

MPR 7123.1
REVISION C-2
EFFECTIVE DATE: May 18, 2015
EXPIRATION DATE: May 18, 2025

MARSHALL PROCEDURAL REQUIREMENTS

DA01

MSFC SYSTEMS ENGINEERING PROCESSES AND REQUIREMENTS *With Change 2 (11/8/17)*

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DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Change/ Revalidation/ Canceled)	Document Revision/ Change	Effective Date	Description
Baseline		7/10/2009	
Revision	A	12/16/2009	Paragraphs 2.3.5, 3.2.5, 3.2.6, and 3.2.7 were added to be compliant with AS9100 requirements and allow this MPR to replace MPR 8060.1, "Flight Systems Design / Development Control." In addition, the wording of paragraphs 3.2, A.4.4, C.2.4, and C.3.5 were changed to implement compliance with AS9100 requirements.
Change	1	8/25/2011	On 8/25/11, at the request of OPRD, administrative changes were made at P.1 a. to clarify, at P.1.b. to move to 3. Procedures, at P.2 Applicability to update to latest standard statement and move un-related text to 3. Procedures, at P.3 Authority to move NPR 7150.2 to P.4 Applicable Documents, at P.4 Applicable Documents to delete cancelled NPD 2820.1 and replace with NPD 7120.4, at P.5 References to move content to Appendix E to comply with MWI 1410.1, at 1.1 to clarify definition, and throughout to remove SE acronym. Formatting corrections made to comply with MWI 1410.1.
Revision	B	12/12/2012	Major revision to incorporate 17 Systems Engineering processes. Appendix E and F were added to reflect entrance/exit criteria. Reformatted to comply with new required template per MPR 1410.2J & as instructed in MWI 1410.1F.
Revision	C	5/18/2015	Revision to incorporate changes to NPR 7123.1, MPR 7120.1, streamline process requirements, and update Appendix E to incorporate MSFC specific Life-Cycle and Technical Review Tables.
Change	1	3/21/2016	On 3/21/16, at the request of the OPRD, administrative changes were made to replace all references to MPR 7150.1 with NPR 7150.2 in coordination with cancellation of MPR 7150.1. There were changes to Appendix E in reference to typos; replaced SRD/SW-STP with STD/SW-STP; STD/MA-PS with STD/MA-IMS1 and STD/MA-IMS2 and STD/SW-SAP with STD/QE-SAP.
Change	2	11/8/2017	On 11/8/17, at the request of the OPRD, administrative changes were made to remove all references to STD/MA-IMS1 and STD/MA-IMS2, replacing those references to STD/MA-IMS; since these two documents have been consolidated into a single document. References to STD/OP-DRM were removed, as that document has been cancelled. Other clean-up consists of removal of extra spaces and lines as well as removing some capitalization of items for consistency throughout the document.
Revalidation	C-2	5/14/2020	The Directive has been reviewed, and it is determined that no changes are necessary at this time. Removed quotation marks from around document titles and indented notes in accordance with NPR 1400.1. On 5/14/20, at the request of the OPRD, MPR 7123.1C-2 is being revalidated.

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PREFACE

P.1 PURPOSE

To establish Center-level procedures and identify Center-related responsibilities for implementing Agency Systems Engineering (SE) Management, focusing on the 17 processes for establishing and maintaining consistency in Systems Engineering throughout the Agency as mandated by NPR 7123.1.

P.2 APPLICABILITY

a. This MPR applies to Center personnel, programs, projects, and activities, including contractors and resident agencies to the extent specified in their respective contracts or agreements. (“Contractors,” for purposes of this paragraph, include contractors, grantees, Cooperative Agreement recipients, Space Act Agreement partners, or other agreement parties.)

Note: For activities that are part of a project managed at another Center, the Marshall Space Flight Center (MSFC) activity will assess the applicability of the SE processes defined in this MPR and communicate their approach to MSFC governing authorities, as described in MPR 7120.1.

b. This MPR applies to the Michoud Assembly Facility.

c. This MPR applies the following: all mandatory actions (requirements) are denoted by statements containing the term “shall.” The terms “may” or “can” denote discretionary privilege or permission; “should” denotes a good practice and is recommended, but not required; “will” denotes expected outcome; and “are/is” denotes descriptive material.

d. This MPR applies the following: all document citations are assumed to be the latest version unless otherwise noted.

P.3 AUTHORITY

NPR 7123.1, NASA Systems Engineering Processes and Requirements

P.4 APPLICABLE DOCUMENTS AND FORMS

a. NPD 7120.4, NASA Engineering and Program/Project Management Policy

b. NPR 7150.2, NASA Software Engineering Requirements

c. NID 1600.55, Sensitive But Unclassified (SBU) Controlled Information

d. NRRS 1441.1, NASA Records Retention Schedules

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- e. MPR 1420.1, MSFC Forms Management Program
- f. MPR 1440.2, MSFC Records Management Program
- g. MPR 2190.1, MSFC Export Control Program
- h. MPR 7120.1, MSFC Engineering and Program/Project Management Requirements
- i. MPR 8730.3, Control of Nonconforming Product
- j. MSFC-STD-555, MSFC Engineering Documentation Standard
- k. MSFC-STD-3528, Computer-Aided Design (CAD) Standard
- l. STD/DM-DPD, Data Procurement Document (DPD)
- m. STD/DM-DRD, Data Requirements Description (DRD)
- n. STD/DM-DRL, Data Requirements List (DRL)

Note: Documents l. through n. are standard MSFC data requirements descriptions (DRDs). They are found in the MSFC Data Requirements Management System that can be accessed in the MSFC Integrated Document Library.

P.5 MEASUREMENT/VERIFICATION

- a. Program/Project/Activity implementation of the requirements of this MPR is communicated in the Systems Engineering Management Plan (SEMP), or equivalent plan, where the Program/Project/Activities approach to the 17 SE processes is captured. The “Compliance Matrix for Program/Project/Activity” (Appendix C) is used to aid in the assessment and will be attached to the SEMP, or equivalent.
- b. The SEMP (or equivalent), along with the compliance matrix, is approved by the appropriate Designated Governing Authority (DGA). Once approved, the SEMP (or equivalent) becomes the required implementation plan. Any changes to the approved plan will be provided to the DGA.
- c. Any tailoring of requirements will be approved through the approval of the SEMP (or equivalent), by the DGA.
- d. MSFC compliance with NPR 7123.1 is documented in the “Compliance Matrix for Centers” (Appendix G) as part of this MPR.

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P.6 CANCELLATION

MPR 7123.1B, MSFC Systems Engineering Processes and Requirements, dated December 12, 2012.

Original signed by

Patrick E. Scheuermann
Director

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CHAPTER 1. RESPONSIBILITIES:

1.1 The MSFC Center Director or designee:

1.1.1 Ensures implementation of the SE policies at MSFC; and

1.1.2 Serves as Chairperson of the Center Management Council (CMC) to approve SE implementation and review and approve the SEMP for Programs/Projects/Activities governed by the CMC.

1.2 The MSFC Engineering Director or designee:

1.2.1 Serves as Chairperson of the Engineering Management Council (EMC) to approve SE implementation and review and approve the SEMP for Programs/Projects/Activities not under the purview of the CMC.

1.2.2 Ensures Engineering Directorate and EMC review of the SEMP prior to CMC review/approval.

1.3 The Program/Project/Activity Manager or designee:

1.3.1 Ensures that the Program/Project/Activity assess the applicability of the 17 SE processes and document their implementation, typically in the SEMP;

1.3.2 Ensures review and approval by the appropriate DGA;

1.3.3 Controls the SEMP under Program/Project/Activity control processes;

1.3.4 Provides the design team with statutory and regulatory requirements, relevant information from previous similar designs, and any other requirements deemed essential for product design and development;

1.3.5 Ensures that the different design and development tasks are carried out based on safety and functional objectives of the product in accordance with customer, statutory, and regulatory requirements; and

1.3.6 Designates a custodian for the records listed in Appendix D.

1.4 The Implementing Chief Engineer or designee:

1.4.1 Concurs with the implementation of the 17 SE processes and the compliance assessment.

1.4.2 Concurs with the selection and tailoring of life-cycle and technical review criteria.

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1. 5 The Engineering Line Management:

1.5.1 Prepares the SEMP in accordance with this MPR for the Program/Project/Activity;

1.5.2 Ensures compliance with the approved SEMP;

1.5.3 Authorizes a DGA-approved SEMP for implementation, including any customized, tailored and/or waived processes and/or requirements; and

1.5.4 Ensures Software developed within NASA or acquired for NASA, complies with NPD 7120.4 and NPR 7150.2.

1.6 The lead organization for Multi-Center Program/Projects develops documentation to describe the hierarchy and reconciliation of plans for implementing SE processes and requirements that are applicable to all Centers involved.

CHAPTER 2. PROCEDURES

2.1 Program/Project/Activity Systems Engineering Life-Cycle:

The Program/Project/Activity SE Life-Cycle is defined as a set of processes and reviews that enables the smooth, incremental development of products essential to successfully achieving the Program/Project/Activity goals. Figure 2-1 illustrates the required processes of the SE Engine. There are three sets of processes, the system design processes, the product realization processes, and the technical planning processes. The 17 common technical processes illustrated are applied iteratively and recursively during the life-cycle of a program, project, or activity. The processes are applied to design a system solution definition for each Work Breakdown Structure (WBS) model down and across each level of the system structure and to realize the WBS model end products up and across the system structure. Each of the processes is described in section 2.2. The required technical reviews are described in section 2.2.16 and Appendix E. Detailed guidance and best practices for the execution of these 17 processes and the reviews are provided in NASA/SP-2007-6105, MSFC-HDBK-3173, MGM 8040.1, and MGM 7120.3.

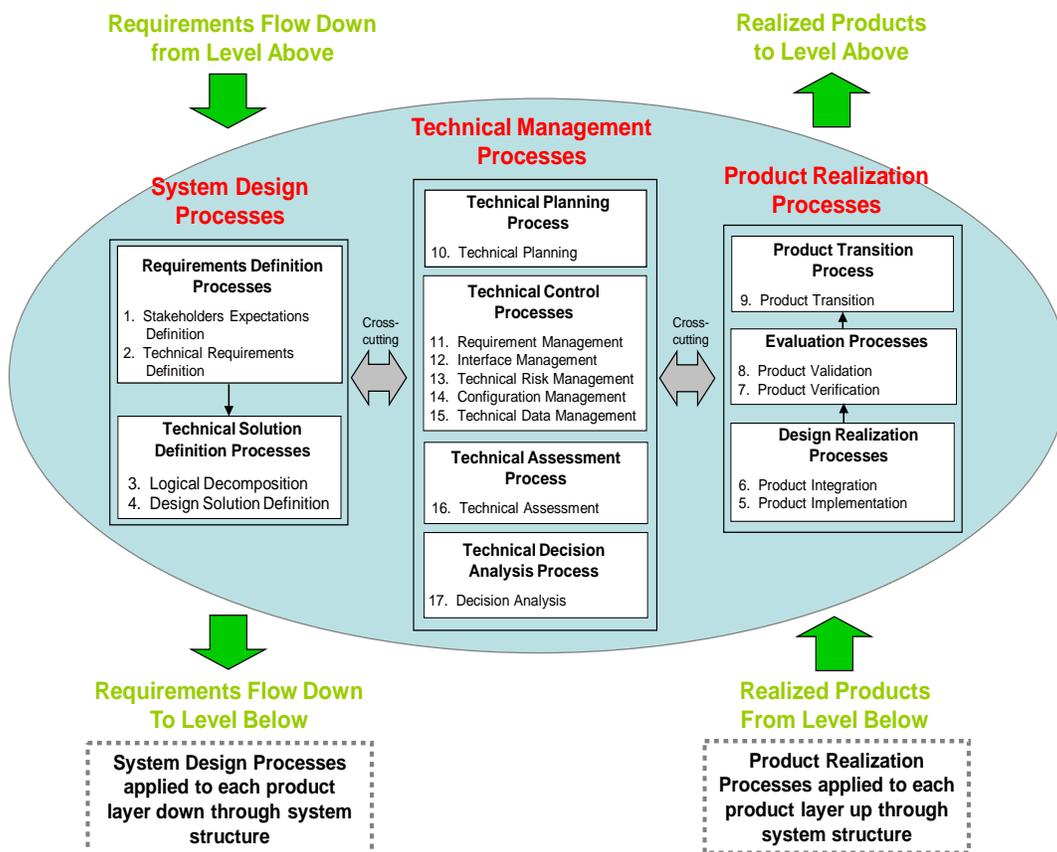


Figure 2-1

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2.2 Systems Engineering Processes

Note: MSFC-HDBK-3173 provides detailed information, guidance and best practices specific to MSFC for each of the 17 SE processes identified in this MPR.

Systems Design Processes:

2.2.1 Stakeholder Expectations (process 1).

2.2.1.1 A list of stakeholders and their expectations shall be established, baselined, and maintained. This is typically captured in a Program/Project Plan and/or SEMP.

2.2.1.2 A Concept of Operations (ConOps) shall be established, baselined, and maintained. STD/SE-CONOPS defines content and technical milestone expectations. The ConOps is baselined for Technical Requirements Definition.

Note: The size and complexity of the project may allow for this information to be compiled and baselined into a single product. Larger and more complex projects would normally baseline this information in separate, stand-alone products.

2.2.2 Technical Requirements Definition (process 2).

2.2.2.1 A set of technical requirements (e.g., constraints, performance, functional, safety, or interface) in “shall” statements shall be established, baselined, and maintained. STD/SE-REQSPEC and STD/SE-IRD define content and technical milestone expectations. Technical requirements are typically captured at the WBS level at which the requirements are being defined.

2.2.3 Logical Decomposition (process 3).

2.2.3.1 A system architecture (e.g., segment, system, element, or subsystem) shall be established, baselined, and maintained. STD/SE-SARCH defines content and technical milestone expectations. The system architecture is typically captured in a Product Breakdown Structure in conjunction with a WBS.

2.2.3.2 Technical requirements (e.g., functions, capabilities, performance, or resources) shall be decomposed from higher-level requirements and allocated to the next lower level of the system architecture. STD/SE-REQSPEC and STD/SE-IRD define content and technical milestone expectations.

2.2.4 Design Solution Definition (process 4).

2.2.4.1 A Technical Data Package (e.g., released engineering drawings, product specifications) that meets the prescribed technical requirements shall be developed.

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Product Realization Processes:

2.2.5 Product Implementation (process 5).

2.2.5.1 The approach for product acquisition (e.g., make the product, buy an existing product, or reuse/modify a product) shall be established, baselined, and maintained. This information is typically captured in the Program/Project Plan and/or SEMP.

2.2.6 Product Integration (process 6).

2.2.6.1 The approach for product integration shall be established, baselined, and maintained. This information is typically captured in the Program/Project Plan and/or SEMP.

Note: The product integration process assures the product is physically (assembly, mate, connect, stacked, etc.) and analytically (loads, environments, envelops, etc.) integrated in accordance with requirements, configuration documentation, interface specifications, procedures, and applicable standards.

2.2.7 Product Verification (PVe) (process 7).

2.2.7.1 The approach to product verification shall be established, baselined, and maintained. STD/SE-VVPLAN defines content and technical milestone expectations.

Note: The stakeholder expectations and Concept of Operations are utilized to define the technical requirements. The product verification process provides evidence (e.g., Verification Procedures, Inspection Reports, Analysis Results, and Models) that the product complies with the technical requirements. MSFC-HDBK-2221, Volume II provides examples.

2.2.7.2 The verification requirements (e.g., method, level, and phase) shall be established, baselined, and maintained. STD/SE-VVREQ defines content and technical milestone expectations. Verification requirements are typically captured with the set of technical requirements.

2.2.7.3 The verification success criteria shall be established, baselined, and maintained. STD/SE-VVSC defines content and technical milestone expectations. STD/SE-VVPROC defines content and technical milestone expectations when verification procedures are utilized.

Note: ED-OWI-004 defines the MSFC Engineering process for controlling test programs, facilities, and test documentation. MPR 8730.1 establishes Center specific requirements for in-process inspections and final processing of flight hardware, associated flight support equipment, and other quality sensitive products. MPR 7120.1 Chapter 20 defines requirements relevant to the use of models and simulations.

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2.2.7.4 Quality Assurance personnel or Quality Designee(s) shall be appointed to perform inspections or monitor tests in support of the verification process.

2.2.7.5 A product verification compliance assessment shall be established and maintained. STD/SE-VVREP and STD/SE-VVC define content and technical milestone expectations.

2.2.7.6 Nonconformances, failures, and anomalies that occur during the verification processes are documented and resolved in accordance with MPR 8730.3.

2.2.7.7 Any rework, repair, and redesign that occurs to the existing configuration during the verification program will be evaluated to determine if existing compliance data is invalidated and reverification is required. Document objective evidence that these items have been reviewed for verification impact. Perform reverification if required.

2.2.8 Product Validation (PVa) (process 8).

2.2.8.1 The approach to product validation shall be established, baselined, and maintained. STD/SE-VVPLAN defines content and technical milestone expectations.

Note: The stakeholder expectations and Concept of Operations are utilized to define the technical requirements. The product validation process provides evidence that the product complies with stakeholder expectations and Concept of Operations. MSFC-HDBK-2221, Volume II provides examples.

2.2.8.2 Quality Assurance personnel or Quality Designee(s) shall be appointed to perform inspections or monitor tests in support of the validation process.

2.2.8.3 A product validation compliance assessment shall be established and maintained. STD/SE-VVREP and STD/SE-VVC define content and technical milestone expectations.

2.2.9 Product Transition (process 9).

2.2.9.1 The approach for product transition shall be established, baselined, and maintained. The product transition approach is typically captured in a Program/Project Plan and/or SEMP.

Technical Management Processes:

2.2.10 Technical Planning (TP) (process 10).

2.2.10.1 The approach to the 17 SE processes shall be established, baselined, and maintained. STD/SE-SEMP defines content and technical milestone expectations. Each applicable level of the system architecture is considered when defining the approach.

Note: Certain SE processes may not apply to a given subsystem or element. For example, if the Program/Project/Activity makes a decision to purchase an off-the-shelf subsystem or element, some of the Systems Design Processes and some of the Product Realization

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Processes may not be applicable. Tailoring specific requirements requires a definition of both the breadth and depth of the project.

2.2.10.2 The Program/Project/Activity's implementation of the 17 SE processes will be coordinated with the project plan to ensure compatibility with the allocated resources/enabling products (cost, schedule, personnel, and facilities), milestones, risk assessment, and deliverables (NASA and contractor).

2.2.10.3 For projects with significant portions of the engineering work contracted out, the MSFC SEMP will scope and plan the NASA portion of the project implementation of the technical processes before, during, and at the completion of the contracted effort.

Note: The MSFC SEMP content includes planning for the technical team's involvement in the Request for Proposal (RFP) preparation, in source selection activities, in oversight/surveillance, and in acceptance of deliverables.

2.2.11 Requirements Management (process 11).

2.2.11.1 The requirements/specifications architecture and metadata shall be established, baselined, and maintained (e.g., Requirements/Specification tree). STD/SE-RST defines content and technical milestone expectations.

Note: The requirements/specification architecture includes hierarchical levels and interrelationships, while metadata is any information that describes the actual requirement/specification, (ownership, subject matter, assessments, synopsis, identification or location, etc.). The requirements management approach is typically captured in a Program/Project Plan and/or SEMP.

2.2.11.2 Requirements traceability shall be established, baselined, and maintained. STD/SE-RT defines content and technical milestone expectations.

2.2.12 Interface Management (process 12).

2.2.12.1 The approach for managing interfaces (e.g., responsibilities, agreements used, or assess changes to) shall be established, baselined, and maintained. The interface management approach is typically captured in a Program/Project Plan and/or SEMP.

2.2.12.2 Control of the interface design solution(s) shall be established, baselined, and maintained. STD/SE-ICD defines content and technical milestone expectations. Interface design solutions are typically captured in an Interface Control Document or Drawing (ICD) (e.g., details the interface solution between two or more systems).

2.2.13 Technical Risk Management (process 13).

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2.2.13.1 The approach to perform technical risk management shall be established, baselined, and maintained. This information is typically captured in a Program/Project Plan and/or SEMP.

2.2.13.2 Technical risk management shall be performed to support technical assessment and decision-making.

2.2.14 Configuration Management (process 14).

Note: MGM 8040.1 provides detailed guidance and best practices for the Configuration Management Process.

2.2.14.1 Configuration Management Planning.

a. Configuration management planning shall be established, baselined, and maintained. STD/CM-CMP defines content and technical milestone expectations.

Note: CM planning describes the configuration management strategy and processes for configuration identification, release, configuration control, configuration status accounting, and configuration verification.

2.2.14.2 Configuration Identification.

a. Configuration identification shall be established and maintained.

Note: The configuration identification function selects the Configuration Item (CI)/Computer Software Configuration Item (CSCI), identifies the configuration documentation that describes the functional and physical characteristics of the CIs/CSCIs, identifies the planned and actual CI/CSCI baseline at maturity milestones, establishes the baseline control authority for each CI/CSCI baseline, assigns unique identifiers for each CI/CSCI and configuration documentation, releases configuration documentation with traceability to the affected CI/CSCI, and ensures user access to released data.

b. For parts/part lists, drawings, and computer-aided design (CAD) models that are produced by MSFC to describe MPR 7120.1 Mission Type 1 or Mission Type 2 flight, qualification, or associated ground support equipment CI/CSCI, the release process and configuration identifier assignment shall be implemented in accordance with MSFC-STD-555 and MSFC-STD-3528 for mechanical CAD.

2.2.14.3 Configuration Control.

a. Configuration control processes shall be established and maintained for CIs/CSCIs.

Note: The configuration control process defines a consistent methodology for the baseline control authority to control changes and deviation/waivers to CI/CSCI baselines, including

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methods for documenting, receiving, recording, evaluating, dispositioning, tracking implementation of changes, deviation/waivers, and releasing changed documentation.

2.2.14.4 Configuration Accounting.

- a. Configuration status accounting of CI/CSCI baselines, configuration documentation, changes, and deviations/waivers shall be established and maintained.

Note: Configuration status accounting includes traceability per CI/CSCI to the latest baseline and historic baselines, configuration documentation status, change and deviation/waiver status, and change implementation status.

2.2.14.5 Configuration Verification.

- a. The CI/CSCI's actual product configuration shall be confirmed to meet its functional and physical requirements.

Note: Configuration verification includes auditing functional requirements against actual performance, reconciling the as-built configuration with the as-designed configuration, confirming that records of configuration item changes and deviation/waivers are complete, and tracking any noncompliance actions to closure.

2.2.15 Technical Data Management (process 15).

Note: MGM 7120.3 provides detailed guidance and best practices for the Data Management Process.

2.2.15.1 Data Management Planning

- a. Technical data management (DM) planning shall be established, baselined, and maintained. STD/DM-DMP defines content and technical milestone expectations.

Note: DM planning describes the technical data management strategy and processes for data identification/definition, preparation, access, control, and records.

2.2.15.2 Identification/Definition.

- a. Technical data identification and definition shall be established and maintained.
- b. MSFC-produced technical data requirements content and submission shall be identified and defined using a Data Requirements List (DRL). Data requirements descriptions (DRDs) may be used with the DRL to define more detailed requirements for the identified data. STD/DM-DRL and STD/DM-DRD define content expectations.

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c. Contractual data content, format, and submission shall be identified and defined using DRDs and a DRL packaged into a Data Procurement Document (DPD). STD/DM-DRD, STD/DM-DRL, and STD/DM-DPD define content and format expectations.

Note: The MSFC Standard DRDs available in the MSFC Data Requirements Management System provide the basis for program/project-activity DRD, DRL, and DPD development. The Standard DRDs represent the standard data requirements content endorsed by the MSFC offices of primary responsibility (OPRDs). The Center Data Requirements Manager assigns DRL and DPD identification numbers (MPR 8070.1).

2.2.15.3 Preparation, Access and Control

a. The approach for technical data preparation, access, and control shall be established and maintained.

Note 1: Data preparation, access, and control processes and schemes typically include data and revision identifiers, data format templates, data quality, data review and approval, project specific forms (MPR 1420.1) and formats, data status and accounting.

