. End-to-end testing of critical functions using flight software wherever possible; otherwise, use of qualified software simulators.	**Expected Results:** Mixed qualification, flight acceptance, and protoflight test programs for development and flight units. Flight spare units are flight acceptance or protoflight tested if designated for flight. Testing at higher levels of assembly is acceptable. Protoflight test program for primary and secondary structures is acceptable. Testing at higher levels of assembly including system level is acceptable. End-to-end testing of critical functions using flight software wherever possible; otherwise, use of qualified software simulators.
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**

Electronics, Electrical, and Electromechanical (EEE) Parts	**Objectives:** Select EEE parts at an appropriate level for functions tied directly to mission success commensurate with safety, performance, and environmental requirements. **Accepted Standard:** NASA-STD-8739.10, Electrical, Electronic, and Electromechanical (EEE) Parts Assurance Standard or OSMA endorsed NASA Electronic Parts and Packaging (NEPP) interim standards.			
	Expected Results: Assurance Level 1 parts, equivalent Source Control Drawings (SCD), requirements per Center Parts Management Plan, or documented proven developer practices that have demonstrated results, consistent with the lowest level of risk tolerance, to achieve necessary performance.	**Expected Results:** Assurance Level 2 parts, equivalent SCD, requirements per Center Parts Management Plan, or documented proven developer practices that have demonstrated results, consistent with a low level of risk tolerance, to achieve necessary performance.	**Expected Results:** Assurance Level 3 parts, equivalent SCD, requirements per Center Parts Management Plan, or documented proven developer practices that have demonstrated results, consistent with a moderate level of risk tolerance, to achieve necessary performance.	**Expected Results:** Assurance Level 4 parts.
	EEE Parts Notes: The intent is always to select the most appropriate assurance level parts to meet mission needs and requirements. There is nothing to disallow or discourage the use of parts aligned with higher classification levels "as-is," when available, with no additional testing. However, it is highly discouraged to require higher assurance level parts be used or to require parts screening and/or qualification to achieve compliance above the current recommended assurance level (across of the board).			
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Materials	**Objectives:** Prepare and implement Materials and Processes (M&P) Selection, Control, and Implementation Plan. Implement an M&P Control Board process or similar developer process that defines the planning management, and coordination of the selection, application, procurement, nondestructive evaluation, control, and standardization of M&P and for directing the disposition of M&P problem resolutions. **Accepted Standard:** NASA-STD-6016, Standard Materials and Processes Requirements for Spacecraft			

	Expected Results: Requirements are applicable based on critical items and processes whose failure would result in failure to meet mission objectives, injury to personnel, or collateral damage. Materials assessed for application and life limits.	**Expected Results:** Requirements are applicable based on critical items and processes whose failure would result in failure to meet mission objectives, injury to personnel, or collateral damage. Materials assessed for application and life limits.	**Expected Results:** Requirements are applicable based on critical items and processes whose failure would result in failure to meet mission objectives, injury to personnel, or collateral damage. Materials assessed for application and life limits.	**Expected Results:** Requirements are applicable based on critical items or processes whose failure would result in injury to personnel or collateral damage.
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Telemetry Coverage for Critical Events	**Objectives:** Monitor and downlink to ground station or relay spacecraft or record telemetry coverage during critical events where failure would result in failure to meet mission objectives. Critical events in the operation of a spacecraft are those which, if not executed successfully (or recovered from quickly in the event of a problem), can lead to loss or significant degradation of mission. Included in critical event planning are timelines allowing for problem identification, generation of recovery commands, and up linking in a timely manner to minimize risk to the in-space assets. Examples include separation from a launch vehicle, critical propulsion events, deployment of appendages necessary for communication or power generation, stabilization into a controlled power positive attitude, and entry-descent and landing sequences. **Accepted Standard:** Refer to Center and/or Development organization Standards and/or Best Practices.			
	Expected Results: Monitor and downlink to ground station and record spacecraft telemetry coverage during all events where failure would result in failure to meet mission objectives to assure data is available from the	**Expected Results:** Monitor and downlink to ground station and record spacecraft telemetry coverage during all events where failure would result in failure to meet mission objectives to assure data is available from the	**Expected Results:** Record telemetry coverage during all events where failure would result in failure to meet mission objectives to assure data are available for critical anomaly investigations to	**Expected Results:** Record telemetry coverage during all events where failure would result in failure to meet mission objectives to assure data are available for critical anomaly investigations to

	available from the flight system to support mission operations and anomaly investigations to prevent future recurrence.	available from the flight system to support mission operations and anomaly investigations to prevent future recurrence.	investigations to prevent future recurrence.	investigations to prevent future recurrence.
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Quality Assurance and Quality Engineering	**Objectives:** Plan, document, and implement the quality assurance (QA) plans and quality engineering functions described in NPR 8735.2, Hardware Quality Assurance Program Requirements for Programs and Projects, including how the critical design, construction, and verification specifications are captured and conveyed to project SMA teams, system developers, and hardware suppliers; how quality data will be managed; supplier risk management; quality management system (QMS) elements and elements of production readiness; product and process QA and product acceptance; and how risks due to nonconformance will be managed. **Accepted Standard:** NPR 8735.2.			
	Expected Results: Broadly apply quality controls and QA processes throughout the hardware development life cycle in a manner that defines conformance criteria for all levels of hardware and processes and that produces a continuous record of conformance and traceability to technical specifications and requirements. Require established design and construction technical standards and QMS standards to minimize supply	**Expected Results:** Apply quality controls and QA processes to systems identified as strongly tied to mission success objectives throughout the hardware development life cycle in a manner that defines conformance criteria and that produces a continuous record of conformance and traceability to technical specifications and requirements. Require established design and construction technical standards	**Expected Results:** Apply quality controls and QA processes to systems identified as strongly tied to mission success objectives throughout the hardware development life cycle. Require established design and construction technical standards and QMS standards to minimize supply chain risk and demonstrate adequate production readiness, both for in-house and	**Expected Results:** Apply quality controls and QA processes to systems identified as tied to safety objectives throughout the hardware development life cycle. Compare established design and construction technical standards and QMS standards to suppliers' standards to identify supplier quality risks. Use focused audits and production or test readiness reviews to

	to minimize supply chain risk and demonstrate adequate production readiness, both for in-house and external supplier hardware production and launch and mission operations functions. Determine supplier risk using requirement implementation plans and physical audits. Apply design review processes that include evaluations of manufacturability and manufacturing process stability. Use results of oversight as well as insight supplier quality surveillance methods as evidence of compliance for both processes and products. Acquire and use quality data and other quality deliverables to track QA rigor and risks across the entire mission life cycle. Use review boards and corrective action processes to	technical standards and QMS standards to minimize supply chain risk and demonstrate adequate production readiness, both for in-house and external supplier hardware production and launch and mission operations functions. To determine supplier risk, require prime developer implementation plans and perform physical audits of key or higher risk suppliers. Address manufacturability risks for unique or custom constructions. Apply oversight as well as insight supplier quality surveillance methods for key or high risk processes and products. Acquire and use quality data and other quality deliverables to track QA rigor and risks across the entire mission life cycle. Use review boards and corrective action processes to	for in-house and external supplier hardware production and launch and mission operations functions. Leverage from industry standards for design, construction, and verification specifications for custom or unique constructions and processes. Perform assessments of key suppliers and physical audits of higher risk suppliers. Use insight methods for supplier quality surveillance. Acquire and use quality data and other quality deliverables to track QA rigor and risks across the entire mission life cycle. Use review boards to resolve nonconformances. Build and use product acceptance data packages that record conformance of the product to its key technical	reviews to identify and mitigate production risks. Use insight methods for supplier quality surveillance. Acquire and use quality data and other quality deliverables to track QA rigor and risks across the entire mission life cycle. Use review boards to resolve nonconformances. Build and use product acceptance data packages that record conformance of the product to its key technical specifications.