Note 2: DM processes are required to comply with Agency and Center requirements for SBU identification, marking, and safeguarding (NID 1600.55); export control (MPR 2190.1), proprietary information, forms establishment (MPR 1420.1), and program/project/activity records identification, retention, and archival (NRRS 1441.1, MPR 1440.2).

2.2.16 Technical Assessment (process 16).

2.2.16.1 The technical assessment approach shall be established, baselined, and maintained. This information is typically captured in a Program/Project Plan and/or SEMP.

2.2.16.2 A set of quantifiable measures shall be established and maintained. These may include measures of Effectiveness (MoE), Measures of Performance (MoP), and Technical Performance Measures (TPM). The breadth of these measures will vary based on the stakeholder and the size and complexity of the Program/Project/Activity.

2.2.16.3 Mass and Power Margins will be measured for applicable systems.

2.2.16.4 The agreed-upon measures will be reported (plan vs. actual) to the Program/Project/Activity per an agreed-upon reporting schedule.

2.2.16.5 Life-cycle and technical reviews shall be conducted to assess the technical validity and completeness of technical work products and processes relative to planned cost, schedule, and technical objectives.

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Note: MPR 7120.1 defines the requirements for minimum life-cycle reviews for the Program/Project/Activity.

2.2.16.6 Entrance and success criteria shall be established for each review. Entrance and success criteria are typically captured in a stand-alone review plan for each of the respective reviews.

Note: Appendix E “Life-Cycle and Technical Reviews” provides entrance and success Criteria for each review. The products and maturities necessary will vary based upon the Program/Project/Activity and should be aligned with the established entrance and success criteria for that review. These product and maturity expectations are typically captured in a review plan or SEMP, Data Requirements List, and the project schedule.

2.2.16.7 The review discrepancies/actions, their disposition, and the objective evidence supporting closure shall be identified and tracked.

2.2.16.8 Software shall be included in technical reviews and assessed per NPR 7150.2 software review requirements

2.2.17 Decision Analysis (process 17).

2.2.17.1 The approach to perform decision analysis shall be established and maintained. This information is typically captured in a Program/Project Plan and/or SEMP.

2.2.17.2 Decision analysis shall be performed to support technical assessment and decision-making.

2.3 Process Applicability

All tailoring of processes, requirements, and reviews is to be approved by the DGA as defined in Chapter 4 of this MPR. Appendix C “Compliance Matrix for Program/Project/Activity” captures this tailoring and is attached to the SEMP, or equivalent.

CHAPTER 3. SEMP

3.1 General

3.1.1 The SEMP communicates the implementation of the 17 SE processes.

3.1.2 The SEMP provides a single integrated TP product that addresses the SE management and implementation for systems and subsystems for in-house and contracted programs/projects/activities. It is used to identify and evaluate the required technical teams' performance, technical risk assessment, and deriving the progress measurement criteria.

3.1.3 The SEMP will be updated throughout the life-cycle as the implementation approach matures or changes and communicated to the DGA.

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3.1.4 Programs/Projects/Activity managers may communicate their approach to the 17 SE processes and their assessment in an equivalent plan such as the project plan.

3.2 Tailoring

3.2.1 The Program/Project/Activity’s tailoring of this MPR shall be identified in Appendix C “Compliance Matrix for Program/Project/Activity” and included in the SEMP or equivalent plan.

CHAPTER 4. DGA

4.1 The DGA is assigned primary responsibility for evaluating the technical content of a particular program, project, or activity to ensure that it is meeting the commitments specified in the key management directives. Typically, the DGA is the final approval signature on the SEMP, and other key technical products. While overall management of the SEMP, reviews, and similar project-specific SE products is the responsibility of the program/project/activity manager, the DGA has the final approval to ensure independent assessment of technical content and tailoring that pertain to this MPR.

4.2 For Programs/Projects/Activities that fall under the purview of the CMC, the SEMP will be concurred upon by Associate Center Director, Technical, who will invoke the Program and Project Management Advisory Committee, as necessary, in support of the approval by the Center Director, or designee.

4.3 For Program/Projects/Activities that fall outside the purview of the CMC, the SEMP will be approved by the Engineering Director who will invoke the EMC as necessary. Through this delegation, the Engineering Director has authority to approve tailoring of Center Director requirements.

Note: CMC governance is determined by the process defined in MPR 7120.4.

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APPENDIX A

DEFINITIONS

Activities – (1) A set of tasks that describe the technical effort to accomplish a process and help generate expected outcomes. (2) A set of tasks that support the execution of, or provides a product to, a program or project.

Architecture – Model(s) showing performance, function, and interface. The architectural drawings provide a means to evaluate alternate solutions by highlighting risks and enabling judgments. Operating and use-case conditions are exercised on the architectural model to provide insight on how the system will perform.

Baseline (noun) – The authorized and identified data that defines an item (e.g., configuration item, schedule, or project) at a specific point in time where changes from that point forward are controlled through a traceable approval and implementation process.

Baseline (verb) – To authorize and identify data that defines an item (e.g., configuration item, schedule, or project) where changes from that point forward are controlled through a traceable approval and implementation process.

Configuration Item (CI) – An aggregate of hardware, firmware, software, or any of its discrete portions, which satisfies an end-use function and is designated for configuration management.

CI Baseline – All released configuration documentation that represents the definition of the CI at a specific point in time. The baseline serves as the basis for defining changes to the CI. CI baselines are established incrementally as configuration documentation is released. Typical configuration baselines utilized for planning and verifying maturity of the configuration item are: functional, allocated, and product baselines.

Configuration Documentation – The documentation (e.g., drawings, parts lists, requirements, specifications, standards, ICDs, software version descriptions (SVDs) and documents invoked therein) that identifies and defines a configuration item’s functional and physical characteristics.

Constraint – Constraints are derived requirements and they may be based on limits of physical design that result in budgeted allocations such as fuel, weight, or power, but they may also be determined by management considerations such as cost or schedule.

Customize – An adaptation or modification of a process or procedure that is not specifically specified as a requirement. For modification of a requirement see tailoring.

Designated Governing Authority (DGA) – The DGA for the technical effort in this MPR is the Center Director or designee to ensure the appropriate level of technical management oversight. The DGA may be delegated to a line manager or other appropriate technical expert.

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Detailed Design – Fully defines the structures and capabilities to the level necessary to build a product or to develop software.

Deviation – A documented agreement, granted prior to implementation, intentionally releasing a Program/Project/Activity from meeting a requirement.

Measure of Effectiveness (MoE) – A measure by which a stakeholder’s expectations are judged in assessing satisfaction with products and systems produced and delivered in accordance with the associated technical effort. The MoE is deemed critical to both the product stakeholder and the operational/mission usage. A MoE is typically qualitative in nature or not able to be used directly as a “design-to” requirement.

Measure of Performance (MoP) – A quantitative measure that, when met by the design solution, will help ensure that a MoE for a product or system will be satisfied. These MoPs are given special attention during design to ensure that the MoEs with which they are associated are met. There are generally two or more measures of performance for each MoE.

Preliminary Design – Initiates the process of transferring the raw requirements into functional entities. Verbal requirements are visualized into product partitions, components, system-states and modes. The designer draws out the system architecture as blocks assigning mechanical and electronic functions. (software, timing and memory requirements are included.)

Product Validation Process (PVa) – The product validation process is used to confirm that a verified end product satisfies its intended use when placed in its intended environment. Validation is proof that the product accomplishes its stakeholders’ expectations and proves that “the right system was done.”

Product Verification Process (PVe) – The product verification process is used to confirm the end product conforms to its design solution. Verification is proof that the product is in compliance with shalls/requirements/specifications and proves that “the system was done right.”

Stakeholders – Individuals and/or organizations who are affected by or in some way accountable for the outcome of an undertaking but who may not be directly involved with doing the processing work. Stakeholders include all who are involved in the Program/Project/Activity -- end-users, designers, manufacturing, test, and quality personnel.

Tailoring – An adaptation of a process or approach to meet a requirement. Tailoring specific requirements requires a definition of both the breadth and depth of the project. Tailoring in breadth deals with factors that may include numbers/types of systems impacted by the development of a subsystem, the numbers/types of assessments, and the number/types of reviews. Tailoring in-depth involves decisions concerning the level of detail needed to generate and substantiate the requirements. The depth of SE effort varies from project to project in relationship to complexity, uncertainty, urgency, and the willingness to accept risk.

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Technical Performance Measures (TPM) – The set of critical or key performance parameters that are monitored by comparing the current actual achievement of the parameters with the anticipated performance and used to confirm progress and identify deficiencies that might jeopardize meeting a system requirement. Assessed parameter values that fall outside an anticipated value range indicates a need for evaluation and corrective action. TPMs are typically selected from the defined set of MoPs.

Technical Requirements – Statements defining performance characteristics of a product. Requirements are written from the top down. The “system” is initially described, and subsequently, requirements devolve to lower level components. Specific documents are associated with requirements. Each system requirement, configuration item specification, critical item specification, manufacturing specification, etc., defines an area of requirements that is traceable from the top down or from the bottom up. Requirements are stated in such a manner that pass/fail or quantitative assessment criteria are specified.

Tools (prototypes, models, analysis) – Engineering/Design Tools convert design into objects that present virtual or real physical appearance with limited functional performance (prototypes), provide realistic output response from different inputs (models), or provide some computer analysis or model that simulates the final end product. Manufacturing Tools relate to hardware used during the production of end items.

Use-Case – A defined task within a system that provides a measured result for someone or something outside the system. Use-cases bridge the gap between user’s statements and performance functionality. No single use-case specifies the entire system. Each use-case explains one particular interaction.

Waiver – A documented agreement, granted during implementation, intentionally releasing a Program/Project/Activity from meeting a requirement.

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APPENDIX B

ACRONYMS

ADP	Acceptance Data Package
ASM	Acquisition Strategy Meeting
BOE	Basis of Estimate
CAD	Computer-Aided Design
CADRe	Cost Analysis Data Requirement
CCBD	Configuration Control Board Directive
CDR	Critical Design Review
CEI	Configuration End Item
CERR	Critical Event Readiness Review
CI	Configuration Item
CIL	Critical Items List
CM	Configuration Management
CMC	Center Management Council
ConOps	Concept of Operations
CoCC	Certificate of Configuration Compliance
CoFW	Certification of Flight Worthiness
CoQ	Certification of Qualification
COR	Close Out Review
CSCI	Computer Software Configuration Item
DCR	Design Certification Review
DGA	Designated Governing Authority
DM	Data Management
DN	Discrepancy Notice
DPD	Data Procurement Document
DR	Decommissioning Review
DRR	Disposal Readiness Review
DRD	Data Requirements Description

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DRL Data Requirements List

DRM Design Reference Mission

ECR Engineering Change Request

EEE Electrical, Electronic, & Electromechanical

ELV Expendable Launch Vehicle

EMC Engineering Management Council

EMI Electromagnetic Interference

EO Engineering Order

FA Formulation Agreement

FAD Formulation Authorization Document

FCA Functional Configuration Audit

FDF Flight Data File

FMEA Failure Modes Effects Analysis

FRR Flight Readiness Review

GSE Ground Support Equipment

HDBK Handbook

HOSC Huntsville Operations Support Center

HSIP Human Systems Integration Plan

ICD Interface Control Document or Drawing

IMS Integrated Master Schedule

IRD Interface Requirements Document

ISS International Space Station

IT Information Technology

JCL Joint Confidence Level

KDP Key Decision Point

LLIL Limited Life Items List

MCR Mission Concept Review

MDR Mission Definition Review

MIDL MSFC Integrated Document Library

MoE Measures of Effectiveness

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MoP Measures of Performance

MPR Marshall Procedural Requirements

MRR Mission Readiness Review

MSFC Marshall Space Flight Center

MUA Material Usage Agreement

MWI Marshall Work Instruction

NEPA National Environmental Policy Act

NID NASA Interim Directive

NPR NASA Procedural Requirements

NRRS NASA Records Retention Schedules

ORR Operational Readiness Review

PCA Physical Configuration Audit

PDLM Product Data Life-Cycle Management

PDR Preliminary Design Review

PFAR Post-Flight Assessment Review

PHA Preliminary Hazard Analysis

PIR Program Implementation Review

PLAR Post-Launch Assessment Review

PM Program/Project Manager

POCC Payload Operations Control Center

PRA Probabilistic Risk Assessment

PRR Production Readiness Review

PSR Program Status Review

PVa Product Validation

PVe Product Verification

R&T Research and Technology

RFA Request for Action

RFP Request for Proposal

RID Review Item Discrepancy

SAR System Acceptance Review

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SBU	Sensitive But Unclassified
SDR	System Definition Review
SE	Systems Engineering
SEMP	Systems Engineering Management Plan
SIR	Systems Integration Review
SMA	Safety and Mission Assurance
SMSR	Safety and Mission Success Review
SRB	Standing Review Board
SRR	System Requirements Review
SVD	Software Version Descriptions
SW	Software
TBD	To Be Determined
TBR	To Be Resolved
TD	Technology Development
ToR	Terms of Reference
TPM	Technical Performance Measures
TRL	Technology Readiness Level
TRR	Test Readiness Review
V&V	Verification and Validation
WBS	Work Breakdown Structure

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APPENDIX C

COMPLIANCE MATRIX FOR PROGRAM/PROJECT/ACTIVITY

Note: The compliance matrix is attached to the SEMP or equivalent plan (see 3.2.1). A template is also available on the MSFC Integrated Document Library (MIDL) under the Program/Project Documents link.

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MPR 7123.1 Section	Requirement Statement	Comply (Full, Tailored, or NA)	Rationale for Decisions, Comments, Deviations
2.2.1.1	A list of stakeholders and their expectations shall be established, baselined, and maintained.		
2.2.1.2	A Concept of Operations (ConOps) shall be established, baselined, and maintained.		
2.2.2.1	A set of technical requirements (e.g., constraints, performance, functional, safety, or interface) in “shall” statements shall be established, baselined, and maintained.		
2.2.3.1	A system architecture (e.g., segment, system, element, or subsystem, etc.) shall be established, baselined, and maintained.		
2.2.3.2	Technical requirements (e.g., functions, capabilities, performance, or resources) shall be decomposed from higher level requirements and allocated to the next lower level of the system architecture.		
2.2.4.1	A Technical Data Package (e.g., released engineering drawings, product specifications) that meets the prescribed technical requirements shall be developed.		
2.2.5.1	The approach for product acquisition (e.g. make the product, buy an existing product, or reuse/modify a product) shall be established, baselined, and maintained.		
2.2.6.1	The approach for product integration shall be established, baselined, and maintained.		
2.2.7.1	The approach to product verification shall be established, baselined, and maintained.		
2.2.7.2	The verification requirements (e.g., method, level, and phase) shall be established, baselined, and maintained.		
2.2.7.3	The verification success criteria shall be established, baselined, and maintained.		
2.2.7.4	Quality Assurance personnel or Quality Designee(s) shall be appointed to perform inspections or monitor tests in support of the verification process.		
2.2.7.5	A product verification compliance assessment shall be established and maintained.		
2.2.8.1	The approach to product validation shall be established, baselined, and maintained.		

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MPR 7123.1 Section	Requirement Statement	Comply (Full, Tailored, or NA)	Rationale for Decisions, Comments, Deviations
2.2.8.2	Quality Assurance personnel or Quality Designee(s) shall be appointed to perform inspections or monitor tests in support of the validation process.		
2.2.8.3	A product validation compliance assessment shall be established and maintained.		
2.2.9.1	The approach for product transition shall be established, baselined, and maintained.		
2.2.10.1	The approach to the 17 SE processes shall be established, baselined, and maintained.		
2.2.11.1	The requirements/specifications architecture and metadata shall be established, baselined, and maintained (e.g. Requirements/Specification tree).		
2.2.11.2	Requirements traceability shall be established, baselined, and maintained.		
2.2.12.1	The approach for managing interfaces (e.g., responsibilities, agreements used, or assess changes to) shall be established, baselined, and maintained.		
2.2.12.2	Control of the interface design solution(s) shall be established, baselined, and maintained.		
2.2.13.1	The approach to perform technical risk management shall be established, baselined, and maintained.		
2.2.13.2	Technical risk management shall be performed to support technical assessment and decision-making.		
2.2.14.1a	Configuration management planning shall be established, baselined, and maintained.		
2.2.14.2a	Configuration identification shall be established and maintained.		
2.2.14.2b	For parts/part lists, drawings, and computer-aided design (CAD) models that are produced by MSFC to describe MPR 7120.1 Mission Type 1 or Mission Type 2 flight, qualification, or associated ground support equipment CI/CSCI, the release process and configuration identifier assignment shall be implemented in accordance with MSFC-STD-555 and MSFC-STD-3528 for mechanical computer-aided design (CAD).		

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MPR 7123.1 Section	Requirement Statement	Comply (Full, Tailored, or NA)	Rationale for Decisions, Comments, Deviations
2.2.14.3a	Configuration control processes shall be established and maintained for CIs/CSCIs.		
2.2.14.4a	Configuration status accounting of CI/CSCI baselines, configuration documentation, changes, and deviations/waivers shall be established and maintained.		
2.2.14.5a	The CI/CSCI's actual product configuration shall be confirmed to meet its functional and physical requirements.		
2.2.15.1a	Technical data management (DM) planning shall be established, baselined, and maintained.		
2.2.15.2a	Technical data identification and definition shall be established and maintained.		
2.2.15.2b	MSFC-produced technical data requirements content and submission shall be identified and defined using a Data Requirements List (DRL).		
2.2.15.2c	Contractual data content, format, and submission shall be identified and defined using DRDs and a DRL packaged into a Data Procurement Document (DPD).		
2.2.15.3a	The approach for technical data preparation, access, and control shall be established and maintained.		
2.2.16.1	The technical assessment approach shall be established, baselined, and maintained.		
2.2.16.2	A set of quantifiable measures shall be established and maintained.		
2.2.16.5	Life-cycle and technical reviews shall be conducted to assess the technical validity and completeness of technical work products and processes relative to planned cost, schedule, and technical objectives.		
2.2.16.6	Entrance and success criteria shall be established for each review.		
2.2.16.7	The review discrepancies/actions, their disposition, and the objective evidence supporting closure, shall be identified and tracked.		
2.2.16.8	Software shall be included in technical reviews and assessed per NPR 7150.2 software review requirements.		

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MPR 7123.1 Section	Requirement Statement	Comply (Full, Tailored, or NA)	Rationale for Decisions, Comments, Deviations
2.2.17.1	The approach to perform decision analysis shall be established, baselined, and maintained.		
2.2.17.2	Decision analysis shall be performed to support technical assessment and decision-making.		
3.2.1	The Program/Project/Activity's tailoring of this MPR shall be identified in Appendix C "Compliance Matrix for Program/Project/Activity" and included in the SEMP or equivalent plan.		

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APPENDIX D

RECORDS

The following records are required by this MPR:

Record	Custodian
Configuration Management Planning	PM or designee
Data Procurement Document	PM or designee
Data Requirements Description	PM or designee
Data Requirements List	PM or designee
Data Management Planning	PM or designee
System Architecture	PM or designee
Concept of Operations	PM or designee
Interface Control Data	PM or designee
Requirements Data	PM or designee
Requirements/Specifications Architecture	PM or designee
Systems Engineering Management Plan	PM or designee
Verification/Validation Data	PM or designee
Verification/Validation Compliance	PM or designee
Technical Data	PM or designee
Technical Assessment Data	PM or designee

These records are the minimum set. Additional records may be called out in the Program/Project Plan, Data Management Plan, and/or Records Plan.

D.1 Records Custodian

Program/Project Manager (PM) designates a custodian for the records listed in the above matrix and document the designation in the Program/Project Plan, Data Management Plan, and/or Records Management Plan.

D.1.1 Records Custodians prepare and maintain records plans in accordance with MPR 1440.2.

D.1.2 Records plans will be submitted to the applicable Records Liaison Officer for approval/concurrence.

D.2 Records Retention

D.2.1 Program/Project related records will be retained and dispositioned in accordance with NRRS 1441.1, schedule 8, items 101-113 and MPR 1440.2.

Note: Exactly which of those items (NRRS 8/101-113) are used depends on the program/project (see the descriptions in schedule 8 item 101).

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APPENDIX E

LIFE-CYCLE AND TECHNICAL REVIEWS

E.1 Overview:

This appendix provides an integrated programmatic and technical set of requirements, guidance, and best practices for entrance criteria, success criteria, and product maturity expectations (the change in product maturity as a result of the review including RIDs and/or RFAs) for each of the life-cycle and technical reviews. This appendix does not invoke nor define new requirements; instead it reflects requirements, guidance, and best practice already defined by an MPR or standard (such as MPR 7120.1 or MSFC-HDBK-3173) that should be addressed at each review. Each program/project/activity determines the appropriate review(s) and corresponding success and entrance criteria and communicates any requests for tailoring through the MPR process that controls that requirement.

This Appendix is organized by the program and project types indicated below:

- a. E.2 applies to Spaceflight Projects, Single-Project Programs, or activities supporting a Spaceflight Program.
- b. E.3 applies to Spaceflight Programs (e.g. Uncoupled/Loosely-Coupled, Tightly-Coupled, and Single-Project Programs, as applicable, for each review).
- c. E.4 applies to Research and Technology Programs/Projects (e.g., R&T Portfolio Projects/Activities, TD Projects/Activities or R&T Programs, as applicable, for each review).
- d. E.5 defines technical reviews potentially applicable to any program/project type and any phase of the life-cycle.

Assume the following for configuration controlled data as indicated in the entrance and success table:	
D	Rough draft version
P	Preliminary version
B/L	Baselined version
UPD	Update expected (data expected to evolve throughout formulation and implementation)
I	Initial version
F	Data is expected to exist in its final form
SUM	Summarizes results of previous review or some other process
Plan	Captures work planned for following phases
The following color code is used to specify where the expectation originates:	
Black Text or Standard Text	Agency Requirements
Red Text or Italics	Agency Guidance
Green Text or Standard Text Preceded by “**”	MSFC Additional Requirements
Blue Text or Italics Preceded by “**”	MSFC Additional Guidance/Best Practices

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Note: These tables are also available on the MIDL under the Templates link.

E. 2 Spaceflight Project and SPP Reviews

E.2.1 Project Mission Concept Review (MCR)

The Project MCR affirms the mission need and examines the proposed mission's objectives and the concept for meeting those objectives.