	action processes to resolve nonconformances. Build and use product acceptance data packages that demonstrate requirements compliance and that substantiate flight readiness.	action processes to resolve nonconformances. Build and use product acceptance data packages that demonstrate requirements compliance and that substantiate flight readiness.	key technical specifications.	
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Software Assurance and Software Safety (including IV&V)	**Objectives:** Requirements tailoring by Software Classes is provided in NPR 7150.2, NASA Software Engineering Requirements, and Software Assurance tailoring provided by Software Class is provided in NASA-STD-8739.8, Software Assurance and Software Safety Standard. **Accepted Standard:** NPR 7150.2; NASA-STD-8739.8.			
	Expected Results: Flight software is designated as "Software Class B" (see NPR 7150.2). NASA Software Independent Verification and Validation (IV&V) is performed on Category 1 projects, Category 2 projects (see NPR 7120.5).	**Expected Results:** Flight software is designated as "Software Class B" (see NPR 7150.2). NASA Software IV&V is performed on Category 1 projects, Category 2 projects (see NPR 7120.5).	**Expected Results:** Flight software is designated as "Software Class B" (see NPR 7150.2). NASA Software IV&V is performed on projects selected by the MDAA	**Expected Results:** Flight software is designated as "Software Class C" (see NPR 7150.2). NASA Software IV&V is performed on projects selected by the MDAA.
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Risk Informed Decision Making (RIDM) and Continuous Risk Management (CRM) Processes	**Objectives:** Plan, implement, and document a graded approach to Risk Management implementing Risk Informed Decision Making (RIDM) and Continuous Risk Management (CRM) processes as detailed in NPR 8000.4 and NASA/SP-2011-3422, NASA Risk Management Handbook. Support risk-informed selection of project and activity solutions and designs by developing, comparing, documenting, and communicating to organizational decision-makers the risk profiles of available alternatives and corresponding			

performance measures.

Proactively identify risks using well-structured statements, risk scenarios, decisions (i.e., accept, watch, research, mitigate, elevate, and close risks) based on risk ranking, rationale behind all recommendations to management, and controls. Conduct Analysis of Alternatives (AoA) to develop risk mitigation strategies. Make reassessments of the risk response strategies on a continuous basis.

Tracking of individual risks, leading indicators, and performance measures on a continuous basis. Tracking concentrates on realization and operational stages of the life cycle.

Communicate results, decisions, and associated rationale to programmatic chains of command. Make recommendations on reformulation and reallocation of objectives, requirements, and risk tolerances.

Accepted Standard:
NPR 8000.4.

Expected Results: Apply comprehensive scope and rigor across programmatic, engineering, institutional, partnership, and enterprise domains, addressing mission technical, cost, schedule, safety, and security performance. RIDM built upon identification and consideration of mission objectives and sub-objectives, as appropriate to identify all relevant dimensions of performance. Risk and uncertainty profiles of corresponding performance measures for safety, technical,	**Expected Results:** Apply comprehensive scope and rigor across programmatic, engineering, institutional, partnership, and enterprise domains, addressing mission technical, cost, schedule, safety, and security performance. RIDM built upon identification and consideration of mission objectives and sub-objectives, as appropriate to identify all relevant dimensions of performance. Risk and uncertainty profiles of corresponding performance measures for safety, technical,	**Expected Results:** Apply comprehensive scope and rigor across programmatic, engineering, institutional, partnership, and enterprise domains, addressing mission technical, cost, schedule, safety, and security performance. RIDM built upon identification and consideration of principal mission objectives, as appropriate to identify the critical dimensions of performance. Risk and uncertainty	**Expected Results:** Apply limited scope and rigor across programmatic, engineering, institutional, partnership, and enterprise domains, focused on critical areas where failure would result in injru to personnel or collateral damage. RIDM emphasis is on key safety objectives to "Do No Harm" to systems or missions across the payload interfaces. Safety risk profiles developed via qualitative risk analysis and AoA. Informal deliberation