Project Mission Concept Review (MCR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>All planned higher-level MCRs and peer reviews have been successfully conducted and RID/RFAs and responses have been made to all review actions with the concurrence of the originators or a timely closure plan exists.</i> 2. <i>A preliminary MCR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the MCR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. B/L – FAD <i>*(Reference Data)</i> b. B/L – Program Plan <i>*(Reference Data)</i> c. B/L – Applicable Agency strategic goals <i>*(Reference Data)</i> d. P – Documentation of program-level requirements and constraints on the project (from the Program Plan) and stakeholder expectations, including mission objectives/goals and mission success criteria. <i>*(Reference Data)</i> e. P – Documentation of driving mission, technical, and programmatic ground rules and assumptions. <i>*(Reference Data)</i> f. P – Partnerships and Inter-Agency and international agreements. <i>*(Reference Data)</i> g. D – Technology readiness assessment documentation. <i>*Definition of any Technology required of the project, its TRL level, the approach to raise the TRL level and its criticality to the project with alternatives.</i> h. D – Engineering development assessment documentation i. D – Heritage assessment documentation. <i>*Identification of any heritage</i> 	<ol style="list-style-type: none"> 1. <i>Mission objectives are clearly defined and stated and are unambiguous and internally consistent.</i> 2. <i>The selected concept(s) satisfactorily meets the stakeholder expectations.</i> 3. <i>The mission is feasible. A concept has been identified that is technically feasible. A rough cost estimate is within an acceptable cost range.</i> 4. <i>The concept evaluation criteria to be used in candidate systems evaluation have been identified and prioritized.</i> 5. <i>The need for the mission has been clearly identified.</i> 6. <i>The cost and schedule estimates are credible and sufficient resources are available for project formulation.</i> 7. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 8. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 9. <i>Alternative concepts have adequately considered the use of existing assets or products that could satisfy the mission or parts of the mission.</i> 10. <i>Technical planning is sufficient to proceed to the next phase.</i> 11. <i>Risk and mitigation strategies have been identified and are acceptable based on technical risk assessments.</i> 12. <i>Software components meet the exit criteria defined in the NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Project Mission Concept Review (MCR)

Entrance Criteria:	Success Criteria:
<p><i>hardware/software proposed for use, pros/cons and plans for final decision.</i></p> <ul style="list-style-type: none"> j. D – Orbital Debris Assessment k. P – Formulation Agreement (for Phase A) l. D – Formulation Agreement (for Phase B) m. D – Project Plan <i>*(STD/MA-PRP)</i> n. D – Top technical, cost, schedule, and safety risks, risk mitigation plans and associated resources. o. D – Staffing requirements and plans, <i>*including disciplines/skill and plans to acquire the staffing including civil servants and/or contractors.</i> p. D – Infrastructure requirements and plans, business case analysis for infrastructure; Alternative Future Use Questionnaire. <i>*Definition of the facilities and environmental, aircraft, personal property, equipment, and information technology resources that are needed to support the project. Utilization of the capability afforded by the infrastructure includes consideration of the maintenance and other liabilities it presents.</i> q. D – Schedule (Risk informed at project level with preliminary Phase D completion ranges) <i>* STD/MA-IMS. (Software schedule included in IMS).</i> r. <i>*Project Level IMS with control milestones, critical paths to the next lower level.</i> s. D – Cost estimate (risk informed or schedule-adjusted depending on Phase) (Preliminary Range estimate) (Software Cost Estimate included in above costing data). t. D – BOE (cost and schedule) (Initial for range) u. Approach for managing schedule and cost during Phase A. (Not the plan, but documentation of high-level process) v. Approach for managing risks during Phase A. (Not the plan, but documentation of high-level process) w. D – Acquisition Plan (Preliminary Strategy) 	

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Project Mission Concept Review (MCR)

Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> x. P – Technology Development Plan (may be part of the FA) y. D – SEMP <i>*(STD/SE-SEMP)</i> z. V&V approach (Not the plan, but documentation of considerations that might impact cost and schedule baseline) aa. D – Review Plan bb. Approach for managing logistics. (Not the plan, but considerations that might impact cost and schedules baseline) cc. Integration approach (Not the plan, but considerations that might impact cost and schedule baseline) dd. Lessons Learned approach (Not the plan, but documentation of high-level process and approach for managing during Phase A.) ee. Preliminary approach for Human Rating Certification (Not the plan, but considerations that might impact cost and schedules baseline) <p>4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i></p> <ul style="list-style-type: none"> a. P – Stakeholder identification and expectations b. I – MoEs and mission success criteria c. I – Concept documentation <i>*(P – STD/SE-CONOPS). Documentation that captures and communicates a feasible concept that meets the goals and objectives of the mission including results of analyses of alternative concepts, the concept of operations, preliminary risks, and potential de-scope. It may include images, tabular data, graphs, and other descriptive material. The Concept of Operations should consider all aspects of operations including integration, test, ground operations, and launch through disposal, and typically includes a description of the major phases; operation timelines; operational scenarios; end-to-end communications strategy;</i> 	

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Project Mission Concept Review (MCR)	
Entrance Criteria:	Success Criteria:
<p><i>command and data architecture; operational facilities; integrated logistic support (resupply, maintenance, and assembly); and critical events.</i></p> <p><i>The operational scenarios describe the dynamic view of the systems' operations and include how the system is perceived to function throughout the various modes and mode transitions, including interactions with external interfaces</i></p> <p>d. D – Mission and spacecraft architecture <i>*(STD/SE-SARCH) Conceptual mission, vehicle and ground architectures showing interfaces, structure, relationships, principles, assumptions based on selected feasible concept.</i></p> <p>e. D – Project level requirements <i>*(STD/SE-REQSPEC) and (STD/SE-RT)</i> <i>Preliminary project-level requirements traceable to the Program/Agency goals and the program requirements and constraints.</i></p> <p>f. D – Operations Concept <i>*(Operations Planning)</i></p> <p>g. <i>Analysis of alternative concepts to show at least one is feasible.</i></p> <p>h. <i>Preliminary mission de-scope options.</i></p> <p>i. <i>Conceptual life-cycle support strategies (logistics, manufacturing, and operation).</i></p> <p>j. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i></p> <p>k. <i>*D – Software Maintenance Plan (STD/SW-SMP)</i></p>	

Project MCR Product Maturity Post Review
<p>Programmatic Products:</p> <p>a. I – Technology readiness assessment documentation</p> <p>b. I – Engineering development assessment documentation</p> <p>c. I – Heritage assessment documentation</p> <p>d. P – Orbital Debris Assessment</p> <p>e. B/L – Formulation Agreement (for Phase A)</p> <p>f. P – Formulation Agreement (for Phase B)</p> <p>g. P – Project Plan <i>*(STD/MA-PRP)</i></p>

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Project MCR Product Maturity Post Review	
<ul style="list-style-type: none"> h. I – Top technical, cost, schedule, and safety risks, risk mitigation plans and associated resources i. I – Staffing requirements and plans j. I – Infrastructure requirements and plans, business case analysis for infrastructure; Alternative Future Use Questionnaire (Form NF 1739), per NPR 9250.1 k. P – Schedule (Risk informed at project level with preliminary Phase D completion ranges) <i>*(STD/MA-IMS1 and STD/MA-IMS2) Schedule under data management control.</i> l. P – Cost estimate (risk informed or schedule-adjusted depending on Phase) (Preliminary Range estimate m. I – BOE (cost and schedule) (Initial for range) n. Approach for managing schedule and cost during Phase A. (Not the plan, but documentation of high-level process) o. Approach for managing risks during Phase A. (Not the plan, but documentation of high-level process) p. P – Acquisition Plan (Preliminary Strategy) q. B/L – Technology Development Plan (may be part of the FA) r. Approach for managing logistics. (Not the plan, but considerations that might impact cost and schedules baseline) s. Integration approach (Not the plan, but considerations that might impact cost and schedule baseline) t. Lessons Learned approach (Not the plan, but documentation of high-level process and approach for managing during Phase A.) u. Preliminary approach for Human Rating Certification (Not the plan, but considerations that might impact cost and schedules baseline) <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. B/L – Stakeholder identification and expectations <i>*(Document in the SEMP)</i> b. Approve – MoEs and mission success criteria <i>*(Document in the SEMP)</i> c. Approve – Concept documentation <i>*(B/L – STD/SE-CONOPS)</i> d. P – Mission and spacecraft architecture <i>*(STD/SE-SARCH)</i> e. P – Project level requirements <i>*(STD/SE-REQSPEC, STD/SE-RT)</i> f. P – Operations Concept <i>*(Operations Planning)</i> g. <i>*Data under data management control</i> h. <i>*D – Software Maintenance Plan (STD/SW-SMP)</i> i. P – SEMP <i>*(STD/SE-SEMP)</i> j. V&V approach (Not the plan, but documentation of considerations that might impact cost and schedule baseline) k. P – Review Plan 	

E.2.2 Project System Requirements Review (SRR)

The Project SRR examines the functional and performance requirements defined for the system, the preliminary project plan, and ensures that the requirements and the selected concept will satisfy the mission. This table is used for projects and single-project programs. Uncoupled, loosely coupled, and tightly coupled programs should use the tables for programs.

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Project System Requirements Review (SRR)

Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all higher level reviews, and responses has been made to all RID/RFAs or a timely closure plan exists.</i> 2. <i>A preliminary SRR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the SRR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. UPD – Applicable Agency strategic goals <i>*(Reference Data)</i> b. B/L – Documentation of program-level requirements and constraints on the project (from the Program Plan) and stakeholder expectations, including mission objectives/goals and mission success criteria. <i>*(Reference Data)</i> c. P – Documentation of driving mission, technical, and programmatic ground rules and assumptions. <i>*(Reference Data)</i> d. P – Partnerships and Inter-Agency and international agreements e. Final – ASM minutes <i>*(Reference Data)</i> f. Approved Terms of Reference (TOR) for SRB <i>*(Reference Data)</i> g. P – Project Plan <i>*(STD/MA-PRP)</i> h. Summary – Documentation of performance against FA or against plans for work to be accomplished during implementation phase, including performance against baseline and status/closure of formal actions from previous KDP. i. P – Schedule (Risk informed at system level with preliminary Phase E completion ranges) <i>*(STD/MA-IMS).</i> j. P – Cost estimate (risk informed or schedule-adjusted depending on Phase) k. D – Technical Schedule and Cost Control Plan l. P – SMA Plan <i>*(STD/SA-SSP, STD/RM-RMP)</i> m. P – Risk Management Plan <i>*(STD/MA-RMP, STD/RM-PRAP)</i> n. P – Acquisition Plan o. D – IT Plan 	<ol style="list-style-type: none"> 1. <i>The functional and performance requirements defined for the system are responsive to the parent requirements and represent achievable capabilities.</i> 2. <i>The maturity of the requirements definition and associated plans is sufficient to begin Phase B.</i> 3. <i>The project utilizes a sound process for the allocation and control of requirements throughout all levels, and a plan has been defined to complete the definition activity within schedule constraints.</i> 4. <i>Interfaces with external entities and between major internal elements have been identified.</i> 5. <i>Preliminary approaches have been determined for how requirements will be verified and validated.</i> 6. <i>Major risks have been identified and technically assessed, and viable mitigation strategies have been defined.</i> 7. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 8. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 9. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Project System Requirements Review (SRR)	
Entrance Criteria:	Success Criteria:
<p>p. D – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i></p> <p>q. D – Human Rating Certification Package</p> <p>r. <i>*D – Quality Plan (STD/QE-QP)</i></p> <p>4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i></p> <p>a. P – SEMP <i>*(STD/SE-SEMP)</i></p> <p>b. P – Project & system level requirements <i>*(STD/SE-REQSPEC, STD/SE-RT, STD/SE-RST, STD/ SE-IRD, STD/SE-ICD)</i> <i>Requirements definition and allocation, in the form of a system specification including requirements flow down. Software system requirements. Preliminary IRDs or ICDs. Mission and requirements analyses (includes mission operations activities, feasibility and utility analyses). System analyses and models, including performance and requirements analyses, technology/risk assessments, cost risk analyses and assessment.</i></p> <p>c. <i>*D – SW Requirements Specifications (STD/SW-SRS)</i></p> <p>d. P – Mission and spacecraft architecture <i>*(STD/SE SARCH)</i></p> <p>e. D – Ground and payload architecture <i>*(STD/SE-SARCH)</i></p> <p>f. P – Operations Concept <i>*(Operations Planning)</i></p> <p>g. P – CM Plan <i>*(STD/CM-CMP, STD/SW-SCMP)</i></p> <p>h. P – Review Plan</p> <p>i. <i>*P – Data Management Plan (STD/DM-DMP)</i></p> <p>j. <i>Updated risk assessment and mitigations (including Probabilistic Risk Assessment (PRA), as applicable</i></p> <p>k. <i>Initial document tree.</i></p> <p>l. <i>Verification and validation approach.</i></p> <p>m. <i>Preliminary hazard analysis (PHA).</i></p> <p>n. <i>Other specialty discipline analyses, as required</i></p> <p>o. <i>Preliminary MoPs and TPMs</i></p>	

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Project System Requirements Review (SRR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> p. <i>Human Systems Integration Plan (HSIP) ready to be baselined after review comments are incorporated</i> q. <i>*Preliminary Fracture Control Plan</i> r. <i>Software criteria and products, per the NASA- HDBK-2203, NASA Software Engineering Handbook</i> s. D – SW Management Plan <i>*(STD/SW- SDMP)</i> t. <i>*D – Software Data Dictionary (STD/SW- SWDD)</i> u. <i>*D – Software Assurance Plan (STD/QE- SAP)</i> 	

Project SRR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. UPD – Partnerships and Inter-Agency and international agreements b. UPD – Technology readiness assessment documentation c. UPD – Engineering development assessment documentation d. UPD – Heritage assessment documentation e. B/L – Project Plan <i>*(STD/MA-PRP)</i> f. Summary – Documentation of performance against FA or against plans for work to be accomplished during implementation phase, including performance against baseline and status/closure of formal actions from previous KDP. g. <i>*Planning of work and entry data requirements to SDR</i> h. UPD – Top technical, cost, schedule, and safety risks, risk mitigation plans and associated resources i. UPD – Staffing requirements and plans j. UPD – Infrastructure requirements and plans, business case analysis for infrastructure; Alternative Future Use Questionnaire (Form NF 1739) k. P – Schedule (Risk informed at system level with preliminary Phase E completion ranges) <i>*(STD/MA-IMS)</i> l. UPD – Cost estimate (risk informed or schedule-adjusted depending on Phase) m. UPD – BOE (cost and schedule) (Update for range) n. P – Technical Schedule and Cost Control Plan o. B/L – SMA Plan <i>*(STD/SA-SSP, STD/RM-RMP)</i> p. B/L – Risk Management Plan <i>*(STD/MA-RMP, STD/RM-PRAP)</i> q. B/L – Acquisition Plan r. UPD – Technology Development Plan s. P – IT Plan t. P – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> u. I – Human Rating Certification Package v. <i>*P – Quality Plan *(STD/QE-QP)</i>

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Project SRR Product Maturity Post Review	
Technical Products:	
<ul style="list-style-type: none"> a. B/L – SEMP <i>*(STD/SE-SEMP)</i> b. B/L – Project & system level requirements <i>*(STD/SE-REQSPEC, STD/SE-RT, STD/SE-RST, STD/ SE-IRD, STD/SE-ICD)</i> c. <i>*B/L – Software Requirements Specifications (STD/SW-SRS)</i> d. UPD – Concept documentation <i>*(STD/SE-CONOPS)</i> e. B/L – Mission and spacecraft architecture <i>*(STD/SE-SARCH)</i> f. P – Ground and payload architecture <i>*(STD/SE-SARCH)</i> Classify payload by risk g. P – Operations Concept <i>*(Operations Planning)</i> h. B/L – CM Plan <i>*(STD/CM-CMP) *(STD/SW-SCMP)</i> i. <i>*B/L – Data Management Plan *(STD/DM-DMP)</i> j. B/L – Review Plan k. <i>*B/L Fracture Control Plan</i> l. P – SW Management Plan <i>*(STD/SW-SDMP)</i> m. <i>*P – Software Data Dictionary (STD/SW-SWDD)</i> n. <i>*D – Software Assurance Plan (STD/QE-SAP)</i> 	

E.2.3 Project System Definition Review/Mission Design Review (SDR/MDR)

The Project SDR/MDR examines the proposed system architecture and design and the flow down to all functional elements of the system.

Project System Definition Review/Mission Design Review (SDR/MDR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all higher-level reviews, and responses has been made to all RID/RFAs or a timely closure plan exists.</i> 2. <i>A preliminary SDR/MDR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the SDR/MDR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. UPD – Applicable Agency strategic goals <i>*(Reference Data)</i> b. UPD – Documentation of program-level requirements and constraints on the project (from the Program Plan) and stakeholder expectations, including mission objectives/goals and mission success criteria. <i>*(Reference Data)</i> c. B/L – Documentation of driving mission, technical, and programmatic ground rules and assumptions. <i>*(Reference Data)</i> 	<ul style="list-style-type: none"> 1. <i>The proposed mission/system architecture is credible and responsive to program requirements and constraints, including resources.</i> 2. <i>The mission can likely be achieved within available resources with acceptable risk.</i> 3. <i>The project’s mission/system definition and associated plans are sufficiently mature to begin Phase B.</i> 4. <i>All technical requirements are allocated to the architectural elements.</i> 5. <i>The architectural tradeoffs are completed, and those planned for Phase B adequately address the option space.</i> 6. <i>Significant development, mission, and safety risks are identified and technically assessed, and a process and resources exist to manage the risks.</i> 7. <i>Adequate planning exists for the development of any enabling new technology.</i> 8. <i>The operations concept is consistent with proposed design concept(s) and is in alignment with the mission requirements.</i> 9. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i>

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Project System Definition Review/Mission Design Review (SDR/MDR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> d. P – Partnerships and Inter-Agency and international agreements e. D – Project Baselines f. D – Confidence Level(s) and supporting documentation (Preliminary cost confidence level & preliminary schedule confidence level) g. D – External Cost and Schedule Commitments (for ranges) h. D – CADRe i. P – Technical, Schedule, and Cost Control Plan <i>*(STD/MA-PRP)</i> j. P – IT Plan k. P – Environmental Management Plan l. D – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> m. D – Integration plan <i>*(STD/SE-IP)</i> n. D – Security Plan o. D – Project Protection Plan(if required) p. D – Export Control Plan q. D – Technology Transfer Control Plan (if required) r. D – Lessons Learned Plan s. D – Planetary Protection Plan (Planetary Protection Certification, if required) t. P – Nuclear Safety Launch Approval Plan (if mission has nuclear material) u. <i>*P – Quality Plan *(STD/QE-QP)</i> v. D – Education Plan w. D – Communication Plan 4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. P – Ground and payload architecture <i>*(STD/SE-SARCH)</i> b. D – Subsystem level requirements <i>*(STD/SE-REQSPEC, STD/SE-RT, STD/SE-RST, STD/SE-IRD, STD/SE-ICD)</i> c. <i>*P – Interface requirements documents (including software). Updated conceptual design data. Preliminary IRDs or ICDs</i> d. P – MoPs and TPMs e. Initial trending information on the mass margins (for projects involving hardware), 	<ul style="list-style-type: none"> 10. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 11. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Project System Definition Review/Mission Design Review (SDR/MDR)	
Entrance Criteria:	Success Criteria:
<p>power margins (for projects that are powered) and closure of review actions (RFA, RID, and/or Action Items)</p> <p>f. D – Design Documentation</p> <p>g. P – Operations Concept <i>*(Operations Planning)</i></p> <p>h. D – V&V Plan <i>*(STD/SE-VVPLAN)</i> <i>*(STD/SW-SDMP)</i></p> <p>i. <i>Initial technical resource utilization estimates and margins.</i></p> <p>j. <i>Updated risk assessment and mitigations (including Probabilistic Risk Assessment (PRA), as applicable)</i></p> <p>k. <i>Preliminary system safety analysis.</i></p> <p>l. <i>Other specialty discipline analyses, as required.</i></p> <p>m. <i>Updated Human Systems Integration Plan.</i></p> <p>n. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i></p> <p>o. P – SW Management Plan <i>*(STD/SW-SDMP, *(STD/QE-SAP)</i></p>	

Project SDR/MDR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <p>a. B/L – US partnerships and agreements</p> <p>b. UPD – Technology Readiness Assessment Documentation</p> <p>c. UPD – Engineering Development Assessment Documentation</p> <p>d. UPD – Heritage Assessment Documentation</p> <p>e. B/L – Formulation Agreement (for Phase B)</p> <p>f. UPD – Project Plan <i>*(STD/MA-PRP)</i></p> <p>g. Sum – Documentation of performance against Formulation Agreement OR against plans for work to be accomplished during Implementation life-cycle phase including performance against baselines</p> <p>h. <i>*Planning of work and entry data requirements to PDR</i></p> <p>i. P – Project Baselines</p> <p>j. UPD – Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources</p> <p>k. UPD – Staffing requirements and plans</p> <p>l. UPD – Infrastructure requirements and plans, business case analysis for infrastructure Alternative Future Use Questionnaire (Form NF 1739), per NPR 9250.1 (B/L for NF 1739, section A)</p> <p>m. P – Schedule (Risk informed at subsystem level with preliminary Phase D completion ranges. Preliminary IMS) <i>*(STD/MA-IMS).</i></p> <p>n. UPD – Cost estimate (risk informed schedule-adjusted range estimate)</p> <p>o. UPD – BOE (cost and schedule) (Update for range)</p>

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Project SDR/MDR Product Maturity Post Review	
<ul style="list-style-type: none"> p. P – Confidence Level(s) and supporting documentation (Preliminary cost confidence level & preliminary schedule confidence level) q. P – External Cost and Schedule Commitments (for ranges) r. P – CADRe s. B/L – Technical, Schedule, and Cost Control Plan <i>*(STD/MA-PRP)</i> t. UPD – SMA Plan <i>*(STD/SA-SSP, STD/RM-RMP)</i> u. UPD – Risk Management Plan <i>*(STD/MA-RMP, STD/RM-PRAP)</i> v. UPD – Acquisition Plan w. UPD – Technology Development Plan x. B/L – IT Plan y. B/L – Environmental Management Plan z. P – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> aa. P – Integration plan <i>*(STD/SE-IP)</i> bb. P – Security Plan cc. P – Project Protection Plan(if required) dd. P – Export Control Plan ee. P – Technology Transfer Control Plan (if required) ff. P – Lessons Learned Plan gg. UPD – Human Rating Certification Package hh. P – Planetary Protection Plan (Planetary Protection Certification, if required) ii. B/L Nuclear Safety Launch Approval Plan (if mission has nuclear material) jj. *P – Quality Plan <i>*(STD/QE-QP)</i> kk. P – Education ll. P – Communication Plan <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. UPD – Mission and spacecraft architecture <i>*(STD/SE-SARCH)</i> b. B/L – Ground and payload architecture <i>*(STD/SE-SARCH)</i> c. P– Subsystem level requirements <i>*(STD/SE-REQSPEC, STD/SE-RT, STD/SE-RST, STD/ SE-IRD, STD/SE-ICD)</i> d. UPD – SEMP <i>*(STD/SE-SEMP)</i> e. Approve – MoPs and TPMs f. Initial trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered) and closure of review actions (RFA, RID, and/or Action Items) g. UPD – Concept documentation <i>*(STD/SE-CONOPS)</i> h. UPD – Project & system level requirements (STD/SE-REQSPEC, STD/SE-RT, STD/SE-RST, STD/ SE-IRD, STD/SE-ICD) i. P – Design Documentation j. P – Operations Concept <i>*(Operations Planning)</i> k. P – V&V Plan <i>*(STD/SE-VVPLAN) *(STD/SW-SDMP)</i> l. UPD – CM Plan (STD/CM-CMP, STD/SW-SCMP) m. *UPD – Data Management Plan <i>*(STD/DM-DMP)</i> n. UPD – Review Plan o. B/L – SW Management Plan <i>*(STD/SW-SDMP, *STD/QE-SAP)</i> 	

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E.2.4 Project Preliminary Design Review (PDR)

The Project PDR demonstrates that the preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described.

Project Preliminary Design Review (PDR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all PDR RIDs or a timely closure plan exists.</i> 2. <i>A preliminary PDR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the PDR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. P – International agreements b. I – NEPA compliance documentation <i>*(Environmental assessments or Environmental Impact Statement)</i> c. <i>Plans to respond to regulatory requirements (e.g., Environmental Impact Statement), as required.</i> d. D – Mishap Preparedness and Contingency Plan e. P – Plans for work to be accomplished during next implementation life-cycle phase <i>*with CDR data products defined</i> f. D – Safety Data Package (safety analyses and plans) <i>*which should include (but not limited to):</i> <ol style="list-style-type: none"> i. <i>*Hazard analyses</i> ii. <i>*Preliminary FMEA/CIL</i> g. D – ELV Payload Safety Process Deliverable h. D – Orbital Debris Assessment (for preliminary design) i. P – Project baselines j. P – IMS (Risk informed and cost – or resource-loaded) <i>*(STD/MA-IMS).</i> k. P – Cost Estimate (Risk-informed & schedule-adjusted) l. P – Confidence Level(s) and supporting documentation (JCL) m. P – External Cost and Schedule Commitments 	<ol style="list-style-type: none"> 1. <i>Top-level requirements – including mission success criteria, TPMs, and any sponsor-imposed constraints – are agreed upon, finalized, stated clearly, and are consistent with the preliminary design.</i> 2. <i>The flow down of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to mission goals and objectives.</i> 3. <i>The program cost, schedule, and JCL analysis (when required) are credible and within program constraints and ready for NASA commitment.</i> 4. <i>The preliminary design is expected to meet the requirements at an acceptable level of risk.</i> 5. <i>Definition of the technical interfaces (both external entities and between internal elements) is consistent with the overall technical maturity and provides an acceptable level of risk.</i> 6. <i>Any required new technology has been developed to an adequate state of readiness, or back-up options exist and are supported to make them viable alternatives.</i> 7. <i>The project risks are understood and have been credibly assessed, and plans, a process, and resources exist to effectively manage them.</i> 8. <i>SMA (e.g., safety, reliability, maintainability, quality, and Electrical, Electronic, and Electromechanical (EEE) parts) have been adequately addressed in preliminary designs and any applicable SMA products (e.g., PRA, system safety analysis, and failure modes and effects analysis) meet requirements, are at the appropriate maturity level for this phase of the program’s life-cycle, and indicate that the program safety/reliability residual risks will be at an acceptable level.</i> 9. <i>Adequate technical and programmatic margins (e.g., mass, power, memory) and resources exist to complete the development within budget, schedule, and known risks.</i> 10. <i>The operational concept is technically sound, includes (where appropriate) human systems, and includes the flow down of requirements for its execution.</i> 11. <i>Technical trade studies are mostly complete to sufficient detail and remaining trade studies are</i>

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Project Preliminary Design Review (PDR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> n. P – CADRe o. P – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> p. D – Science Data Management Plan q. P – Integration plan <i>*(STD/SE-IP)</i> r. P – Security Plan s. P – Project Protection Plan t. <i>Decommissioning/Disposal plan</i> u. P – Export Control Plan v. P – Technology Transfer Control Plan (if required) w. P – Lessons Learned Plan x. P – Planetary Protection Plan y. D – Range Safety Risk Management Process Documentation z. <i>*P – Quality Plan *(STD/QE-QP)</i> aa. P – Education Plan bb. P – Communication Plan 4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. P – Design Documentation, <i>*which should include (but not limited to):</i> b. <i>*P – Design Drawings (10% maturity of top level and long lead items)</i> c. <i>*D – Software Interface Design Description (STD/SW-IDD)</i> d. <i>*D – Software Design Description (STD/SW-SDD)</i> e. <i>*(STD/SW-SDMP)</i> f. UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) g. P – Subsystem level requirements <i>*(STD/SE-REQSPEC, STD/SE-RT, STD/SE-RST, STD/SE-IRD, STD/SE-ICD)</i>, <i>which should include (but not limited to):</i> <ul style="list-style-type: none"> i. <i>*UPD – Requirements flow down (update)</i> ii. <i>*P – GSE requirements</i> h. P – Operations Concept <i>*(Operations Planning)</i> i. P – V&V Plan <i>*(STD/SE-VVPLAN)</i> j. <i>Applicable technical plans (e.g., technical performance measurement plan, contamination control plan, parts</i> 	<ul style="list-style-type: none"> <i>identified, plans exist for their closure, and potential impacts are understood.</i> 12. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 13. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 14. <i>Preliminary analysis of the primary subsystems has been completed and summarized, highlighting performance and design margin challenges.</i> 15. <i>Appropriate modeling and analytical results are available and have been considered in the design.</i> 16. <i>Heritage designs have been suitably assessed for applicability and appropriateness.</i> 17. <i>Manufacturability has been adequately included in design.</i> 18. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Project Preliminary Design Review (PDR)	
Entrance Criteria:	Success Criteria:
<p><i>management plan, environments control plan, Electromagnetic Interference (EMI)/ EMC control plan, payload-to-carrier integration plan, producibility/manufacturability program plan, reliability program plan, quality assurance plan)</i></p> <p>k. <i>*P – Integrated Test plan</i></p> <p>l. <i>*Draft – Software Test Plan (STD/SW-STP)</i></p> <p>m. <i>*UPD – Fracture Control Plan, Manufacturing and Assembly Plan</i></p> <p>n. <i>*Flow diagrams</i></p> <p>o. <i>*WBS and Dictionary</i></p> <p>p. <i>*Part I CEI update</i></p> <p>q. <i>*Preliminary strength and fracture mechanics analyses</i></p> <p>r. <i>*Proof of concept engineering analyses</i></p> <p>s. <i>Applicable standards.</i></p> <p>t. <i>Preliminary Engineering drawing tree.</i></p> <p>u. <i>Interface control documents.</i></p> <p>v. <i>Updated technical resource utilization estimates/margins.</i></p> <p>w. <i>UPD – Risk assessment and mitigation</i></p> <p>x. <i>Updated Human Systems Integration Plan.</i></p> <p>y. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i></p>	

Project PDR Product Maturity Post Review
<p>Programmatic Products:</p> <p>a. UPD – Documentation of program-level requirements and constraints on the project (from the Program Plan) and stakeholder expectations, including mission objectives/goals</p> <p>b. UPD – Documentation of driving mission, technical, and programmatic ground rules and assumptions</p> <p>c. B/L – International Agreements (Update US agreements, as required)</p> <p>d. Final – NEPA compliance documentation <i>*(Environmental assessments or Environmental Impact Statement)</i></p> <p>e. P – Mishap Preparedness and Contingency Plan</p> <p>f. UPD – Technology Readiness Assessment Documentation</p> <p>g. UPD – Engineering Development Assessment Documentation</p> <p>h. UPD – Heritage Assessment Documentation</p> <p>i. P – Safety Data Package (safety analyses and plans)</p> <p>i. <i>*Hazard analyses</i></p> <p>ii. <i>*Preliminary FMEA/CIL</i></p> <p>j. P – ELV Payload Safety Process Deliverables</p> <p>k. P – Orbital Debris Assessment (for preliminary design)</p> <p>l. UPD – Project Plan <i>*(STD/MA-PRP)</i></p> <p>m. B/L for Phase C – Plans for work to be accomplished during next implementation life-cycle phase <i>*with CDR data products defined</i></p> <p>n. Summary – Documentation of performance against FA or against plans for work to be accomplished during implementation phase, including performance against baselines and status/closure of formal actions from previous KDP.</p> <p>o. B/L – Project baselines</p>

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Project PDR Product Maturity Post Review		
<ul style="list-style-type: none"> p. UPD – Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources q. UPD – Staffing requirements and plans r. UPD – Infrastructure requirements and plans, business case analysis for infrastructure Alternative Future Use Questionnaire (Form NF 1739), per NPR 9250.1 (B/L for NF 1739, section B) s. B/L – IMS (Risk informed and cost – or resource-loaded) <i>*(STD/MA-IMS.)</i> t. B/L – Cost Estimate (Risk-informed & schedule-adjusted) u. UPD – Basis of Estimate (Update for cost and schedule estimate) v. B/L – Confidence Level(s) and supporting documentation (Joint cost and schedule confidence level (JCL)) w. B/L – External Cost and Schedule Commitments x. B/L – CADRe y. UPD – Technical, Schedule, and Cost Control Plan <i>*(STD/MA-PRP)</i> z. UPD – SMA Plan <i>*(STD/SA-SSP, STD/RM-RMP)</i> aa. UPD – Risk Management Plan <i>*(STD/MA-RMP, STD/RM-PRAP)</i> bb. UPD – Acquisition Plan cc. UPD – Technology Development Plan dd. UPD – IT Plan ee. B/L – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> ff. P – Science Data Management Plan gg. B/L – Integration plan <i>*(STD/SE-IP)</i> hh. B/L – Security Plan ii. B/L – Project Protection Plan jj. B/L – Export Control Plan kk. B/L – Technology Transfer Control Plan (if required) ll. B/L – Lessons Learned Plan mm. UPD – Human Rating Certification Package nn. B/L – Planetary Protection Plan oo. P – Range Safety Risk Management Process Documentation pp. <i>*B/L – Quality Plan *(STD/QE-QP)</i> qq. B/L – Education Plan rr. B/L – Communication Plan <p>Technical Products:</p> <ul style="list-style-type: none"> a. B/L – Preliminary Design Documentation b. <i>*P – design drawings</i> c. <i>*P – Software Interface Design Description (STD/SW-IDD)</i> d. <i>*P – Software Design Description (STD/SW-SDD)</i> e. UPD – SW Management Plan <i>*(STD/SW-SDMP) *(STD/QE-SAP)</i> f. UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) g. UPD – Concept documentation <i>*(STD/SE-CONOPS)</i> h. UPD – Mission, spacecraft, ground, and payload architecture <i>*(STD/SE-SARCH)</i> i. UPD – Project & system level requirements <i>*(STD/SE-REQSPEC, STD/SE-RT, STD/SE-RST, STD/ SE-IRD, STD/SE-ICD)</i> j. B/L– Subsystem level requirements (STD/SE-REQSPEC, STD/SE-RT, STD/SE-RST, STD/ SE-IRD, STD/SE-ICD) k. <i>*Requirements flow down (update)</i> l. <i>*Preliminary launch site requirements</i> m. B/L – Operations Concept (<i>Operations Planning</i>) n. UPD– SEMP <i>*(STD/SE-SEMP)</i> o. B/L – V&V Plan <i>*(STD/SE-VVPLAN) *(STD/SW-SDMP)</i> p. UPD – CM Plan <i>*(STD/CM-CMP) *(STD/SW-SCMP)</i> q. <i>*UPD – Data Management Plan *(STD/DM-DMP)</i> r. UPD – Review Plan s. <i>*Preliminary Integrated Test plan</i> 		

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Project PDR Product Maturity Post Review	
<ul style="list-style-type: none"> t. *P – Software test Plan (STD/SW-STP) u. *UPD – Fracture Control Plan v. *Manufacturing and Assembly Plan w. *UPD <ul style="list-style-type: none"> i. ICDs ii. Flow diagrams iii. WBS and Dictionary x. *B/L – Part I CEI update y. *P – Strength and fracture mechanics analyses z. *Final – Proof of concept engineering analyses 	

E.2.5 Project Critical Design Review (CDR)

The Project CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and test. CDR determines that the technical effort is on track to complete the flight and ground system development and mission operations to meet mission performance requirements within the identified cost and schedule constraints.

Project Critical Design Review (CDR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all CDR RIDs or a timely closure plan exists.</i> 2. <i>A preliminary CDR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the CDR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. P – Safety Data Package b. D – ELV Payload Safety Process Deliverables c. D – Orbital Debris Assessment (for detailed design) d. <i>Updated cost and schedule data.</i> e. <i>Disposal Plan (including decommissioning or termination).</i> f. D – Range Safety Risk Management Process Documentation 4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. P – Detailed Design Documentation <ol style="list-style-type: none"> i) <i>*Design drawings (90% maturity)</i> ii) <i>*P – Software Design Description (STD/SW-SDD)</i> b. Updated trending information on the mass margins (for projects involving hardware), 	<ol style="list-style-type: none"> 1. <i>The detailed design is expected to meet the requirements with adequate margins at an acceptable level of risk.</i> 2. <i>Interface control documents are appropriately matured to proceed with fabrication, assembly, integration and test, and plans are in place to manage any open items.</i> 3. <i>The program cost and schedule estimates are credible and within program constraints.</i> 4. <i>High confidence exists in the product baseline, and adequate documentation exists and/or will exist in a timely manner to allow proceeding with fabrication, assembly, integration, and test.</i> 5. <i>The product verification and product validation requirements and plans are complete.</i> 6. <i>The testing approach is comprehensive, and the planning for system assembly, integration, test, and launch site and mission operations is sufficient to progress into the next phase.</i> 7. <i>Adequate technical and programmatic margins (e.g., mass, power, memory) and resources exist to complete the development within budget, schedule, and known risks.</i> 8. <i>Risks to mission success are understood and credibly assessed, and plans and resources exist to effectively manage them.</i> 9. <i>Safety and Mission Assurance (SMA) (e.g., safety, reliability, maintainability, quality, and EEE parts) have been adequately addressed in system and operational designs and any applicable SMA</i>

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Project Critical Design Review (CDR)	
Entrance Criteria:	Success Criteria:
<p>power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items)</p> <p>c. <i>Product build-to specifications for each hardware and software configuration item, along with supporting trade-off analyses and data.</i></p> <p>d. <i>Fabrication, assembly, integration, and test plans and procedures.</i></p> <p>e. <i>Technical Data Package (e.g., Integrated Schematics, Spares Provisioning List, Interface Control Documents, engineering analyses, specifications).</i></p> <p>f. <i>Operational Limits and Constraints.</i></p> <p>g. <i>Updated Technical Resource Utilization estimates and margins.</i></p> <p>h. <i>Acceptance Criteria.</i></p> <p>i. <i>Command and Telemetry List.</i></p> <p>j. <i>Launch Site Operations Plan.</i></p> <p>k. <i>Checkout and Activation Plan</i></p> <p>l. <i>Updated Human Systems Integration Plan (HSIP).</i></p> <p>m. <i>Update reliability analyses and assessments</i></p> <p>n. <i>Updated logistics documentation.</i></p> <p>o. <i>Subsystem-level and preliminary operations hazards analyses.</i></p> <p>p. <i>Systems and subsystem certification plans and requirements (as needed).</i></p> <p>q. <i>System safety analysis with associated verifications.</i></p> <p>r. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i></p> <p>s. <i>*P – Software Interface Description (STD/SW-IDD)</i></p> <p>t. <i>*P – Software Requirements Specifications (STD/SW-SRS)</i></p> <p>u. <i>*P – Software Test Plan (STD/SW-STP)</i></p> <p>v. <i>*P – Software Test Procedure (STD/SW-STPR)</i></p> <p>w. <i>*P – Software Data Dictionary (STD/SW-SWDD)</i></p>	<p><i>products (e.g., PRA, system safety analysis, and failure modes and effects analysis) meet requirements, are at the appropriate maturity level for this phase of the program's life-cycle, and indicate that the program safety/reliability residual risks will be at an acceptable level.</i></p> <p>10. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i></p> <p>11. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i></p> <p>12. <i>Engineering test units, life test units, and/or modeling and simulations have been developed and tested per plan.</i></p> <p>13. <i>Material properties tests are completed along with analyses of loads, stress, fracture control, contamination generation, etc.</i></p> <p>14. <i>EEE parts have been selected, and planned testing and delivery will support build schedules.</i></p> <p>15. <i>The operational concept has matured, is at a CDR level of detail, and has been considered in test planning.</i></p> <p>16. <i>Manufacturability has been adequately included in design.</i></p> <p>17. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i></p>

Project CDR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <p>a. UPD – Documentation of driving mission, technical, and programmatic ground rules and assumptions</p> <p>b. UPD – Technology Readiness Assessment Documentation</p> <p>c. B/L – Safety Data Package</p> <p>d. P – ELV Payload Safety Process Deliverables</p> <p>e. P – Orbital Debris Assessment (for detailed design)</p>

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Project CDR Product Maturity Post Review	
<ul style="list-style-type: none"> f. Summary – Documentation of performance against FA or against plans for work to be accomplished during implementation phase, including performance against baselines and status/closure of formal actions from previous KDP. g. UPD – Project baselines h. UPD – Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources i. UPD – Staffing requirements and plans j. UPD – Infrastructure requirements and plans, business case analysis for infrastructure Alternative Future Use Questionnaire (Form NF 1739) k. UPD – IMS (STD/MA-IMS) l. UPD – Cost Estimate m. UPD – Basis of Estimate (cost and schedule) n. UPD – CADRe o. UPD – SMA Plan (STD/SA-SSP, STD/RM-RMP) p. UPD – Integrated Logistics Support Plan (STD/LS-ILSP) q. UPD – Integration plan (STD/SE-IP) r. UPD – Project Protection Plan(if required) s. UPD – Export Control Plan t. UPD – Technology Transfer Control Plan (if required) u. UPD – Lessons Learned Plan v. UPD– Human Rating Certification Package w. P – Range Safety Risk Management Process Documentation x. <i>*UPD – Quality Plan *(STD/QE-QP)</i> y. UPD – Education Plan z. UPD – Communication Plan <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. B/L – Detailed Design Documentation <ul style="list-style-type: none"> i. <i>*B/L – Design drawings (90% maturity), Detail design specifications, Subsystem description document</i> ii. <i>*BL – Software Design Description (STD/SW-SDD)</i> b. Updated trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) c. UPD – V&V Plan (STD/SE-VVPLAN, STD/SW-SDMP) d. <i>*Fracture Control Plan (updated)</i> e. <i>*Strength and fracture mechanics analysis</i> f. <i>*Preliminary Handling, Transportation, and Storage Plan/requirements</i> g. <i>*Payload Operations Control Center (POCC) data requirements</i> h. <i>*Launch Site Support Plan (Payloads) requirements</i> i. <i>*Preliminary integrated payload safety compliance data.</i> j. <i>*FMEA/CIL. Safety analyses/risk assessments. Hazard analyses.</i> k. <i>*UPD – Integration procedures</i> l. <i>*Preliminary test results</i> m. <i>*BL – Software Interface Description (STD/SW-IDD)</i> n. <i>*BL – Software Requirements Specifications (STD/SW-SRS)</i> o. <i>*BL – Software Test Plan (STD/SW-STP)</i> p. <i>*BL – Software Test Procedure (STD/SW-STPR)</i> q. <i>*BL – Software Data Dictionary (STD/SW-SWDD)</i> 	

E.2.6 Project Production Readiness Review (PRR)

The Project PRR is held for projects developing or acquiring multiple or similar systems greater than three or as determined by the project. The PRR determines the readiness of the system developers to efficiently produce the required number of systems. It ensures that the production plans; fabrication, assembly, and integration enabling products; and personnel are in place and

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ready to begin production.

Project Production Readiness Review (PRR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>The significant production engineering problems encountered during development and non-conformances are resolved.</i> 2. <i>The design documentation needed to support production is available.</i> 3. <i>The production plans and preparation to begin fabrication are developed.</i> 4. <i>The production enabling products are ready.</i> 5. <i>Resources are available, have been allocated, and are ready to support end product production.</i> 6. <i>Updated costs and schedules.</i> 7. <i>Risks have been identified, credibly assessed, and characterized, and mitigation efforts have been defined.</i> 8. <i>The bill of materials is available and critical parts identified.</i> 9. <i>Delivery schedules are available.</i> 10. <i>In-process inspections have been identified and planned.</i> 11. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook</i> 	<ol style="list-style-type: none"> 1. <i>High confidence exists that the system requirements will be met in the final production configuration.</i> 2. <i>Adequate resources are in place to support production.</i> 3. <i>The program cost and schedule estimates are credible and within program constraints</i> 4. <i>Design-for-manufacturing considerations ensure ease and efficiency of production and assembly.</i> 5. <i>The product is deemed manufacturable. Evidence is provided that the program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 6. <i>TBD and TBR items are clearly identified, with acceptable plans and schedule for their disposition. Alternate sources for resources have been identified for key items.</i> 7. <i>Adequate spares have been planned and budgeted.</i> 8. <i>Required facilities and tools are sufficient for end product production.</i> 9. <i>Specified special tools and test equipment are available in proper quantities.</i> 10. <i>Production and support staff are qualified.</i> 11. <i>Drawings and/or production models are approved/certified.</i> 12. <i>Production engineering and planning are sufficiently mature for cost-effective production.</i> 13. <i>Production processes and methods are consistent with quality requirements and compliant with occupational health and safety, environmental, and energy conservation regulations.</i> 14. <i>Qualified suppliers are available for materials that are to be procured.</i> 15. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

Project PRR Product Maturity Post Review:
None

E.2.7 Project Systems Integration Review (SIR)

The SIR ensures that the system is ready, or on schedule, to be integrated. Segments, components, and subsystems are available and ready, or on schedule, to be integrated into the system. Integration facilities, support personnel, and integration plans and procedures are ready, or on schedule, for integration.

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Project Systems Integration Review (SIR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all SIR RID/RFA's or a timely closure plan exists.</i> 2. <i>A preliminary SIR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the SIR.</i> 3. <i>Integration procedures have been identified and are scheduled for completion prior to their need dates.</i> 4. <i>Segments and/or components are on schedule to be available for integration.</i> 5. <i>Mechanical and electrical interfaces for hardware necessary to start system integration have been verified against the interface control documentation and plans for verification of remaining hardware exist.</i> 6. <i>All applicable functional, unit-level, subsystem, and qualification testing has been conducted successfully or is on track to be conducted prior to scheduled integration.</i> 7. <i>Integration facilities, including clean rooms, ground support equipment, handling fixtures, overhead cranes, and electrical test equipment, are ready and available.</i> 8. <i>Support personnel have been trained.</i> 9. <i>Handling and safety requirements have been documented.</i> 10. <i>All known system discrepancies have been identified, dispositioned, and are on schedule for closure.</i> 11. <i>The quality control organization is ready to support the integration effort.</i> 12. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. P – Mishap Preparedness and Contingency Plan b. P – ELV Payload Safety Process Deliverables c. <i>Preliminary decommissioning and disposal plans.</i> d. D – Mission Operations Plan <i>*(STD/OP-MoP, STD/OP-MOR, STD/OP-ESTR, STD/OP-MOIP, STD/OP-TSP, STD/OP-TSRD)</i> e. UPD – Integration plan <i>*(STD/SE-IP)</i> f. P – Range Safety Risk Management Process Documentation 13. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> 	<ol style="list-style-type: none"> 1. <i>Integration plans and procedures are on track for approval to support system integration.</i> 2. <i>Previous component, subsystem, system test results form a satisfactory basis for proceeding to integration.</i> 3. <i>The program cost and schedule estimates are credible and within program constraints.</i> 4. <i>Risk are identified and accepted by program/project leadership as required.</i> 5. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 6. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their dispositions.</i> 7. <i>The integration procedures and work flow have been clearly defined and documented or are on schedule to be clearly defined and documented prior to their need date.</i> 8. <i>The review of the integration plans, as well as the procedures, environment, and the configuration of the items to be integrated, provides a reasonable expectation that the integration will precede successfully.</i> 9. <i>Integration personnel have received appropriate training in the integration and health and safety procedures.</i> 10. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Project Systems Integration Review (SIR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> a. Updated trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) b. Preliminary Verification and Validation results from any lower tier products that have been verified. c. D – Operations Handbook <i>*(STD/OP-ODH)</i> d. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i> e. <i>*P – assembly and installation drawings</i> f. <i>*P – interface schematics</i> g. <i>*P – ground integration requirements.</i> h. <i>*P – Integrated System Verification Plan (with verification success criteria)</i> i. <i>*D – Handling, Transportation, and Storage Plan</i> j. <i>*Payload Operations Control Center (POCC) data requirements</i> k. <i>*Launch Site Support Plan (Payloads) requirements</i> l. <i>*P – Integrated payload safety compliance data.</i> 	

Project SIR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. UPD – Documentation of driving mission, technical, and programmatic ground rules and assumptions b. UPD – Mishap Preparedness and Contingency Plan c. UPD – Safety Data Package d. B/L– ELV Payload Safety Process Deliverables e. B/L for Phase D – Plans for work to be accomplished during next implementation life-cycle phase f. Summary – Documentation of performance against FA or against plans for work to be accomplished during implementation phase, including performance against baselines and status/closure of formal actions from previous KDP. g. UPD – Project baselines h. UPD – Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources i. UPD – IMS <i>*(STD/MA-IMS)</i> j. UPD – Cost Estimate k. UPD – Basis of Estimate (cost and schedule) l. P – Mission Operations Plan <i>*(STD/OP-MoP, STD/OP-MOR, STD/OP-ESTR, STD/OP-MOIP, STD/OP-TSP, STD/OP-TSRD)</i> m. UPD – Integration plan <i>*(STD/SE-IP)</i> n. UPD – Project Protection Plan (if required) o. B/L – Range Safety Risk Management Process Documentation <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. Updated trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) b. P – Verification/Validation results from any lower tier products that have been verified. c. UPD – Design Documentation

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Project SIR Product Maturity Post Review	
<ul style="list-style-type: none"> d. P – Operations Handbook (<i>STD/OP-ODH</i>) e. UPD – V&V Plan <i>*(STD/SE-VVPLAN) *(STD/SW-SDMP)</i> f. <i>*B/L assembly and installation drawings.</i> g. <i>*B/L interface schematics</i> h. <i>*B/L – ground integration requirements.</i> i. <i>*B/L – Integrated System Verification Plan (with verification success criteria)</i> j. <i>*P – Handling, Transportation, and Storage Plan</i> k. <i>*Payload Operations Control Center (POCC) data base</i> l. <i>*Launch Site Support Plan (Payloads)</i> m. <i>*B/L – integrated payload safety compliance data.</i> 	

E.2.8 Project Design Certification Review (DCR)

The DCR ensures that the qualification verifications demonstrate CI design compliance with the functional and performance requirements (hardware and software).

Project Design Certification Review (DCR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> 1. <i>*Successful completion of CI DCR.</i> 2. <i>*Summary of findings from DCRs conducted on lower level assemblies (if done).</i> 3. <i>*A preliminary DCR agenda, plan, success criteria, and charge to the board have been agreed to by the technical team, PM, and DCR review board chair prior to the DCR.</i> 4. <i>*The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. <i>Documentation of as-built configuration versus as-designed configuration (equivalent to a PCA). (STD/CM-AD)</i> b. <i>Documentation demonstrating CI compliance to functional and performance requirements, including verification /validation requirements (equivalent to a FCA). (STD/CM-AD).</i> c. <i>Summary of the CI design.</i> d. <i>*CDR pre-board/board briefing and RID status.</i> e. <i>Hardware changes since CDR.</i> f. <i>*Findings from DCRs conducted on lower-level assemblies (if done).</i> g. <i>Baselined V&V plan and requirements (including success criteria) (Reference Data).</i> h. <i>Safety and Reliability Assessment Package including Hazard Analyses; PRA; FMEA/CIL; Risk Assessments.</i> i. <i>Problems encountered during fabrication, assembly, and verification.</i> j. <i>Waivers and deviations.</i> k. <i>Material Usage Agreements (MUAs).</i> l. <i>Flight and ground test software.</i> 	<ul style="list-style-type: none"> 1. <i>*Verification results satisfy functional and performance requirements.</i> 2. <i>*The pedigrees of the test articles directly traceable to the production unit.</i> 3. <i>*Test procedures and environments used comply with those specified in design to specification.</i> 4. <i>*Design changes in the CI resulting from the verification process (as run – test, etc.) have been incorporated and/or appropriately addressed (successfully retested as required).</i> 5. <i>*Verify the approach is compliant with requirements relative to SMA and reliability.</i> 6. <i>*All issues and concerns raised during the DCR process are documented, discussed and provided with a plan for resolution and implementation.</i>

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Project Design Certification Review (DCR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> m. <i>Preliminary Handling, Transportation, and Storage Plan</i> n. <i>Any other documentation included in the DCR Plan, such as:</i> <ul style="list-style-type: none"> i. <i>ICDs.</i> ii. <i>Configuration Control Board Directives (CCBDs).</i> iii. <i>Drawings/EOs.</i> iv. <i>Certificate of Configuration Compliance (CoCC).</i> v. <i>Design requirements (including requirements, manufacturing records, traceability).</i> vi. <i>Verification/validation reports (STD/SE-VVREP)</i> <i>*Verification/validation compliance (STD/SE-VVC)</i> vii. <i>Verification/validation procedures (STD/SE-VVPROC)</i> viii. <i>Open Work List</i> ix. <i>Engineering analyses</i> x. <i>Non-conformance reports/status</i> xi. <i>Certification of Qualification (CoQs)</i> xii. <i>Vendors' Certification of Flight Worthiness (CoFW)</i> xiii. <i>Mission constraints</i> xiv. <i>All software development documentation</i> xv. <i>Fracture Control Plan</i> xvi. <i>Strength and fracture mechanics for as-built hardware</i> 	

Project DCR Product Maturity Post Review:
<u>Programmatic Products:</u> None
<u>Primary & Other technical products:</u> <ul style="list-style-type: none"> a. <i>*CoQs</i> b. <i>*Vendors CoFW</i> c. <i>*B/L – Handling, Transportation, and Storage Plan</i>

E.2.9 Project System Acceptance Review (SAR)

The SAR verifies the completeness of the specific end item products in relation to their expected maturity level and to assess compliance to stakeholder expectations. The SAR examines the system, its end items and documentation, and test data and analyses that support verification. It also ensures that the system has sufficient technical maturity to authorize its shipment to the designated operational facility or launch site.

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Project System Acceptance Review (SAR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>The project has successfully completed the previous planned milestone reviews, RFA/RIDs have been closed, and plans to complete open work are defined.</i> 2. <i>A preliminary SAR agenda, success criteria, and instructions to the review team have been agreed to by the technical team, project manager, and review chair prior to the review</i> 3. <i>The following SAR technical products have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Results of the SARs conducted at the major suppliers</i> b. <i>Product verification results</i> c. <i>Product validation results</i> d. <i>Documentation that the delivered system complies with the established acceptance criteria</i> e. <i>Documentation that the system will perform properly in the expected operational environment</i> f. <i>Technical data package that has been updated to include all test results</i> g. <i>Final certification package</i> h. <i>Baselined as-built hardware and software documentation</i> i. <i>Updated risk assessment and mitigation</i> j. <i>Required safe shipping, handling, checkout, and operational plans and procedures</i> k. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook</i> 4. <i>*The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review: ADP which includes</i> <ol style="list-style-type: none"> a. <i>As-built configuration assembly and installation drawings</i> b. <i>Final Mass Properties Status Report including weight and balance sheets</i> c. <i>Baselined interface schematic drawings</i> d. <i>Phase III Safety Compliance Data Package (ISS payloads) which includes the final experiment safety package cover sheet, and complete hazard reports with supporting data</i> e. <i>As-built certification data on Safety Critical Structures Data Package</i> f. <i>Requirements traceability</i> g. <i>Verification/validation reports (STD/SE-VVREP)</i> 	<ol style="list-style-type: none"> 1. <i>Required tests and analyses are complete and indicate that the system will perform properly in the expected operational environment.</i> 2. <i>Risks are known and manageable.</i> 3. <i>System meets the established acceptance criteria.</i> 4. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 5. <i>TBD and TBR items are resolved.</i> 6. <i>Technical data package is complete and reflects the delivered system.</i> 7. <i>All applicable lessons learned for organizational improvement and system operations are captured.</i> 8. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Project System Acceptance Review (SAR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> h. <i>Verification/validation compliance (STD/SE-VVC)</i> i. <i>Verification/validation procedures (STD/SE-VVPROC)</i> <i>Update of pointing and control dynamics data requirements document</i> j. <i>Open Items List which includes any open verification/validation tasks and/or open hazard reports and:</i> k. <i>Verification/validation critique (e.g., as-built flight hardware vs. design requirements vs. verification/validation plan) and results</i> l. <i>Critique of as-built flight hardware vs. safety hazard sheets</i> m. <i>Any design, safety, verification and/or operations issues not included in ADP</i> n. <i>Open Work List that identifies and describes any work planned for completion before shipment to the integration/launch site but was actually not completed. It also includes any work or test previously planned to be performed at the integration/launch site. These items are categorized as follows:</i> <ul style="list-style-type: none"> i. <i>To be performed before shipment</i> ii. <i>To be performed at the integration/ launch site</i> o. <i>Off-line/after turnover to the integration/launch site</i> p. <i>Status and discussion of all:</i> <ul style="list-style-type: none"> i. <i>Waivers/Deviations/Engineering Change Requests (ECRs)</i> ii. <i>MUAs</i> iii. <i>Hardware modifications (planned/proposed)</i> iv. <i>Phase-down/phase-up plans</i> v. <i>Open RIDs/ Discrepancy Notices DNs)</i> vi. <i>All Alerts</i> q. <i>Response to any MSFC design and operations issues, Open Items List and identification of additional items.</i> r. <i>After the above documentation review is completed, there will be a physical inspection of the hardware.</i> s. <i>This inspection will be to verify:</i> <ul style="list-style-type: none"> i. <i>Completeness</i> ii. <i>Interface safety requirements satisfied by inspection</i> iii. <i>Pre-Ship configuration versus Flight configuration</i> t. <i>*P – Software User Manual (STD/SW-SUM)</i> u. <i>*P – Software Test Report (STD/SW-STR)</i> 	

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Project SAR Product Maturity Post Review
<u>Programmatic Products:</u> None
<u>Technical Products:</u> <i>*Upon successful completion of all activities, a certificate of acceptance is signed by the Project Manager.</i>
a. <i>*BL – Software User Manual (STD/SW-SUM)</i>
b. <i>*F – Software Test Report (STD/SW-STR)</i>

E.2.10 Project Operational Readiness Review (ORR)

The ORR examines the actual system characteristics and the procedures used in the system or end product’s operation, and it ensures that all system and support (flight and ground) hardware, software, personnel, procedures, and user documentation accurately reflect the deployed state of the system.

Project Operational Readiness Review (ORR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all ORR RID/RFAs or a timely closure plan exists.</i> 2. <i>A preliminary ORR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the ORR.</i> 3. <i>All planned ground based testing has been completed *except launch site activities.</i> 4. <i>Test failures and anomalies from verification and validation testing have been resolved and the results/mitigations/workarounds have been incorporated into all supporting and enabling operational products.</i> 5. <i>All operational supporting and enabling products (e.g., facilities, equipment, documents, software tools, databases) that are necessary for the nominal and contingency operations have been tested and delivered/ installed at the site(s) necessary to support operations.</i> 6. <i>Operations documentation (handbook, procedures, etc.) has been written, verified, and approved.</i> 7. <i>Users/operators have been trained on the correct operation of the system.</i> 8. <i>Operational contingency planning has been completed, and operations personnel have been trained on their use.</i> 9. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> 	<ol style="list-style-type: none"> 1. <i>The system, including any enabling products, is determined to be ready to be placed in an operational status.</i> 2. <i>All applicable lessons learned for organizational improvement and systems operations have been captured.</i> 3. <i>All waivers and anomalies have been closed.</i> 4. <i>Systems hardware, software, personnel, and procedures are in place to support operations.</i> 5. <i>Operations plans and schedules are consistent with mission objectives.</i> 6. <i>Mission risks have been identified, planned mitigations are adequate, and residual risks are accepted by the program/project manager.</i> 7. <i>Testing is consistent with the expected operational environment.</i> 8. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 9. <i>TBD and TBR items are resolved.</i> 10. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Project Operational Readiness Review (ORR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> a. P – Mission Operations Plan <i>*(STD/OP-MoP, STD/OP-MOR, STD/OP-ESTR, STD/OP-MOIP, STD/OP-TSP, STD/OP-TSRD)</i> b. P – Science Data Management Plan c. <i>Preliminary decommissioning plan.</i> 10. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. Updated operations plans. b. Updated operational procedures. c. D – Verification/Validation Reports <i>*(STD/SE-VVREP)</i> d. <i>*D – Verification/Validation Compliance Assessment (STD/SE-VVC)</i> e. P – Operations Handbook <i>*(STD/OP-ODH)</i> f. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i> g. <i>*P – Operations and Integration Agreements/facility support agreements (STD/OP-OMM)</i> h. <i>*P – Flight Definition Document (ISS Payloads)</i> i. <i>*P – flight supplement payload operations guidelines (ISS payloads)</i> j. <i>*P – flight planning</i> k. <i>*P – flight operations support</i> l. <i>*P – Integrated Training Plan</i> m. <i>*P – payload/vehicle data processing requirements</i> n. <i>*D – Payload FDF</i> o. <i>*P – ground data system data base</i> p. <i>*P – Data Flow and Data Configuration Document</i> q. <i>*P – Post-flight Evaluation Plan.</i> r. <i>*P – Launch Facility Agreements and operations flows</i> s. <i>*Ground integration requirements (Ref)</i> t. <i>*Integrated System Verification Plan (with verification success criteria) (Ref)</i> u. <i>*Assembly and installation drawings (Ref)</i> v. <i>*Interface schematics (Ref)</i> 	

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Project Operational Readiness Review (ORR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> w. <i>*Integrated payload safety compliance data (Ref)</i> x. <i>*Payload Operations Control Center (POCC) data base</i> y. <i>*Launch Site Support Plan (including Payloads)</i> 	

Project ORR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. Summary – Documentation of performance against FA or against plans for work to be accomplished during implementation phase, including performance against baselines and status/closure of formal actions from previous KDP. b. UPD – Project baselines c. UPD – Safety Data Packages d. UPD – Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources e. UPD – Staffing requirements and plans f. UPD – Schedule (IMS) <i>*(STD/MA-IMS)</i> g. UPD – Cost Estimate h. UPD – Basis of Estimate (cost and schedule) i. <i>Preliminary decommissioning plan.</i> j. <i>P – Disposal Plan</i> k. B/L – Mission Operations Plan <i>*(STD/OP-MoP, STD/OP-MOR, STD/OP-ESTR, STD/OP-MOIP, STD/OP-TSP, STD/OP-TSRD)</i> l. B/L – Science Data Management Plan m. UPD – Project Protection Plan n. UPD – Human Rating Certification Package o. UPD – Education Plan p. UPD – Communication Plan <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. Updated operations plans. b. Updated operational procedures. c. P – Verification/Validation Reports <i>*(STD/SE-VVREP)</i> d. <i>*P – Verification/Validation Compliance Assessment (STD/SE-VVC)</i> e. B/L – Operations Handbook <i>(STD/OP-ODH)</i> f. <i>Updated as-built hardware and software documentation</i> g. <i>Preliminary certification for flight/use</i> h. <i>*B/L – Operations and Integration Agreements/facility support agreements (STD/OP-OMM)</i> i. <i>*B/L – Flight Definition Document (ISS Payloads)</i> j. <i>*B/L – flight supplement payload operations guidelines (ISS payloads)</i> k. <i>*B/L – flight planning</i> l. <i>*B/L – flight operations support</i> m. <i>*B/L-Integrated Training Plan (STD/OP-MOIP)</i> n. <i>*B/L – payload/vehicle data processing requirements</i>

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Project ORR Product Maturity Post Review	
<ul style="list-style-type: none"> o. <i>*P – Payload FDF</i> p. <i>*B/L – ground data system data base</i> q. <i>*B/L – Data Flow and Data Configuration Document</i> r. <i>*B/L – Post-flight Evaluation Plan.</i> s. <i>*B/L – Launch Facility Agreements and operations flows</i> t. <i>*Payload Operations Control Center (POCC) data base is correct & up to date.</i> u. <i>*Launch Site Support Plan (including Payloads) is complete.</i> v. <i>*Huntsville Operations Support Center (HOSC) database (launch vehicles)</i> 	

E.2.11 Project Flight Readiness Review/Mission Readiness Review (FRR/MRR)

The FRR/MRR examines tests, demonstrations, analyses, and audits that determine the system’s readiness for a safe and successful flight or launch and for subsequent flight operations. It also ensures that all flight and ground hardware, software, personnel, and procedures are operationally ready.

Project Flight Readiness Review/Mission Readiness Review (FRR/MRR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all FRR/MRR RID/RFAs or a timely closure plan exists.</i> 2. <i>A preliminary FRR/MRR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the FRR/MRR.</i> 3. <i>The system and support elements are ready and have been confirmed as properly configured for flight.</i> 4. <i>System and support element interfaces have been demonstrated to function as expected.</i> 5. <i>The system state supports a lunch “go” decision based on based on the established go/no go criteria.</i> 6. <i>Flights failures and anomalies from previous completed flights and reviews have been resolved and the results/mitigations/workarounds have been incorporated into supporting and enabling operational products.</i> 7. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>P – Mishap Preparedness and Contingency Plan (SMSR)</i> b. <i>Updated Orbital Debris Assessment per NPR 8715.6 (SMSR)</i> c. <i>P – End of Mission Plan per NPR 8715.6/NASA STD 8719.14 App B. (SMSR).</i> 	<ol style="list-style-type: none"> 1. <i>The flight vehicle is ready for flight.</i> 2. <i>The hardware is deemed acceptably safe for flight.</i> 3. <i>Certification that flight operations can safely proceed with acceptable risk has been achieved.</i> 4. <i>Flight and ground software elements are ready to support flight and flight operations.</i> 5. <i>Interfaces have been checked and demonstrated to be functional.</i> 6. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 7. <i>TBD and TBR items are resolved.</i> 8. <i>Open items and waivers have been examined and residual risk from these is deemed to be acceptable.</i> 9. <i>The flight and recovery environmental factors are within constraints.</i> 10. <i>All open safety and mission risk items have been addressed, and the residual risk is deemed acceptable.</i> 11. <i>Supporting organizations are ready to support flight.</i> 12. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Project Flight Readiness Review/Mission Readiness Review (FRR/MRR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> d. P – Plans for work to be accomplished during next implementation life-cycle Phase (For Phase E) e. <i>Preliminary decommissioning plan</i> f. <i>P – Disposal Plan</i> g. Updated Human Rating Certification Package 8. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. <i>Final certification for flight use</i> b. P – Verification/Validation Reports <i>*(STD/SE-VVREP)</i> c. <i>*P – Verification/Validation Compliance Assessment (STD/SE-VVC)</i> d. P – Design Documentation (As built hardware and software) e. <i>Updated schedule</i> f. <i>Updated operations procedures</i> g. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook</i> h. <i>*Payloads FRR Phase I</i> <ul style="list-style-type: none"> i. <i>Recertification of interface requirements.</i> ii. <i>Confirmation that required hazard control verifications have been completed, all potential safety issues have been properly disposed, and management has advised of any open or residual safety risk issues.</i> iii. <i>Level I integration requirements have been defined.</i> iv. <i>Payload is ready for Level I integration.</i> v. <i>Payload ground integration requirements have been satisfied.</i> i. <i>*Payloads FRR Phase II commences at completion of Level I integration and ensures that the payload and the operations team are ready for flight.</i> <ul style="list-style-type: none"> i. <i>Recertification of interface requirements.</i> ii. <i>Confirmation that required hazard control verifications have been completed, all potential safety issues have been properly disposed, and management has advised of any open or residual safety risk issues.</i> iii. <i>Vehicle ground integration requirements have been satisfied.</i> iv. <i>Vehicle and facility operations teams are ready for flight.</i> 	

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<p>Project FRR/MRR Product Maturity Post Review</p> <p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. B/L – Mishap Preparedness and Contingency Plan (SMSR) b. UPD – Safety Data Packages c. FINAL – Orbital Debris Assessment per NPR8715.6 (SMSR) d. B/L – End of Mission Plan per NPR 8715.6/NASA STD 8719.14 App B. (SMSR). e. B/L for Phase E – Plans for work to be accomplished during next implementation life-cycle phase. f. Summary – Documentation of performance against FA or against plans for work to be accomplished during implementation phase, including performance against baselines and status/closure of formal actions from previous KDP. g. UPD – Project baselines h. UPD – Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources i. UPD – Cost Estimate j. UPD – Basis of Estimate (cost and schedule) k. UPD – CADRe l. <i>B/L – Disposal Plan</i> m. UPD – Safety And Mission Assurance Plan (SMSR) n. UPD – Mission Operations Plan <i>*(STD/OP-MoP, STD/OP-MOR, STD/OP-ESTR, STD/OP-MOIP, STD/OP-TSP, STD/OP-TSRD)</i> o. UPD – Science Data Management Plan p. UPD – Project Protection Plan q. Approve Certification – Human Rating Certification Package <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. <i>Final certification for flight/use</i> b. B/L – Verification/Validation Reports <i>*(STD/SE-VVREP)</i> c. <i>*B/L – Verification/Validation Compliance Assessment (STD/SE-VVC)</i> d. B/L – Design Documentation (As built hardware and software) e. UPD – Operations Handbook <i>*(STD/OP-ODH)</i> f. <i>*B/L – Payload Flight Data File (FDF)</i>
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E.2.12 Project Post Launch Assessment Review (PLAR)

The PLAR is a post-deployment evaluation of the readiness of the spacecraft systems to proceed with full-up, routine operations. The review evaluates the status, performance, and capabilities of the project evident from the flight operations experience since launch. Post launch assessment can also mean assessing readiness to transfer responsibility from the development organization to the operations organization. The review also evaluates the status of the project plans and the capability to conduct the mission with emphasis on near-term operations and mission-critical events. The PLAR is typically held after the early flight operations and initial checkout

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Project Post Launch Assessment Review (PLAR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>The launch and early operations performance, including (when appropriate) the early propulsive maneuver results, are available.</i> 2. <i>The observed spacecraft and science instrument performance including instrument calibration plans and status are available.</i> 3. <i>The launch vehicle performance assessment and mission implications including launch sequence assessment and launch operations experience with lessons learned are completed.</i> 4. <i>The mission operations and ground data system experience, including tracking and data acquisition support and spacecraft telemetry data analysis is available.</i> 5. <i>The mission operations organization including status of staffing, facilities, tools, and mission software (e.g., spacecraft analysis, sequencing) is available.</i> 6. <i>In-flight anomalies and the response taken, including any autonomous fault protection actions taken by the spacecraft, or any unexplained spacecraft telemetry including alarms are documented.</i> 7. <i>The need for significant changes to procedures, interface agreements, software, and staffing has been documented.</i> 8. <i>Documentation is updated, including any updates originating from the early operations experience.</i> 9. <i>Plans for post-launch development have been addressed.</i> 	<ol style="list-style-type: none"> 1. <i>The observed spacecraft and science payload performance agrees with prediction, or, if not, it is adequately understood such that future behavior can be predicted with confidence.</i> 2. <i>All anomalies have been adequately documented, and their impact on operations assessed. Further, anomalies impacting spacecraft health and safety or critical flight operations have been properly dispositioned.</i> 3. <i>The mission operations capabilities, including staffing and plans are adequate to accommodate the actual flight performance.</i> 4. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 5. <i>Open items, if any, on operations, identified as part of the ORR, have been satisfactorily disposed.</i>

Project PLAR Product Maturity Post Review
<i>*Post Launch Assessment Report</i>

E.2.13 Project Critical Event Readiness Review (CERR)

The CERR confirms the project’s readiness to execute the mission’s critical activities during flight operation.

Project Critical Event Readiness Review (CERR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Critical event/activity requirements and constraints have been identified.</i> 2. <i>Critical event/activity design and implementation are complete.</i> 3. <i>Critical event/activity testing is complete.</i> 4. <i>Critical event/activity operations planning, including contingencies, is complete.</i> 	<ol style="list-style-type: none"> 1. <i>The critical activity design complies with requirements. The preparation for the critical activity, including the verification and validation, is thorough.</i> 2. <i>The project (including all the systems, supporting services, and documentation) is ready to support the activity.</i> 3. <i>The requirements for the successful execution of the critical event(s) are complete and understood and</i>

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Project Critical Event Readiness Review (CERR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 5. <i>Operations personnel training for the critical event/activity has been conducted.</i> 6. <i>Critical event/activity sequence verification and validation is complete.</i> 7. <i>Flight system is healthy and capable of performing the critical event/activity.</i> 8. <i>Flight failures and anomalies from critical event/activity testing have been resolved, and the results/mitigations/workarounds have been incorporated into supporting and enabling operational products.</i> 9. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Final certification for critical event readiness.</i> b. <i>Updated operations procedures.</i> 	<ol style="list-style-type: none"> 4. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 5. <i>Any TBD and TBR items have been resolved.</i> 6. <i>All open risk items have been addressed and the residual risk is deemed acceptable.</i>

Project CERR Product Maturity Post Review
<i>*Approval to execute the Critical Event</i>

E.2.14 Project Post Flight Assessment Review (PFAR)

The PFAR evaluates the activities from the flight after recovery. The review identifies all anomalies that occurred during the flight and mission and determines the actions necessary to mitigate or resolve the anomalies for future flights.

Project Post Flight Assessment Review (PFAR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>All anomalies that occurred during the mission as well as during preflight testing, countdown, and ascent identified.</i> 2. <i>All flight and post-flight documentation applicable to future flights of the spacecraft or the design is available.</i> 3. <i>All planned activities to be performed post-flight have been completed.</i> 4. <i>Problem reports, corrective action requests, Post Flight Anomaly Records, and final post-flight documentation completed.</i> 5. <i>All post-flight hardware and flight data evaluation reports completed.</i> 6. <i>Plans for retaining assessment documentation and imaging have been made.</i> 	<ol style="list-style-type: none"> 1. <i>Formal final report documenting flight performance and recommendations for future missions is complete and adequate.</i> 2. <i>All anomalies have been adequately documented and dispositioned.</i> 3. <i>The impact of anomalies on future flight operations has been assessed and documented.</i> 4. <i>Reports and other documentation have been retained for performance comparison and trending.</i>

Project PFAR Product Maturity Post Review
<i>*Post flight Assessment Report</i>

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E.2.15 Project Decommissioning Review (DR)

The DR confirms the decision to terminate or decommission the system and assesses the readiness of the system for the safe decommissioning and disposal of system assets.

Project Decommissioning Review (DR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Requirements associated with decommissioning are defined.</i> 2. <i>Plans are in place for decommissioning, and any other removal from service activities.</i> 3. <i>Resources are in place to support and implement decommissioning.</i> 4. <i>Health, safety, environmental, and any other constraints have been identified.</i> 5. <i>Current system capabilities related to decommissioning are understood.</i> 6. <i>Off-nominal operations, all contributing events, conditions, and changes to the originally expected baseline have been considered and assessed.</i> 7. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>P for Phase F – Plans for work to be accomplished during next implementation life-cycle phase</i> b. <i>Updated cost</i> c. <i>Updated schedule</i> d. <i>P – Decommissioning Plan</i> e. <i>Updated disposal plan</i> 8. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review: none</i> 	<ol style="list-style-type: none"> 1. <i>The rationale for decommissioning is documented.</i> 2. <i>The decommissioning plan is complete, approved by appropriate management, and compliant with applicable Agency safety, environmental, and health regulations.</i> 3. <i>Operations plans for decommissioning, including contingencies, are complete and approved.</i> 4. <i>Adequate resources (schedule, budget, and staffing) have been identified and are available to successfully complete all decommissioning activities.</i> 5. <i>All required support systems for decommissioning are available.</i> 6. <i>All personnel have been properly trained for the nominal and contingency decommissioning procedures.</i> 7. <i>Safety, health, and environmental hazards have been identified and controls have been verified.</i> 8. <i>Risks associated with the decommissioning have been identified and adequately mitigated.</i> 9. <i>Residual risks have been accepted by the required management.</i> 10. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 11. <i>Any TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 12. <i>Plans for archival and subsequent analysis of mission data have been defined and approved, and arrangements have been finalized for the execution of such plans.</i> 13. <i>Plans for the capture and dissemination of appropriate lessons learned during the project life-cycle have been defined and approved.</i> 14. <i>Plans for transition of personnel have been defined and approved.</i>

Project DR Product Maturity Post Review
<p>Programmatic Products:</p> <ol style="list-style-type: none"> a. <i>UPD – Mishap Preparedness and Contingency Plan</i> b. <i>UPD – End of Mission Plans per NPR 8715.6/NASA STD 8719.14 App B. (Update annually)</i> c. <i>B/L for Phase F – Plans for work to be accomplished during next implementation life-cycle phase.</i>

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Project DR Product Maturity Post Review	
<ul style="list-style-type: none"> d. Summary – Documentation of performance against FA or against plans for work to be accomplished during implementation phase, including performance against baselines and status/closure of formal actions from previous KDP. e. UPD – Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources f. UPD – Cost Estimate g. <i>UPD – Schedule</i> h. UPD – Basis of Estimate (cost and schedule) i. UPD – CADRe j. B/L – Decommissioning Plan k. <i>UPD – Disposal Plan</i> l. UPD – SMA Plan m. UPD – Security Plan (Update annually) n. UPD – Project Protection Plan (Update annually) 	<p>Technical Products: none</p>

E.2.16 Project Disposal Readiness Review (DRR)

A DRR confirms the readiness for the final disposal of the system assets.

Project Disposal Readiness Review (DRR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> 1. <i>Requirements associated with disposal are defined.</i> 2. <i>Plans are in place for disposal and any other removal from service activities.</i> 3. <i>Resources are in place to support disposal.</i> 4. <i>Safety, environmental, health, and any other constraints are described.</i> 5. <i>Current system capabilities related to disposal are described and understood.</i> 6. <i>Off-nominal operations, all contributing events, conditions, and changes to the originally expected baseline have been considered and assessed.</i> 7. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. I – Mission Report b. <i>Updated cost</i> c. <i>Updated schedule</i> d. UPD – Disposal Plan 8. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review: none</i> 	<ul style="list-style-type: none"> 1. <i>The rationale for disposal is documented.</i> 2. <i>The disposal plan is complete, meets requirements, is approved by appropriate management, and is compliant with applicable Agency safety, environmental, and health regulations.</i> 3. <i>Operations plans for disposal, including contingencies, are complete and approved.</i> 4. <i>All required support systems for disposal are available.</i> 5. <i>All personnel have been properly trained for the nominal and contingency disposal procedures.</i> 6. <i>Safety, health, and environmental hazards have been identified, and controls have been verified.</i> 7. <i>Risks associated with the disposal have been identified and adequately mitigated.</i> 8. <i>Residual risks have been accepted by the required management.</i> 9. <i>If hardware is to be recovered from orbit:</i> <ul style="list-style-type: none"> a. <i>Return site activity plans have been defined and approved.</i> b. <i>Required facilities are available and meet requirements, including those for contamination control, if needed.</i> c. <i>Transportation plans are defined and approved.</i>

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Project Disposal Readiness Review (DRR)	
Entrance Criteria:	Success Criteria:
	<ul style="list-style-type: none"> <i>d. Shipping containers and handling equipment, as well as contamination and environmental control and monitoring devices, are available.</i> 10. <i>Plans for disposition of mission-owned assets (e.g., hardware, software, and facilities) have been defined and approved.</i> 11. <i>Adequate resources (schedule, budget, and staffing) have been identified and are available to successfully complete all disposal activities.</i> 12. <i>All mission and project data and documentation has been archived per disposal plan.</i> 13. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 14. <i>TBD and TBR items have all been dispositioned.</i>

Project DRR Product Maturity Post Review	
<u>Programmatic Products:</u>	
<ul style="list-style-type: none"> a. UPD – Mishap Preparedness and Contingency Plan b. UPD – End of Mission Plans per NPR 8715.6/NASA STD 8719.14 App B. c. Final – Mission Report d. UPD – Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources e. UPD – Cost Estimate f. <i>UPD – Schedule</i> g. UPD – Basis of Estimate (cost and schedule) h. UPD –Disposal Plan 	
<u>Technical Products:</u>	
none	

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E.3 Spaceflight Program Reviews

E.3.1 Program System Requirements Review (SRR)

The program SRR is used to ensure that the program requirements are properly formulated and correlated with the Agency and mission directorate strategic objectives. Uncoupled, loosely coupled, and tightly coupled programs should use the tables for programs. Single-project programs should use these program tables and also the tables for projects.

Program System Requirements Review (SRR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>The Program has successfully completed the MCR milestone review (if applicable), any higher level SRRs and responses have been made to all RFAs and RIDs, or a timely closure plan exists for those remaining open.</i> 2. <i>A preliminary Program SRR agenda, success criteria, and instructions to the review board have been agreed to by the technical team, the program manager, and the review chair prior to the Program SRR.</i> 3. <i>Top program risks with significant technical, health and safety, cost, and schedule impacts have been identified along with corresponding mitigation strategies.</i> 4. <i>An approach for verifying compliance with program requirements has been defined.</i> 5. <i>Procedures for controlling changes to program requirements have been defined and approved.</i> 6. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. B/L – Formulation Authorization Document (FAD) <i>has been approved. *(Reference Data)</i> b. Approved Terms of Reference (TOR) for SRB <i>*(Reference Data)</i> c. D – Program Plan d. P – Mission Directorate requirements and constraints on the program (including performance, health and safety, and defined interfaces to other programs) e. <i>*The high-level program requirements have been documented to include:</i> <ol style="list-style-type: none"> i. <i>performance</i> ii. <i>safety, and</i> iii. <i>programmatic requirements, consistent with the selected Conceptual design from the project MCR.</i> f. D – Traceability of program-level requirements on projects to the Agency 	<ol style="list-style-type: none"> 1. <i>Program requirements have been defined and support Mission Directorate strategic objectives.</i> 2. <i>The program requirements are adequately levied on either the single-program project or the multiple projects of the program.</i> 3. <i>Traceability of program requirements to individual projects is documented in accordance with Agency needs, goals, and objectives, as described in the NASA Strategic Plan.</i> 4. <i>Definition of interfaces with other programs is complete and approved.</i> 5. <i>The program cost and schedule estimates are credible to meet program requirements.</i> 6. <i>Top risk identification is complete and mitigation strategies appear reasonable.</i> 7. <i>Evidence is provided that the program is compliant with NASA and implementing Center requirements, standards, processes, and procedures.</i> 8. <i>To-be-determined (TBD) and to-be-resolved (TBR) items are clearly identified with acceptable plans and schedules for their disposition.</i>

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Program System Requirements Review (SRR)	
Entrance Criteria:	Success Criteria:
<p>strategic goals and Mission Directorate requirements and constraints</p> <ul style="list-style-type: none"> g. D – Documentation of driving ground rules and assumptions on the program h. D – Interagency and international agreements i. D – Risk mitigation plans and resources for significant risks j. D – Documented Cost and Schedule Baselines k. D – Documentation of Basis of Estimate (cost and schedule) l. D – Shared Infrastructure, Staffing, and Scarce Material Requirements and Plans m. Plans for work to be accomplished during next life-cycle Phase n. D – Technical, Schedule, and Cost Control Plan o. D – Safety and Mission Assurance (SMA) Plan <i>*(STD/SA-SSP, STD/RM-RMP)</i> p. D – Risk Management Plan <i>*(STD/MA-RMP, STD/RM-PRAP)</i> q. D – Acquisition Plan r. D – Technology Development Plan s. D – Information Technology (IT) Plan t. D – Lessons Learned Plan u. <i>*D – Integration plan (STD/SE-IP) including overall Program integration tasks: Integrated Analytical integration tasks; Physical Integration tasks and hardware/software integration.</i> <p><i>7. The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i></p> <ul style="list-style-type: none"> a. <i>*B/L– Con Ops (from projects’ MCRs) (STD/SE-CONOPS)</i> b. <i>*Results of the Analysis of Alternative concepts from the projects’ MCRs</i> c. D – Systems Engineering Management Plan (SEMP) <i>*(STD/SE-SEMP)</i> d. P – Review Plan e. D – Configuration Management (CM) Plan <i>*(STD/CM-CMP)</i> f. <i>*D – Data Management Plan (STD/DM-DMP)</i> 	

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Program System Requirements Review (SRR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> g. *D – Software Development Plan (STD/SW-SDMP) h. *D – Software Requirements Specification (STD/SW-SRS) i. *D – Software Data Dictionary (STD/SW-SWDD) j. *(STD/SW-SCMP) k. *D – Software Assurance Plan *(STD/QE-SAP) 	

Program SRR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. P – Program Plan b. B/L – Mission Directorate requirements and constraints on the program (including performance, health and safety, and defined interfaces to other programs) c. P – Traceability of program-level requirements on projects to the Agency strategic goals and Mission Directorate requirements and constraints d. P – Documentation of driving ground rules and assumptions e. P – Inter-Agency and international agreements f. I – Risk mitigation plans and resources for significant risks g. P – Documented Cost and Schedule Baselines h. P – Documentation of Basis of Estimate BOE (cost and schedule) i. I – Shared Infrastructure, Staffing, and Scarce Material Requirements and Plans j. Plans for work to be accomplished during next life-cycle Phase k. P – Technical, Schedule, and Cost Control Plan l. P – SMA Plan *(STD/SA-SSP, STD/RM-RMP) m. P-Risk Management Plan *(STD/MA-RMP, STD/RM-PRAP) n. P-Acquisition Plan o. P-Technology Development Plan p. P – IT Plan q. P – Lessons Learned Plan r. *P – <i>Integration plan (STD/SE-IP) including overall Program integration tasks: Integrated Analytical integration tasks; Physical Integration tasks and hardware/software integration.</i> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. *UPD– <i>Con Ops from projects (STD/SE-CONOPS)</i> b. P – SEMP *(STD/SE-SEMP) c. B/L – Review Plan d. P – CM Plan *(STD/CM-CMP) *(STD/SW-SCMP) e. *P – <i>Data Management Plan (STD/DM-DMP)</i> f. *P – <i>Software Development Plan (STD/SW-SDMP)</i> g. *P – <i>Software Requirements Specification (STD/SW-SRS)</i> h. *P – <i>Software Data Dictionary (STD/SW-SWDD)</i> i. *P – <i>Software Assurance Plan *(STD/QE-SAP)</i>

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E.3.2 Program System Definition Review (SDR)

The SDR examines the proposed program architecture and the flow down to the functional elements of the system. The proposed program's objectives and the concept for meeting those objectives are evaluated. Key technologies and other risks are identified and assessed. The baseline Program Plan, budgets, and schedules are presented. The technical team provides the technical content to support the Program SDR.

Program System Definition Review (SDR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>The Program has successfully completed previous milestone review (if applicable), any higher level SDRs and responses have been made to all RFAs and RIDs, or a timely closure plan exists for those remaining open.</i> 2. <i>A preliminary Program SDR agenda, success criteria, and instructions to the review board have been agreed to by the technical team, the program manager, and the review chair prior to the Program SDR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. Final – ASM minutes <i>*(Reference Data)</i> b. D – PCA c. P – Program Plan d. P – Traceability of program-level requirements on projects to the Agency strategic goals and Mission Directorate requirements and constraints e. P – Documentation of driving ground rules and assumptions on the program f. P – Inter-Agency and international agreements g. I – Risk mitigation plans and resources for significant risks h. P – Documented Cost and Schedule Baselines i. P – Documentation of Basis of Estimate (cost and schedule) j. D – Cost confidence level and schedule confidence level k. I – Shared infrastructure, staffing, and scarce material requirements and plans l. Documentation of Performance against plan/baseline, including status/closure of formal actions from previous KDP (Summary) 	<ol style="list-style-type: none"> 1. <i>Evidence is provided that the program formulation activities are complete and implementation plans are credible to meet mission success.</i> 2. <i>The program requirements address critical NASA needs as identified in the Mission Directorate strategic objectives.</i> 3. <i>The program cost and schedule estimates are credible to meet program requirements within available resources.</i> 4. <i>Program implementation plans are credible to achieve mission success.</i> 5. <i>The program risks have been identified and mitigation strategies appear reasonable.</i> 6. <i>Allocation of program requirements to projects has been completed and proposed projects are feasible within available resources.</i> 7. <i>The maturity of the program's definition and associated plans are sufficient to begin preliminary design.</i> 8. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 9. <i>TBD and TBR items are clearly identified with acceptable plans and schedules for their disposition.</i>

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Program System Definition Review (SDR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> m. P – Technical, Schedule, and Cost Control Plan n. P – SMA Plan <i>*(STD/SA-SSP, STD/RM-RMP)</i> o. P – Risk Management Plan <i>*(STD/MA-RMP, STD/RM-PRAP)</i> p. P – Acquisition Plan q. P – Technology Development Plan r. D – Product Data Life-Cycle Management (PDLM) Plan s. P – IT Plan t. D – Environmental Management Plan u. D – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> v. D – Security Plan w. D – Threat Summary x. D – Technology Transfer Control Plan (if Required) y. D – Export Control Plan z. D – Education Plan aa. D – Communications Plan bb. P – Lessons Learned Plan cc. <i>D – Integration plans *(STD/SE-IP)</i> 4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. P – Program architecture definition and a list of specific supporting projects b. P – Allocation of program requirements to the supporting projects c. D – Initial trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) d. P – SEMP including TPMs <i>*(STD/SE-SEMP)</i> e. P – CM Plan <i>*(STD/CM-CMP) *(STD/SW-SCMP)</i> f. D – Verification and Validation (V&V) Plan <i>*(STD/SE-VVPLAN) *(STD/SW-SDMP)</i> g. <i>*P – Data Management Plan (STD/DM-DMP)</i> h. <i>D – Interface definitions.</i> i. <i>D – Implementation plans.</i> 	

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Program System Definition Review (SDR)	
Entrance Criteria:	Success Criteria:
j. *P – Software Assurance Plan *(STD/QE-SAP)	

Program SDR Product Maturity Post Review	
<u>Programmatic Products:</u>	
<ul style="list-style-type: none"> a. P – PCA b. B/L Program Plan c. UPD – Mission Directorate requirements and constraints on the program d. B/L – Traceability of program-level requirements on projects to the Agency strategic goals and Mission Directorate requirements and constraints e. B/L – Documentation of driving ground rules and assumptions on the program f. B/L – Inter-Agency and international agreements g. UPD – Risk mitigation plans and resources for significant risks h. P – Documented Cost and Schedule Baselines i. P – Documentation of Basis of Estimate (cost and schedule) j. P – Cost confidence level and schedule confidence level k. UPD – Shared infrastructure, staffing, and scarce material requirements and plans l. Summary – Documentation of Performance against plan/baseline, including status/closure of formal actions from previous KDP m. B/L – Technical, Schedule, and Cost Control Plan n. B/L – SMA Plan *(STD/SA-SSP, STD/RM-RMP) o. B/L – Risk Management Plan *(STD/MA-RMP, STD/RM-PRAP) p. B/L – Acquisition Plan q. B/L – Technology Development Plan r. I – PDLM Plan s. B/L – IT Plan t. P – Environmental Management Plan u. P – Integrated Logistics Support Plan *(STD/LS-ILSP) v. P – Security Plan w. P – Threat Summary x. P – Technology Transfer Control Plan (if required) y. P – Export Control Plan z. P – Education Plan aa. P – Communications Plan bb. B/L – Lessons Learned Plan cc. <i>P – Integration plans</i> *(STD/SE-IP) 	
<u>Technical Products:</u>	
<ul style="list-style-type: none"> a. B/L – Program architecture & supporting projects b. B/L – Allocation of program requirements to projects c. I – Leading indicator trends d. B/L – SEMP including TPMs (STD/SE-SEMP) e. P – V&V Plan *(STD/SE-VVPLAN) *(STD/SW-SDMP) f. UPD – Review plan 	

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Program SDR Product Maturity Post Review	
<ul style="list-style-type: none"> g. B/L – CM Plan <i>*(STD/CM-CMP) *(STD/SW-SCMP)</i> h. <i>*B/L – Data Management Plan (STD/DM-DMP)</i> i. <i>P – Interface definitions.</i> j. <i>P – Implementation plans.</i> k. <i>*BL – Software Assurance Plan *(STD/QE-SAP)</i> 	

E.3.3 Program Implementation Review (PIR)/Program Status Review (PSR)

PIRs or PSRs are periodically conducted, as required by the Decision Authority, and documented in the program plan, during the Implementation phase to evaluate the program’s continuing relevance to the Agency’s Strategic Plan. These reviews assess the program performance with respect to expectations and determine the program’s ability to execute the implementation plan with acceptable risk within cost and schedule constraints.

Program Implementation Review (PIR)/ Program Status Review (PSR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> 1. <i>A preliminary PIR/PSR agenda, success criteria, and instructions to the review team have been agreed to by the technical team, PM, and review chair prior to the review.</i> 2. <i>The current status of the overall technical effort is available and ready to be reviewed.</i> 3. <i>Programmatic products are ready for review at the maturity levels stated in the governing program/project management NPR.</i> 4. <i>Current actual and estimated costs, including any Earned Value and JCL information, if applicable, are available and compared to the expected plan.</i> 5. <i>Current schedule is available showing remaining work planned.</i> 6. <i>Trending of the selected Technical Performance Parameters relevant to the current Program phase is available.</i> 7. <i>Updated technical plans are available.</i> 	<ul style="list-style-type: none"> 1. <i>Program still meets Agency needs and should continue.</i> 2. <i>The program cost and schedule estimates are credible and within program constraints.</i> 3. <i>Risks are identified and accepted by program/project leadership, as required.</i> 4. <i>Technical trends are within acceptable bounds.</i> 5. <i>Adequate progress has been made relative to plans, including the technology readiness levels.</i> 6. <i>Technologies have been identified that are ready to be transitioned to another project or to an organization outside the Agency.</i>

PIR/PSR Product Maturity Post Review
<u>Programmatic Products:</u> None
<u>Technical Products:</u> a. <i>*Documented discrepancies from PIR or PSR</i> b. <i>*PIR/PSR Report</i>

E.3.4 Program Preliminary Design Review (PDR)

The PDR demonstrates that the preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described.

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Program Preliminary Design Review (PDR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all PDR RIDs or a timely closure plan exists.</i> 2. <i>A preliminary PDR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the PDR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. P – PCA b. P – Documented Cost and Schedule Baselines c. P – Documentation of Basis of Estimate (cost and schedule) d. P – Cost confidence level and schedule confidence level e. P – Environmental Management Plan f. P – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> g. D – Science Data Management Plan h. P – Security Plan i. P – Threat Summary j. P – Technology Transfer Control Plan (if Required) k. P – Export Control Plan l. P – Education Plan m. P – Communications Plan n. <i>*Program-level Integration plan (STD/SE-IP) including:</i> <ol style="list-style-type: none"> o. <i>*P – Analytical Integration tasks results</i> p. <i>*D-. Physical Integration Plans (STD/SE-IP)</i> q. <i>*D – Hardware/software integration plans (STD/SE-IP)</i> r. <i>*Preliminary analytical integration data</i> s. <i>*Preliminary physical integration data.</i> t. <i>Preliminary Decommissioning and Disposal Plans.</i> 4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. Preliminary Design that meets requirements and key technical performance measures <ol style="list-style-type: none"> i. <i>*Preliminary Design maturity is 10% (top level and long lead items)</i> 	<ol style="list-style-type: none"> 1. <i>Top-level requirements – including mission success criteria, TPMs, and any sponsor-imposed constraints – are agreed upon, finalized, stated clearly, and are consistent with the preliminary design.</i> 2. <i>The flow down of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to mission goals and objectives.</i> 3. <i>The program cost, schedule, and JCL analysis (when required) are credible and within program constraints and ready for NASA commitment.</i> 4. <i>The preliminary design is expected to meet the requirements at an acceptable level of risk.</i> 5. <i>Definition of the technical interfaces (both external entities and between internal elements) is consistent with the overall technical maturity and provides an acceptable level of risk.</i> 6. <i>Any required new technology has been developed to an adequate state of readiness, or back-up options exist and are supported to make them viable alternatives.</i> 7. <i>The project risks are understood and have been credibly assessed, and plans, a process, and resources exist to effectively manage them.</i> 8. <i>SMA (e.g., safety, reliability, maintainability, quality, and Electrical, Electronic, and Electromechanical (EEE) parts) have been adequately addressed in preliminary designs and any applicable SMA products (e.g., PRA, system safety analysis, and failure modes and effects analysis) meet requirements, are at the appropriate maturity level for this phase of the program’s life-cycle, and indicate that the program safety/reliability residual risks will be at an acceptable level. .</i> 9. <i>Adequate technical and programmatic margins (e.g., mass, power, memory) and resources exist to complete the development within budget, schedule, and known risks.</i> 10. <i>The operational concept is technically sound, includes (where appropriate) human systems, and includes the flow down of requirements for its execution 11. Technical trade studies are mostly complete to sufficient detail and remaining trade studies are identified, plans exist for their closure, and potential impacts are understood.</i> 11. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 12. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i>

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Program Preliminary Design Review (PDR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> ii. <i>*P – Interface control documents (ICDs).</i> iii. <i>*Top-level Engineering Drawing Tree.</i> b. UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) c. P – V&V Plan <i>*(STD/SE-VVPLAN) *(STD/SW-SDMP)</i> d. P – CM Plan <i>*(STD/CM-CMP, STD/SW-SCMP)</i> e. <i>*Safety analyses and plans.</i> f. <i>*Integrated System-level safety analysis.</i> g. <i>*Integrated Hazard Analysis</i> h. <i>*Preliminary FEMA/CIL</i> i. <i>*Integrated Preliminary limited life items list (LLIL).</i> j. <i>*Development Plans</i> k. <i>*Preliminary Fabrication and Assembly Plan</i> l. <i>*GSE Plan</i> m. <i>*Preliminary Launch Site Requirements</i> n. <i>*Preliminary Integrated Test plan</i> o. <i>*Preliminary Fracture Control Plan</i> p. <i>*D – V&V Success Criteria (STD/SE-VVSC)</i> q. <i>*D – Software Interface Description (STD/SW-IDD)</i> r. <i>*D – Software Design description (STD/SW-SDD)</i> s. <i>*D – Software Test Plan (STD/SW-STP)</i> 	<ul style="list-style-type: none"> 13. <i>Preliminary analysis of the primary subsystems has been completed and summarized, highlighting performance and design margin challenges.</i> 14. <i>Appropriate modeling and analytical results are available and have been considered in the design.</i> 15. <i>Heritage designs have been suitably assessed for applicability and appropriateness.</i> 16. <i>Manufacturability has been adequately included in design.</i> 17. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i> 18. <i>*Program Integration Plan is compatible with project (s) planning and exchange of data is clearly understood. (STD/SE-IP).</i>

Program PDR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. B/L – PCA b. UPD – Program Plan c. UPD – Mission Directorate requirements and constraints d. UPD – Traceability of program-level requirements on projects to the Agency strategic goals and Mission Directorate requirements and constraints e. UPD – Documentation of driving ground rules and assumptions on the program f. UPD – Inter-Agency and international agreements g. UPD – Risk mitigation plans and resources for significant risks h. B/L – Documented Cost and Schedule Baselines i. B/L – Documentation of Basis of Estimate (cost and schedule)

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Program PDR Product Maturity Post Review	
<ul style="list-style-type: none"> j. B/L – Joint Confidence Level (JCL) and supporting documentation k. UPD – Shared Infrastructure, Staffing, and Scarce Material Requirements and Plans l. Summary – Documentation of Performance against plan/baseline, including status/closure of formal actions from previous KDP m. Plans for work to be accomplished during next life-cycle Phase n. UPD – Technical, Schedule, and Cost Control Plan o. UPD – SMA Plan <i>*(STD/SA-SSP, STD/RM-RMP)</i> p. UPD – Risk Management Plan <i>*(STD/MA-RMP, STD/RM-PRAP)</i> q. UPD – Acquisition Plan r. UPD – Technology Development Plan s. UPD Annually – PDLM Plan t. UPD – IT Plan u. B/L – Environmental Management Plan v. B/L – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> w. P – Science Data Management Plan x. B/L – Security Plan y. B/L – Threat Summary z. B/L – Technology Transfer Control Plan (if required) aa. B/L – Export Control Plan bb. B/L – Education Plan cc. B/L – Communications Plan dd. UPD – Lessons Learned Plan ee. <i>*Program-level Integration plan (STD/SE-IP) including:</i> ff. <i>*B/L – Analytical Integration tasks results</i> gg. <i>*P – Physical Integration Plans (STD/SE-IP)</i> hh. <i>*P – Hardware/software integration plans (STD/SE-IP)</i> <p>Technical Products:</p> <ul style="list-style-type: none"> a. B/L – Preliminary Design Documentation b. UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) c. UPD – SEMP <i>*(STD/SE-SEMP)</i> d. B/L – V&V Plan <i>*(STD/SE-VVPLAN) *(STD/SW-SDMP)</i> e. UPD – Review Plan f. UPD – CM Plan <i>*(STD/CM-CMP) *(STD/SW-SCMP)</i> g. <i>*UPD – Data Management Plan (STD/DM-DMP)</i> h. <i>*Baseline Launch Site Requirements</i> i. <i>*Baseline Integrated Test plan</i> j. <i>*Baseline Fracture Control Plan</i> k. <i>*P – V&V Success Criteria (STD/SE-VVSC)</i> l. <i>*P – Software Interface Description (STD/SW-IDD)</i> m. <i>*P – Software Design description (STD/SW-SDD)</i> n. <i>*P – Software Test Plan (STD/SW-STP)</i> 	

E.3.5 Program Critical Design Review (CDR)

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CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and test. CDR determines that the technical effort is on track to complete the flight and ground system development and mission operations to meet mission performance requirements within the identified cost and schedule constraints.

Program Critical Design Review (CDR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all CDR RIDs or a timely closure plan exists.</i> 2. <i>A preliminary CDR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the CDR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>*Program-level Integration plan (STD/SE-IP) including:</i> b. <i>*B/L – Analytical Integration tasks results</i> c. <i>*P – Physical Integration Plans (STD/SE-IP)</i> d. <i>*P – Hardware/software integration plans (STD/SE-IP)</i> e. <i>*Final Analytical integration data</i> f. <i>*Final physical integration data</i> g. <i>*Results of the hardware/software integration</i> h. <i>Disposal Plan (including decommissioning or termination).</i> 4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>B/L – Detailed Design that meets requirements and key technical performance measures.</i> <ol style="list-style-type: none"> i. <i>*Design maturity is 90%</i> ii. <i>*Design meets the performance and functional requirements</i> b. <i>UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items)</i> c. <i>Product build-to specifications for each hardware and software configuration item, along with supporting trade-off analyses and data.</i> 	<ol style="list-style-type: none"> 1. <i>The detailed design is expected to meet the requirements with adequate margins at an acceptable level of risk.</i> 2. <i>Interface control documents are appropriately matured to proceed with fabrication, assembly, integration and test, and plans are in place to manage any open items.</i> 3. <i>The program cost and schedule estimates are credible and within program constraints.</i> 4. <i>High confidence exists in the product baseline, and adequate documentation exists and/or will exist in a timely manner to allow proceeding with fabrication, assembly, integration, and test.</i> 5. <i>The product verification and product validation requirements and plans are complete.</i> 6. <i>The testing approach is comprehensive, and the planning for system assembly, integration, test, and launch site and mission operations is sufficient to progress into the next phase.</i> 7. <i>Adequate technical and programmatic margins (e.g., mass, power, memory) and resources exist to complete the development within budget, schedule, and known risks.</i> 8. <i>Risks to mission success are understood and credibly assessed, and plans and resources exist to effectively manage them.</i> 9. <i>Safety and Mission Assurance (SMA) (e.g., safety, reliability, maintainability, quality, and EEE parts) have been adequately addressed in system and operational designs and any applicable SMA products (e.g., PRA, system safety analysis, and failure modes and effects analysis) meet requirements, are at the appropriate maturity level for this phase of the program’s life-cycle, and indicate that the program safety/reliability residual risks will be at an acceptable level.</i> 10. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 11. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 12. <i>Engineering test units, life test units, and/or modeling and simulations have been developed and tested per plan.</i>

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Program Critical Design Review (CDR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> d. <i>Fabrication, assembly, integration, and test plans and procedures.</i> e. <i>Technical Data Package (e.g., Integrated Schematics, Spares Provisioning List, Interface Control Documents, engineering analyses, specifications).</i> f. <i>Operational Limits and Constraints.</i> g. <i>Updated Technical Resource Utilization estimates and margins.</i> h. <i>*System (hardware/software) Acceptance Criteria.</i> i. <i>Command and Telemetry List.</i> j. <i>Launch Site Operations Plan.</i> k. <i>Checkout and Activation Plan.</i> l. <i>Updated Technology Development Maturity Assessment Plan</i> m. <i>Updated risk assessment and mitigation.</i> n. <i>Updated Human Systems Integration Plan (HSIP).</i> o. <i>Update reliability analyses and assessments</i> p. <i>Updated cost and schedule data.</i> q. <i>Software Design Document(s) (including Interface Design Documents).</i> r. <i>Updated Limited Life Items List (LLIL).</i> s. <i>*Integrated program-level preliminary operations hazards analyses.</i> t. <i>*Integrated program-level system safety analysis with associated verifications.</i> u. <i>*Integrated program-level systems & subsystem certification plans & requirements (as needed)</i> v. <i>*Preliminary Handling, Transportation, and Storage Plan/requirements</i> w. <i>*Payload Operations Control Center (POCC) data requirements</i> x. <i>*Launch Site Support Plan (Payloads) requirements</i> y. <i>*Preliminary integrated payload safety compliance data.</i> z. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook</i> 	<ul style="list-style-type: none"> 13. <i>Material properties tests are completed along with analyses of loads, stress, fracture control, contamination generation, etc.</i> 14. <i>EEE parts have been selected, and planned testing and delivery will support build schedules.</i> 15. <i>The operational concept has matured, is at a CDR level of detail, and has been considered in test planning.</i> 16. <i>Manufacturability has been adequately included in design.</i> 17. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Program Critical Design Review (CDR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> aa. *P – Software Interface Design Description (STD/SW-IDD) bb. *P – Software Design Description (STD/SW-SDD) cc. *P – Software Requirements Specifications (STD/SW-SRS) dd. *P – Software Test Plan (STD/SW-STP) ee. *P – Software Test Procedures (STD/SW-STPR) ff. *P – Software Data Dictionary (STD/SW-SWDD) gg. *P – V&V Success Criteria (STD/SE-VVSC) 	

Program CDR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. UPD – Program Plan b. UPD – Documentation of driving ground rules and assumptions on the program c. UPD – Risk mitigation plans and resources for significant risks d. UPD – Documented Cost and Schedule Baselines e. UPD – Documentation of Basis of Estimate (Cost and Schedule) f. UPD – Shared Infrastructure, Staffing, and Scarce Material Requirements and Plans g. Summary – Documentation of Performance against plan/baseline, including status/closure of formal actions from previous KDP h. Plans for work to be accomplished during next life-cycle Phase i. UPD – Safety and Mission Assurance Plan <i>*(STD/SA-SSP, STD/RM-RMP)</i> j. UPD Annually – PDLM Plan k. UPD – Environmental Management Plan l. UPD – Integrated Logistics Support Plan <i>*(STD/LS-ILSP)</i> m. UPD – Threat Summary n. UPD – Technology Transfer Control Plan (if required) o. UPD – Export Control Plan p. UPD – Education Plan q. UPD – Communications Plan r. <i>*Program-Level Integration plan (STD/SE-IP) including:</i> s. <i>*UPD – Analytical Integration tasks results</i> t. <i>*B/L – Physical Integration Plans (STD/SE-IP)</i> u. <i>*B/L – Hardware/software integration plans (STD/SE-IP)</i> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. B/L – Detail Design Documentation b. UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) c. UPD – V&V Plan <i>*(STD/SE-VVPLAN, STD/SW-SDMP)</i>

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Program CDR Product Maturity Post Review	
<ul style="list-style-type: none"> d. <i>*B/L – V&V Success Criteria (STD/SE-VVSC) (B/L 90 days before the verification/validation activity begins)</i> e. <i>*BL – Software Interface Design Description (STD/SW-IDD)</i> f. <i>*BL – Software Design Description (STD/SW-SDD)</i> g. <i>*BL – Software Requirements Specifications (STD/SW-SRS)</i> h. <i>*BL – Software Test Plan (STD/SW-STP)</i> i. <i>*BL – Software Test Procedures (STD/SW-STPR)</i> j. <i>*BL – Software Data Dictionary (STD/SW-SWDD)</i> 	

E.3.6 Program Production Readiness Review (PRR)

The PRR is held for programs developing or acquiring multiple or similar systems greater than three or as determined by the program. The PRR determines the readiness of the system developers to efficiently produce the required number of systems. It ensures that the production plans; fabrication, assembly, and integration enabling products; and personnel are in place and ready to begin production.

Program Production Readiness Review (PRR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> 1. <i>The significant production engineering problems encountered during development and non-conformances are resolved.</i> 2. <i>The design documentation needed to support production is available.</i> 3. <i>The production plans and preparation to begin fabrication are developed.</i> 4. <i>The production enabling products are ready.</i> 5. <i>Resources are available, have been allocated, and are ready to support end product production.</i> 6. <i>Updated costs and schedules.</i> 7. <i>Risks have been identified, credibly assessed, and characterized, and mitigation efforts have been defined.</i> 8. <i>The bill of materials is available and critical parts identified.</i> 9. <i>Delivery schedules are available.</i> 10. <i>In-process inspections have been identified and planned.</i> 11. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook</i> 	<ul style="list-style-type: none"> 1. <i>High confidence exists that the system requirements will be met in the final production configuration...</i> 2. <i>Adequate resources are in place to support production.</i> 3. <i>The program cost and schedule estimates are credible and within program constraints</i> 4. <i>Design-for-manufacturing considerations ensure ease and efficiency of production and assembly.</i> 5. <i>The product is deemed manufacturable. Evidence is provided that the program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 6. <i>TBD and TBR items are clearly identified, with acceptable plans and schedule for their disposition. Alternate sources for resources have been identified for key items.</i> 7. <i>Adequate spares have been planned and budgeted.</i> 8. <i>Required facilities and tools are sufficient for end product production.</i> 9. <i>Specified special tools and test equipment are available in proper quantities.</i> 10. <i>Production and support staff are qualified.</i> 11. <i>Drawings and/or production models are approved/certified.</i> 12. <i>Production engineering and planning are sufficiently mature for cost-effective production.</i> 13. <i>Production processes and methods are consistent with quality requirements and compliant with occupational health and safety, environmental, and energy conservation regulations.</i>

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Program Production Readiness Review (PRR)	
Entrance Criteria:	Success Criteria:
	<ul style="list-style-type: none"> 14. <i>Qualified suppliers are available for materials that are to be procured.</i> 15. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook</i>

Program PRR Product Maturity Post Review:
None

E.3.7 Program System Integration Review (SIR)

The SIR ensures that the system is ready, or on schedule, to be integrated. Segments, components, and subsystems are available and ready, or on schedule, to be integrated into the system. Integration facilities, support personnel, and integration plans and procedures are ready, or on schedule, for integration.

Program System Integration Review (SIR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> 1. <i>The program has successfully completed the previous planned milestone reviews, including all lower level reviews, and responses have been made to all RFAs and RIDs or a timely closure plan exists for those remaining open.</i> 2. <i>A preliminary SIR agenda, success criteria, and instructions to the review board have been agreed to by the technical team, PM, and review chair prior to the SIR.</i> 3. <i>Integration procedures have been identified and are scheduled for completion prior to their need dates.</i> 4. <i>Segments and/or components are on schedule to be available for integration.</i> 5. <i>Mechanical and electrical interfaces for hardware necessary to start system integration have been verified against the interface control documentation and plans for verification of remaining hardware exist.</i> 6. <i>All applicable functional, unit-level, subsystem, and qualification testing has been conducted successfully or is on track to be conducted prior to scheduled integration.</i> 7. <i>Integration facilities, including clean rooms, ground support equipment, handling fixtures, overhead cranes, and electrical test equipment, are ready and available.</i> 8. <i>Support personnel have been trained.</i> 9. <i>Handling and safety requirements have been documented.</i> 	<ul style="list-style-type: none"> 1. <i>Integration plans and procedures are on track for approval to support system integration.</i> 2. <i>Previous component, subsystem, system test results form a satisfactory basis for proceeding to integration.</i> 3. <i>The program cost and schedule estimates are credible and within program constraints.</i> 4. <i>Risk are identified and accepted by program/project leadership as required.</i> 5. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 6. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their dispositions.</i> 7. <i>The integration procedures and work flow have been clearly defined and documented or are on schedule to be clearly defined and documented prior to their need date.</i> 8. <i>The review of the integration plans, as well as the procedures, environment, and the configuration of the items to be integrated, provides a reasonable expectation that the integration will precede successfully.</i> 9. <i>Integration personnel have received appropriate training in the integration and health and safety procedures.</i> 10. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Program System Integration Review (SIR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 10. <i>All known system discrepancies have been identified, dispositioned, and are on schedule for closure.</i> 11. <i>The quality control organization is ready to support the integration effort.</i> 12. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>D – Missions Operations Plan *(STD/OP-MoP)</i> b. <i>UPD – Integration plan *(STD/SE-IP)</i> c. <i>*Baselined Integrated Range Safety Risk Management Plan</i> d. <i>Preliminary decommissioning and disposal plans.</i> 13. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>*Baselined ground integration requirements</i> b. <i>Updated trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items)</i> c. <i>Preliminary Verification and Validation results from any lower tier products that have been verified.</i> d. <i>*Baselined/updated Launch Facility Agreements and operations flows</i> e. <i>*Baselined Integrated System Verification Plan</i> f. <i>*Verification success criteria</i> g. <i>*Baselined assembly and installation drawings</i> h. <i>*Baselined interface schematics</i> i. <i>*Preliminary Handling, Transportation, and Storage Plan</i> j. <i>*Payload Operations Control Center (POCC) data base</i> k. <i>*Launch Site Support Plan (Payloads)</i> l. <i>*Baselined integrated payload safety compliance data.</i> 	

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Program System Integration Review (SIR)	
Entrance Criteria:	Success Criteria:
m. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook</i>	

Program SIR Product Maturity Post Review	
Programmatic Products:	
<ul style="list-style-type: none"> a. UPD – Program Plan b. UPD – Documentation of driving ground rules and assumptions on the program c. UPD – Risk mitigation plans and resources for significant risks d. UPD – Documented Cost and Schedule Baselines e. UPD – Documentation of Basis of Estimate (Cost and Schedule) f. Summary – Documentation of performance against plan/baseline, including status/closure of formal actions from previous KDP g. UPD Annually – PDLM Plan h. P – Missions Operations Plan <i>*(STD/OP-MoP, STD/OP-MOR, STD/OP-ESTR, STD/OP-MOIP, STD/OP-TSP, STD/OP-TSRD)</i> i. UPD – Threat Summary j. <i>UPD – Integration Plan *(STD/SE-IP)</i> 	
Technical Products:	
<ul style="list-style-type: none"> a. UPD – Leading indicator trends b. P – Verification/Validation results from any lower tier products that have been verified. c. UPD – V&V Plan <i>*(STD/SE-VVPLAN) *(STD/SW-SDMP)</i> d. <i>*B/L – Assembly and installation drawings.</i> e. <i>*B/L – Interface schematics</i> 	

E.3.8 Program Design Certification Review (DCR)

The DCR ensures that the qualification verifications demonstrate CI design compliance with the functional and performance requirements (hardware and software).

Program Design Certification Review (DCR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>*Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all DCR RID/RFAs or a timely closure plan exists.</i> 2. <i>*A preliminary DCR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the DCR.</i> 3. <i>*The following DCR technical products, for both hardware and software system elements, have been made available to the cognizant participants prior to the review:</i> 	<ol style="list-style-type: none"> 1. <i>*Verification results satisfy functional and performance requirements.</i> 2. <i>*The pedigrees of the test articles directly traceable to the production unit.</i> 3. <i>*Test procedures and environments used comply with those specified in design to specification.</i> 4. <i>*Design changes in the CI resulting from the verification process (as run – test, etc.) have been incorporated and/or appropriately addressed (successfully retested as required).</i> 5. <i>*Verify the approach is compliant with requirements relative to SMA and reliability.</i>

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Program Design Certification Review (DCR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> a. <i>Documentation of as-verified configuration versus as-designed configuration (equivalent to a Physical Configuration Audit [PCA]) (STD/CM-AD).</i> b. <i>Documentation demonstrating project(s) compliance to functional and performance requirements, including verification requirements (equivalent to a Functional Configuration Audit [FCA]) (STD/CM-AD).</i> c. <i>Summary of the final project designs</i> d. <i>Hardware changes since CDR.</i> e. <i>Verification Plan and requirements (including success criteria).</i> f. <i>Safety and Reliability Assessment Package including Hazard analyses, Probabilistic Risk Assessment, Reliability Prediction, Failure Modes and Effects Analysis, Critical Item List, and Risk Assessments.</i> g. <i>Problems encountered during fabrication, assembly, and verification.</i> h. <i>Waivers and deviations.</i> i. <i>Materials Usage Agreement (MUA)</i> j. <i>Flight and ground test software.</i> k. <i>Any other documentation included in the DCR Plan.</i> l. <i>Preliminary Handling, Transportation, and Storage Plan</i> m. <i>ICDs</i> n. <i>Configuration Control Board Directives (CCBDs)</i> o. <i>Drawings/Engineering Orders (EOs)</i> p. <i>Certificate of Configuration Compliance (CoCC)</i> q. <i>Design requirements (including Requirements, Manufacturing records Traceability)</i> r. <i>Open Work List</i> s. <i>Engineering analyses</i> t. <i>Non-conformance Reports/status</i> u. <i>Certification of Qualification (CoQs)</i> v. <i>Vendors Certificate of Flight Worthiness (CoFW)</i> w. <i>Mission constraints</i> x. <i>All software development documentation</i> 	<ul style="list-style-type: none"> 6. <i>*All issues and concerns raised during the DCR process are documented, discussed and provided with a plan for resolution and implementation.</i>

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Program Design Certification Review (DCR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> y. <i>Fracture Control Plan</i> z. <i>Strength and fracture mechanics for as-built hardware</i> aa. <i>Results of program level analytical integration</i> bb. <i>Verification/validation reports (STD/SE-VVREP)</i> cc. <i>Verification/validation compliance (STD/SE-VVC)</i> dd. <i>Verification/validation procedures (STD/SE-VVPROC)</i> ee. *P – Software Test Report (STD/SW-STR) ff. *P – Software User Manual (STD/SW-SUM) 	

Program DCR Product Maturity Post Review
<p><u>Grammatic Products:</u> None</p> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. *Certification of Qualification (CoQs) b. *Project(s)/vendors Certificate of Flight Worthiness (CoFW) c. *B/L – Handling, Transportation, and Storage Plan d. *F – Software Test Report (STD/SW-STR) e. *BL – Software User Manual (STD/SW-SUM)

E.3.9 Program Operational Readiness Review (ORR)

The ORR examines the actual system characteristics and the procedures used in the system or end product’s operation, and it ensures that all system and support (flight and ground) hardware, software, personnel, procedures, and user documentation accurately reflect the deployed state of the system.

Program Operational Readiness Review (ORR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all ORR RIDs or a timely closure plan exists.</i> 2. <i>A preliminary ORR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the ORR.</i> 3. <i>All planned ground based testing has been completed *except launch site activities.</i> 4. <i>Test failures and anomalies from verification and validation testing have been resolved and the results/mitigations/workarounds have been</i> 	<ul style="list-style-type: none"> 1. <i>The system, including any enabling products, is determined to be ready to be placed in an operational status.</i> 2. <i>All applicable lessons learned for organizational improvement and systems operations have been captured.</i> 3. <i>All waivers and anomalies have been closed.</i> 4. <i>Systems hardware, software, personnel, and procedures are in place to support operations.</i> 5. <i>Operations plans and schedules are consistent with mission objectives.</i>

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Program Operational Readiness Review (ORR)	
Entrance Criteria:	Success Criteria:
<p><i>incorporated into all supporting and enabling operational products.</i></p> <ol style="list-style-type: none"> 5. <i>All operational supporting and enabling products (e.g., facilities, equipment, documents, software tools, databases) that are necessary for the nominal and contingency operations have been tested and delivered/ installed at the site(s) necessary to support operations.</i> 6. <i>Operations documentation (handbook, procedures, etc.) has been written, verified, and approved.</i> 7. <i>Users/operators have been trained on the correct operation of the system.</i> 8. <i>Operational contingency planning has been completed, and operations personnel have been trained on their use.</i> 9. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>P – Missions Operations Plan *(STD/OP-MoP)</i> b. <i>P – Science Data Management Plan</i> c. <i>Preliminary decommissioning plan.</i> d. <i>Preliminary disposal plans.</i> 10. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Updated operations plans.</i> b. <i>Updated operational procedures.</i> c. <i>Updated as-built hardware and software documentation.</i> d. <i>Preliminary V&V results.</i> e. <i>Preliminary certification for flight/use.</i> f. <i>Updated Human Rating Certification Package.</i> g. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i> h. <i>*B/L Operations and Integration Agreements/facility support agreements</i> i. <i>*B/L Flight Definition Document (ISS Payloads)</i> j. <i>*B/L flight supplement payload operations guidelines (ISS payloads)</i> k. <i>*B/L flight planning products</i> l. <i>*B/L flight operations support plans and procedures</i> m. <i>*B/L Integrated Training Plan</i> 	<ol style="list-style-type: none"> 6. <i>Mission risks have been identified, planned mitigations are adequate, and residual risks are accepted by the program/project manager.</i> 7. <i>Testing is consistent with the expected operational environment.</i> 8. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 9. <i>TBD and TBR items are resolved.</i> 10. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Program Operational Readiness Review (ORR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> n. <i>*B/L payload/vehicle data processing requirements</i> o. <i>*P – Payload Flight Data File (FDF)</i> p. <i>*B/L ground data system data base</i> q. <i>*B/L Data Flow and Data Configuration Document</i> r. <i>*B/L Post-flight Evaluation Plan.</i> s. <i>*B/L ground integration requirements</i> t. <i>*B/L updated Launch Facility Agreements and operations flows</i> u. <i>*B/L Integrated System Verification Plan</i> v. <i>*Verification success criteria</i> w. <i>*B/L assembly and installation drawings</i> x. <i>*B/L interface schematics</i> y. <i>*Waiver status</i> z. <i>*POCC data base</i> aa. <i>*Launch Site Support Plan (including Payloads)</i> bb. <i>*B/L integrated payload safety compliance data.</i> 	

Program ORR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. UPD – Program Plan b. UPD – Risk mitigation plans and resources for significant risks c. UPD – Documented Cost and Schedule Baselines d. UPD – Documentation of Basis of Estimate (Cost and Schedule) e. Summary – Documentation of Performance against plan/baseline, including status/closure of formal actions from previous KDP f. Plans for work to be accomplished during next life-cycle Phase g. UPD Annually – PDLM Plan h. B/L – Missions Operations Plan <i>*(STD/OP-MoP, STD/OP-MOR, STD/OP-ESTR, STD/OP-MOIP, STD/OP-TSP, STD/OP-TSRD)</i> i. B/L – Science Data Management Plan j. UPD – Threat Summary k. UPD – Education Plan l. UPD – Communication Plan m. <i>Preliminary decommissioning plan.</i> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. Updated operations plans. b. Updated operational procedures. c. <i>*Payload Operations Control Center (POCC) data base is correct & up to date.</i> d. <i>*Launch Site Support Plan (including Payloads) is complete.</i>

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E.3.10 Program Flight Readiness Review/Mission Readiness Review (FRR/MRR)

The FRR/MRR examines tests, demonstrations, analyses, and audits that determine the system’s readiness for a safe and successful flight or launch and for subsequent flight operations. It also ensures that all flight and ground hardware, software, personnel, and procedures are operationally ready.

Program Flight Readiness Review/Mission Readiness Review (FRR/MRR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all FRR/MRR RID/RFAs or a timely closure plan exists.</i> 2. <i>A preliminary FRR/MRR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the FRR/MRR.</i> 3. <i>The system and support elements are ready and have been confirmed as properly configured for flight.</i> 4. <i>System and support element interfaces have been demonstrated to function as expected.</i> 5. <i>The system state supports a lunch “go” decision based on based on the established go/no go criteria.</i> 6. <i>Flights failures and anomalies from previous completed flights and reviews have been resolved and the results /mitigations/workarounds have been incorporated into supporting and enabling operational products.</i> 7. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Preliminary decommissioning plan</i> b. <i>P – Disposal Plan</i> 8. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Final certification for flight use.</i> b. <i>P-Verification/Validation results *(STD/SE-VVREP)</i> c. <i>Updated as-built hardware and software documentation</i> d. <i>Updated operations procedures</i> e. <i>*P – Payload Flight Data File (FDF)</i> 	<ol style="list-style-type: none"> 1. <i>The flight vehicle is ready for flight.</i> 2. <i>The hardware is deemed acceptably safe for flight.</i> 3. <i>Certification that flight operations can safely proceed with acceptable risk has been achieved.</i> 4. <i>Flight and ground software elements are ready to support flight and flight operations.</i> 5. <i>Interfaces have been checked and demonstrated to be functional.</i> 6. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 7. <i>TBD and TBR items are resolved.</i> 8. <i>Open items and waivers have been examined and residual risk from these is deemed to be acceptable.</i> 9. <i>The flight and recovery environmental factors are within constraints.</i> 10. <i>All open safety and mission risk items have been addressed, and the residual risk is deemed acceptable.</i> 11. <i>Supporting organizations are ready to support flight.</i> 12. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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Program Flight Readiness Review/Mission Readiness Review (FRR/MRR)	
Entrance Criteria:	Success Criteria:
f. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook</i>	

Program FRR/MRR Product Maturity Post Review	
Programmatic Products:	
a.	<i>*UPD – Program Plan</i>
b.	<i>*UPD – Risk mitigation plans and resources for significant risks</i>
c.	<i>*UPD – Documented Cost and Schedule Baselines</i>
d.	<i>*UPD – Documentation of Basis of Estimate (Cost and Schedule)</i>
e.	<i>*Summary – Documentation of Performance against plan/baseline, including status/closure of formal actions from previous KDP</i>
f.	<i>UPD – Safety and Mission Assurance Plan *(STD/SA-SSP, STD/RM-RMP)</i>
g.	<i>UPD Annually – PDLM Plan</i>
h.	<i>UPD – Missions Operations Plan *(STD/OP-MoP)</i>
i.	<i>UPD – Science Data Management Plan</i>
j.	<i>UPD Annually – Threat Summary</i>
k.	<i>P – Decommissioning plan</i>
l.	<i>B/L – Disposal plan</i>
Technical Products:	
a.	<i>Final certification for flight/use *(Certification of Flight Readiness (CoFR) of the operational team, the acceptability of the vehicle for flight, and the readiness of the total system to achieve flight objectives.)</i>
b.	<i>B/L – Verification/Validation results (STD/SE-VVREP)</i>
c.	<i>Updated as-built hardware and software documentation</i>
d.	<i>Updated operations procedures</i>
e.	<i>*B/L – Payload Flight Data File (FDF)</i>

E.3.11 Program Post-Launch Assessment Review (PLAR)

The PLAR is a post-deployment evaluation of the readiness of the spacecraft systems to proceed with full-up, routine operations. The review evaluates the status, performance, and capabilities of the program evident from the flight operations experience since launch. Post launch assessment can also mean assessing readiness to transfer responsibility from the development organization to the operations organization. The review also evaluates the status of the program plans and the capability to conduct the mission with emphasis on near-term operations and mission-critical events. The PLAR is typically held after the early flight operations and initial checkout.

Program Post-Launch Assessment Review (PLAR)	
Entrance Criteria:	Success Criteria:
<i>*Integration aspects of the project level PLAR are examined:</i>	<i>*Integration aspects of the project level PLAR are examined:</i>
1. <i>The launch and early operations performance, including (when appropriate) the early propulsive</i>	1. <i>The observed spacecraft and science payload performance agrees with prediction, or, if not, it is</i>

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Program Post-Launch Assessment Review (PLAR)	
Entrance Criteria:	Success Criteria:
<p><i>maneuver results, are available *and assessed for integrated effects.</i></p> <ol style="list-style-type: none"> 2. <i>The observed spacecraft and science instrument performance including instrument calibration plans and status are available *and assessed for integrated effects.</i> 3. <i>The launch vehicle *integrated performance assessment and mission implications including launch sequence assessment and launch operations experience with lessons learned are completed.</i> 4. <i>The mission operations and ground data system experience, including tracking and data acquisition support and spacecraft telemetry data analysis is available.</i> 5. <i>The mission operations organization including status of staffing, facilities, tools, and mission software (e.g., spacecraft analysis, sequencing) is available.</i> 6. <i>In-flight anomalies and the response taken, including any autonomous fault protection actions taken by the spacecraft, or any unexplained spacecraft telemetry including alarms are *assessed for integrated effects across spacecraft/instrument payload and documented.</i> 7. <i>The need for significant changes to procedures, interface agreements, software, and staffing has been documented.</i> 8. <i>Documentation is updated, including any updates originating from the early operations experience.</i> 9. <i>Plans for post-launch development have been addressed.</i> 	<p><i>adequately understood such that future behavior can be predicted with confidence.</i></p> <ol style="list-style-type: none"> 2. <i>All anomalies have been adequately documented, and their impact on operations assessed. Further, anomalies impacting spacecraft health and safety or critical flight operations have been *assessed for integrated effects and properly dispositioned</i> 3. <i>The mission operations capabilities, including staffing and plans are adequate to accommodate the actual flight performance.</i> 4. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 5. <i>Open items, if any, on operations, identified as part of the ORR, have been satisfactorily disposed.</i>

Program Post-Launch Assessment Review
<i>*Integrated Post Launch Assessment Report</i>

E.3.12 Program Critical Event Readiness Review (CERR)

The CERR confirms the program’s readiness to execute the mission’s critical activities during flight operation.

Program Critical Event Readiness Review (CERR)	
Entrance Criteria:	Success Criteria:
<p><i>*Integration aspects of the project level CERR are examined:</i></p> <ol style="list-style-type: none"> 1. <i>Critical event/activity requirements and constraints have been identified.</i> 2. <i>Critical event/activity design and implementation are complete.</i> 	<p><i>*Integration aspects of the project level CERR are examined:</i></p> <ol style="list-style-type: none"> 1. <i>The critical activity design complies with requirements. The preparation for the critical activity, including the verification and validation, is thorough.</i>

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Program Critical Event Readiness Review (CERR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 3. <i>Critical event/activity testing is complete.</i> 4. <i>Critical event/activity operations planning, including contingencies, is complete.</i> 5. <i>Operations personnel training for the critical event/activity has been conducted.</i> 6. <i>Critical event/activity sequence verification and validation is complete.</i> 7. <i>Flight system is healthy and capable of performing the critical event/activity.</i> 8. <i>Flight failures and anomalies from critical event/activity testing have been resolved, and the results/mitigations/workarounds have been incorporated into supporting and enabling operational products.</i> 9. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Final certification for critical event readiness.</i> b. <i>Updated operations procedures.</i> 	<ol style="list-style-type: none"> 2. <i>The project (including all the systems, supporting services, and documentation) is ready to support the activity.</i> 3. <i>The requirements for the successful execution of the critical event(s) are complete and understood and have flowed down to the appropriate levels for implementation.</i> 4. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 5. <i>Any TBD and TBR items have been resolved.</i> 6. <i>All open risk items have been addressed and the residual risk is deemed acceptable.</i>

Program CERR Product Maturity Post Review
<i>*Approval to Execute the Critical Event</i>

E.3.13 Program Post Flight Assessment Review (PFAR)

The PFAR evaluates the activities from the flight after recovery. The review identifies all anomalies that occurred during the flight and mission and determines the actions necessary to mitigate or resolve the anomalies for future flights.

Program Post Flight Assessment Review (PFAR)	
Entrance Criteria:	Success Criteria:
<p><i>*Integration aspects of the project level PFAR are examined:</i></p> <ol style="list-style-type: none"> 1. <i>All anomalies that occurred during the mission as well as during preflight testing, countdown, and ascent identified.</i> 2. <i>All flight and post-flight documentation applicable to future flights of the spacecraft or the design is available.</i> 3. <i>All planned activities to be performed post-flight have been completed.</i> 4. <i>Problem reports, corrective action requests, Post Flight Anomaly Records, and final post-flight documentation completed.</i> 5. <i>All post-flight hardware and flight data evaluation reports completed.</i> 6. <i>Plans for retaining assessment documentation and imaging have been made.</i> 	<p><i>*Integration aspects of the project level PFAR are examined:</i></p> <ol style="list-style-type: none"> 1. <i>Formal final report documenting flight performance and recommendations for future missions is complete and adequate.</i> 2. <i>All anomalies have been adequately documented and dispositioned.</i> 3. <i>The impact of anomalies on future flight operations has been assessed and documented.</i> 4. <i>Reports and other documentation have been retained for performance comparison and trending.</i>

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Program PFAAR Product Maturity Post Review
<i>*Integrated Post Flight Assessment Report</i>

E.3.14 Program Decommissioning Review (DR)

The DR confirms the decision to terminate or decommission the system and assesses the readiness of the system for the safe decommissioning and disposal of system assets.

Program Decommissioning Review (DR)	
Entrance Criteria:	Success Criteria:
<ol style="list-style-type: none"> 1. <i>Requirements associated with decommissioning are defined.</i> 2. <i>Plans are in place for decommissioning, and any other removal from service activities.</i> 3. <i>Resources are in place to support and implement decommissioning. Health, safety, environmental, and any other constraints have been identified.</i> 4. <i>Current system capabilities related to decommissioning are understood.</i> 5. <i>Off-nominal operations, all contributing events, conditions, and changes to the originally expected baseline have been considered and assessed.</i> 6. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Updated cost</i> b. <i>Updated schedule.</i> c. <i>P – Decommissioning Plan</i> d. <i>Updated Disposal Plan</i> 7. <i>The following technical products, for both hardware and software system elements, have been made available to the cognizant participants prior to the review: None</i> 	<ol style="list-style-type: none"> 1. <i>The rationale for decommissioning is documented.</i> 2. <i>The decommissioning plan is complete, approved by appropriate management, and compliant with applicable Agency safety, environmental, and health regulations.</i> 3. <i>Operations plans for decommissioning, including contingencies, are complete and approved.</i> 4. <i>Adequate resources (schedule, budget, and staffing) have been identified and are available to successfully complete all decommissioning activities.</i> 5. <i>All required support systems for decommissioning are available.</i> 6. <i>All personnel have been properly trained for the nominal and contingency decommissioning procedures.</i> 7. <i>Safety, health, and environmental hazards have been identified and controls have been verified.</i> 8. <i>Risks associated with the decommissioning have been identified and adequately mitigated.</i> 9. <i>Residual risks have been accepted by the required management.</i> 10. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 11. <i>Any TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 12. <i>Plans for archival and subsequent analysis of mission data have been defined and approved, and arrangements have been finalized for the execution of such plans.</i> 13. <i>Plans for the capture and dissemination of appropriate lessons learned during the project life-cycle have been defined and approved.</i> 14. <i>Plans for transition of personnel have been defined and approved.</i>

Program DR Product Maturity Post Review
Programmatic Products:
<ol style="list-style-type: none"> a. UPD – Program Plan b. UPD – Risk mitigation plans and resources for significant risks

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Program DR Product Maturity Post Review	
<ul style="list-style-type: none"> c. UPD – Documented Cost and Schedule Baselines d. UPD – Documentation of Basis of Estimate (Cost and Schedule) e. Summary – Documentation of Performance against plan/baseline, including status/closure of formal actions from previous KDP f. Plans for work to be accomplished during next life-cycle Phase g. UPD Annually – PDLM Plan h. <i>B/L – Decommissioning plan</i> i. <i>UPD – Disposal Plan</i> 	
Technical Products:	
None	

E.3.15 Program Disposal Readiness Review (DRR)

A DRR confirms the readiness for the final disposal of the system assets.

Program Disposal Readiness Review (DRR)	
Entrance Criteria:	Success Criteria:
<ul style="list-style-type: none"> 1. <i>Requirements associated with disposal are defined.</i> 2. <i>Plans are in place for disposal and any other removal from service activities.</i> 3. <i>Resources are in place to support disposal.</i> 4. <i>Safety, environmental, health, and any other constraints are described.</i> 5. <i>Current system capabilities related to disposal are described and understood.</i> 6. <i>Off-nominal operations, all contributing events, conditions, and changes to the originally expected baseline have been considered and assessed.</i> 7. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. <i>Updated cost</i> b. <i>Updated schedule</i> c. <i>UPD – Disposal Plan</i> 8. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> none 	<ul style="list-style-type: none"> 1. <i>The rationale for disposal is documented.</i> 2. <i>The disposal plan is complete, meets requirements, is approved by appropriate management, and is compliant with applicable Agency safety, environmental, and health regulations.</i> 3. <i>Operations plans for disposal, including contingencies, are complete and approved.</i> 4. <i>All required support systems for disposal are available.</i> 5. <i>All personnel have been properly trained for the nominal and contingency disposal procedures.</i> 6. <i>Safety, health, and environmental hazards have been identified, and controls have been verified.</i> 7. <i>Risks associated with the disposal have been identified and adequately mitigated.</i> 8. <i>Residual risks have been accepted by the required management.</i> 9. <i>If hardware is to be recovered from orbit:</i> <ul style="list-style-type: none"> a. <i>Return site activity plans have been defined and approved.</i> b. <i>Required facilities are available and meet requirements, including those for contamination control, if needed.</i> c. <i>Transportation plans are defined and approved.</i> d. <i>Shipping containers and handling equipment, as well as contamination and environmental control and monitoring devices, are available.</i> 10. <i>Plans for disposition of mission-owned assets (e.g., hardware, software, and facilities) have been defined and approved.</i>

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Program Disposal Readiness Review (DRR)	
Entrance Criteria:	Success Criteria:
	<ol style="list-style-type: none"> 11. <i>Adequate resources (schedule, budget, and staffing) have been identified and are available to successfully complete all disposal activities.</i> 12. <i>All mission and project data and documentation has been archived per disposal plan.</i> 13. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 14. <i>TBD and TBR items have all been dispositioned.</i>

Program DRR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ol style="list-style-type: none"> a. <i>UPD – Cost</i> b. <i>UPD – Schedule</i> c. <i>UPD – Disposal Plan</i> <p><u>Technical Products:</u> None</p>

E.4 Research and Technology Program/Project Reviews

E.4.1 Portfolio Project Formulation Review

The FR assesses the portfolio project’s readiness and planning to enter the implementation phase.

R&T Portfolio Project Formulation Review (FR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>The Project has successfully completed any prior reviews, any higher level reviews (if applicable), and responses have been made to all RFAs and RIDs, or a timely closure plan exists for those remaining open.</i> 2. <i>A preliminary agenda, success criteria, and instructions to the review board have been agreed to by the technical team, the project manager, and the review chair prior to the review.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. B/L – Formulation Authorization Document (FAD) *(<i>Reference Data</i>) b. P – Agency and International agreements c. I – Environmental Compliance Documentation (see NPR 8580.1 and MPR 8500.1) d. P – R&T Portfolio Project Plan e. *P – Systems Engineering Applicability Assessment (EMC approved) 	<ol style="list-style-type: none"> 1. <i>Program requirements have been defined and support Mission Directorate strategic objectives.</i> 2. <i>The program requirements are adequately levied on either the TD project or the Portfolio projects.</i> 3. <i>The technical performance metrics identified with goals and minimum thresholds needed to achieve the R&T Program objectives.</i> 4. <i>Schedule, cost, safety, and risk factors defined and are acceptable.</i> 5. <i>Customers/beneficiaries/stakeholders identified with their requirements/objectives.</i> 6. <i>Architecture with major components defined Requirements/objectives/performance requirements/success criteria acceptable</i> 7. <i>Project requirements/objectives verified/validated for compliance.</i>

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R&T Portfolio Project Formulation Review (FR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> f. Plans for work to be accomplished during next life-cycle phase g. SUM – Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP. 	

R&T Portfolio Project FR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. B/L – Agency and International agreements b. Final – Environmental Compliance Documentation (see NPR 8580.1 and MPR 8500.1) c. B/L – R&T Portfolio Project Plan d. *B/L – Systems Engineering Applicability Assessment (EMC approved) e. Plans for work to be accomplished during next life-cycle phase f. SUM – Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP. <p><u>Technical Products:</u> None</p>

E.4.2 TD Project Mission Concept Review (MCR)

The MCR affirms the mission need and examines the proposed mission's objectives and the concept for meeting those objectives.

TD Project Mission Concept Review (MCR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> 1. <i>All planned higher-level MCRs and peer reviews have been successfully conducted and RID/RFAs and responses have been made to all review actions with the concurrence of the originators or a timely closure plan exists.</i> 2. <i>A preliminary MCR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the MCR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. B/L – FAD *(Reference Data) b. D – Partnerships and Inter-Agency and international agreements. 4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> 	<ul style="list-style-type: none"> 1. <i>Project objectives are clearly defined and stated and are unambiguous and internally consistent.</i> 2. <i>The selected concept(s) satisfactorily meets the stakeholder expectations.</i> 3. <i>The mission is feasible. A concept has been identified that is technically feasible. A rough cost estimate is within an acceptable cost range.</i> 4. <i>The concept evaluation criteria to be used in candidate systems evaluation have been identified and prioritized.</i> 5. <i>The need for the mission has been clearly identified.</i> 6. <i>The cost and schedule estimates are credible and sufficient resources are available for project formulation.</i> 7. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 8. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i>

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TD Project Mission Concept Review (MCR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> a. P – Stakeholder identification and expectations b. I – MoEs and mission success criteria c. I – Concept documentation <i>*(P – STD/SE-CONOPS)</i> d. <i>D – SEMP</i> e. <i>Approach – V&V plans</i> f. <i>D – Requirements</i> g. <i>Analysis of alternative concepts to show at least one is feasible.</i> h. <i>Preliminary mission de-scope options.</i> i. <i>Preliminary engineering development assessment and technical plans to achieve what needs to be accomplished in the next phase.</i> j. <i>Conceptual life-cycle support strategies (logistics, manufacturing, and operation).</i> k. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i> l. <i>*D – Software Maintenance Plan (STD/SW-SMP)</i> 	<ul style="list-style-type: none"> 9. <i>9. Alternative concepts have adequately considered the use of existing assets or products that could satisfy the mission or parts of the mission.</i> 10. <i>Technical planning is sufficient to proceed to the next phase.</i> 11. <i>Risk and mitigation strategies have been identified and are acceptable based on technical risk assessments.</i> 12. <i>Software components meet the exit criteria defined in the NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

TD Project MCR Product Maturity Post Review
<p><u>Programmatic Products:</u> P – Partnerships and Inter-Agency and international agreements.</p> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. B/L – Stakeholder identification and expectations <i>*(Document in the SEMP)</i> b. Approve – MoEs and mission success criteria <i>*(Document in the SEMP)</i> c. Approve – Concept documentation <i>*(B/L – STD/SE-CONOPS)</i> d. <i>P – SEMP</i> e. <i>Approach – V&V plans</i> f. <i>P – Requirements</i> g. <i>*D – Software Maintenance Plan (STD/SW-SMP)</i>

E.4.3 TD Project System Requirements Review (SRR)

The SRR examines the functional and performance requirements defined for the system, the preliminary project plan, and ensures that the requirements and the selected concept will satisfy the mission.

TD Project System Requirements Review (SRR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all higher level reviews, and responses has been made to all RID/RFAs or a timely closure plan exists.</i> 2. <i>A preliminary agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the SRR.</i> 	<ul style="list-style-type: none"> 1. <i>The functional and performance requirements defined for the system are responsive to the parent requirements and represent achievable capabilities.</i> 2. <i>The maturity of the requirements definition and associated plans is sufficient to begin Phase B.</i> 3. <i>The project utilizes a sound process for the allocation and control of requirements throughout all levels, and</i>

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TD Project System Requirements Review (SRR)	
Entrance Criteria:	Success Criteria
<p>3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i></p> <ul style="list-style-type: none"> a. P – US Partnerships & agreements b. *D – Project Plan (STD/MA-PRP) c. *P – Systems Engineering Applicability Assessment (EMC approved) d. D – Schedule, work breakdown structure, and allocation of resources. <p>4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i></p> <ul style="list-style-type: none"> a. P – SEMP *(STD/SE-SEMP) b. P – Requirements for system being reviewed are ready to be baselined after the review and preliminary allocation to the next lower level system has been performed. c. <i>Updated parent requirements.</i> d. <i>Initial document tree.</i> e. <i>Verification and validation approach.</i> f. <i>Preliminary hazard analysis (PHA).</i> g. <i>Preliminary MoPs and TPMs</i> h. <i>Other specialty discipline analyses, as required</i> <i>Logistics documentation (e.g., preliminary maintenance plan).</i> i. <i>Human Systems Integration Plan (HSIP) ready to be baselined after review comments are incorporated.</i> j. <i>Preliminary engineering development assessment and technical plans to achieve what needs to be accomplished in the next phase.</i> k. <i>Software criteria and products, per the NASA-HDBK-2203, NASA Software Engineering Handbook</i> l. *D – Software Development Plan (SDP)/Software Management Plan (SMP) (STD/SW-SDMP) m. *P – Software Configuration Plan (STD/SW-SCMP) n. *D – Software Assurance Plan (STD/QE-SAP) o. *D – Software Requirements Specification (SRS) (STD/SW-SRS) p. *D – Software Data Dictionary (STD/SW-SWDD) 	<ul style="list-style-type: none"> <i>a plan has been defined to complete the definition activity within schedule constraints.</i> <i>4. Interfaces with external entities and between major internal elements have been identified.</i> <i>5. Preliminary approaches have been determined for how requirements will be verified and validated.</i> <i>6. Major risks have been identified and technically assessed, and viable mitigation strategies have been defined.</i> <i>7. The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> <i>8. TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> <i>9. Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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TD Project SRR Product Maturity Post Review	
Programmatic Products:	
a.	B/L – US Partnerships & agreements
b.	*P – <i>Project Plan (STD/MA-PRP)</i>
c.	*B/L – <i>Systems Engineering Applicability Assessment (EMC approved)</i>
d.	P – Schedule, work breakdown structure, and allocation of resources.
Technical Products:	
a.	B/L – SEMP (STD/SE-SEMP)
b.	B/L – Requirements
c.	<i>UPD – Stakeholders and expectations</i>
d.	<i>UPD – Concept documentation</i>
e.	<i>UPD – Cost and schedule for technical implementation</i>
f.	*P – Software Development Plan (SDP)/Software Management Plan (SMP) (STD