	safety, technical, cost, schedule, and security execution domains developed via comprehensive risk analysis and AoA. Formal deliberation criteria and process defined, applied, and documented to support key decisions.	safety, technical, cost, schedule, and security execution domains developed via comprehensive risk analysis and AoA. Formal deliberation criteria and process defined, applied, and documented to support key decisions.	uncertainty profiles of corresponding performance measures for safety, technical, cost, schedule, and security execution domains developed via comprehensive risk analysis and AoA. Formal deliberation criteria and process defined, applied, and documented to support key decisions.	deliberation criteria and process defined, applied, and documented to support key decisions.
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Nuclear Flight Safety	**Objectives:** Objectives: To ensure a rigorous, risk-informed safety analysis and launch authorization process in accordance with National Security Presidential Memorandum-20 (NSPM-20), and to address NASA's responsibilities under the authorities of other agencies, when NASA's use of Space Nuclear System (SNS) or other radioactive material has the potential (risk) to affect Earth's biosphere under both normal and off-normal conditions during any or all phases of flight. **Accepted Standard:** NPR 8715.26, Nuclear Flight Safety. *Note: Any deviations/waivers to above standards subject to request for relief process referenced in paragraph 1.3.*			
	Expected Results: Categorize missions relative to their nuclear materials to assist in establishing an appropriate risk posture (and comply with Federal policies). Perform nuclear safety analysis	**Expected Results:** Same as Class A	**Expected Results:** Same as Class A	**Expected Results:** Same as Class A

	safety analysis (when applicable) to establish levels of protection (and comply with Federal policies). Perform nuclear safety reviews (when applicable) to confirm levels of protection and (and comply with Federal policies). Obtain launch or reentry authorization (when applicable) to ensure buyoff at the appropriate level (and comply with Federal policies). Conduct radiological contingency planning and coordination activities (when applicable) to further ensure public protection in light of uncertainties (and comply with Federal policies).			
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Orbital DebrisMitigation	**Objectives:** Preserve the near-Earth space environment and mitigate the risk to human life and space missions in accordance with the National Space Policy and the U.S. Government Orbital Debris Mitigation Standard Practices. Orbital debris mitigation measures address the potential for orbital debris generation and post-mission disposal, including (a) debris released during normal operations; (b) debris generated by explosions and intentional break-ups; (c) debris generated by on-orbit collisions; (d) disposal of space structures after mission			

	completion; and (e) structural components impacting the Earth following postmission atmospheric entry. **Accepted Standard:** NPR 8715.6; NASA-STD-8719.14, Process for Limiting Orbital Debris. *Note: Any deviations/waivers to above standards subject to request for relief process referenced in paragraph 1.3.*			
	Expected Results: MMOD mitigation measures are planned and implemented consistent with NASA standards or alternate orbital debris standards accepted by the governmental entity providing authorization and supervision of the activities. Implementations are independently reviewed by NASA or other authorities when spaceflight activities are not conducted under NASA's authority	**Expected Results:** Same as Class A	**Expected Results:** Same as Class A	**Expected Results:** Same as Class A
SMA Area	**CLASS A**	**CLASS B**	**CLASS C**	**CLASS D**
Planetary Protection	**Objectives:** Protect and enable current and future scientific investigations by limiting biological and relevant molecular contamination of solar system bodies through exploration activities and protecting the Earth's biosphere by avoiding harmful biological contamination carried on return spacecraft. Forward protection measures address organic and biological material inventories, bioburden management, avoidance of inadvertent impact, preventing the introduction of viable terrestrial organisms during operations, and spacecraft disposal. Backward protection measures address breaking the chain of contact with and containing materials returned from certain target bodies. Accepted Standard:			

	NPR 8715.24; NID 8715.129, Biological Planetary Protection for Human Missions to Mars; NASA-STD-8719.27, Implementing Planetary Protection Requirements for Space Flight. *Note: Any deviations/waivers to above standards subject to request for relief process referenced in paragraph 1.3.*			
	Expected Results: Planetary protection measures are planned and implemented in accordance with accepted standards for the relevant planetary protection mission category. Implementations are independently reviewed by NASA or other authorities when spaceflight activities are not conducted under NASA's authority.	**Expected Results:** Same as Class A	**Expected Results:** Same as Class A	**Expected Results:** Same as Class A

Appendix E. Assurance Implementation Matrix (AIM)

E.1 This Assurance Implementation Matrix is used by projects to:

a. Facilitate early discussions between the MDAA, Program/Project, and the TAs to reach agreement upfront around high-level SMA objectives, expected results, and corresponding approaches to meet those objectives commensurate with the established risk class(es).

b. Document their planned implementation consistent with the established risk class(es) and SMA objectives in Appendix D to inform more detailed SMA planning and implementation.

E.2 Mission Directorates may choose to invoke a MAR document on a program or project that serves as the baseline set of mission assurance requirements. If the OSMA has concurred with the Mission Directorate's determination to invoke their MAR on a program or project, programs or projects achieve compliance with the invoked Mission Directorate MAR (e.g., SPD-39) in lieu of establishing an Assurance Implementation Matrix.

E.3 Instructions for completing each column of the AIM are as follows:

a. NPR 8705.4, Risk Tolerance Class Objectives and Approved Standards: Include the objectives and accepted standards provided in Appendix D corresponding with the risk tolerance class designated to associated mission or instrument.

b. Objective Satisfied (Y/N): Provide a "Yes" or "No" answer to whether the project plans to satisfy the corresponding objective provided.

c. Project Implementation: Document the project-specific implementation to satisfy the corresponding objective provided, including any approaches provided in the associated NASA-accepted standard(s).

d. Alternate Approaches and Standards: Include details for any alternate approaches or standards proposed and the related project-specific implementation to satisfy the corresponding objective provided.

Table E-1 Assurance Implementation Matrix

Topic in Appendix D of NPR 8705.4	NPR 8705.4 Risk Tolerance Class Objectives and Approved Standards	Objective Satisfied (Y/N)	Project Implementation	Alternate Approaches and Standards
Range and Payload Safety				

Reliability, Maintainability, and Fault Tolerance (including SPFs)				
Environmental Test Program Verification and Validation				
Electronics, Electrical, and Electromechanical (EEE) Parts				
Materials				
Telemetry Coverage for Critical Events				
Quality Assurance and Quality Engineering				
Software (including IV&V)				
Risk Informed Decision Making (RIDM) and Continuous Risk Management (CRM) Processes				
Nuclear Flight Safety				
Orbital Debris Mitigation				
Planetary Protection				

Appendix F. References

a. NID 8715.129, Biological Planetary Protection for Human Missions to Mars.

b. NPD 1000.3, The NASA Organization.

c. NPR 7120.8, NASA Research and Technology Program and Project Management Requirements.

d. NPR 7123.1, NASA Systems Engineering Processes and Requirements.

e. NPR 7150.2, NASA Software Engineering Requirements.

f. NPR 8000.4, Agency Risk Management Procedural Requirements.

g. NPR 8621.1, NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping.

h. NPR 8705.6, Safety and Mission Assurance (SMA) Audits, Reviews, and Assessments.

i. NPR 8715.1, NASA Safety and Health Programs.

j. NPR 8715.3, Requesting Relief from Agency Mission Assurance Requirements.

k. NPR 8715.5, Range Flight Safety Program.

l. NPR 8715.6, Orbital Debris Mitigation.

m. NPR 8715.7, Payload Safety Program.

n. NPR 8715.24, Planetary Protection Provisions for Robotic Extraterrestrial Missions.

o. NPR 8715.26, Nuclear Flight Safety.

p. NPR 8735.1, Exchange of Problem Data Using NASA Advisories and the Government-Industry Data Exchange Program (GIDEP).

q. NPR 8735.2, Hardware Quality Assurance Program Requirements for Programs and Projects.

r. NASA/SP-2011-3422, NASA Risk Management Handbook.

s. NASA-STD-6016, Standard Materials and Processes Requirements for Spacecraft.

t. NASA-STD-8719.14, Process for Limiting Orbital Debris.

u. NASA-STD-8719.24, Payload Safety Requirements.

v. NASA-STD-8719.24 Annex, Annex To NASA-STD-8719.24 Nasa Payload Safety Requirements: Requirements Table.

w. NASA-STD-8719.27, Implementing Planetary Protection Requirements for Space Flight.

x. NASA-STD-8729.1, NASA Reliability and Maintainability (R&M) Standard for Spaceflight and Support Systems.

y. NASA-STD-8739.8, Software Assurance and Software Safety Standard.

z. NASA-STD-8739.10, Electrical, Electronic, and Electromechanical (EEE) Parts Assurance Standard.

aa. NSPM-20, National Security Presidential Memorandum–20

SPD-39, SMD Standard Mission Assurance Requirements For Payload Classification: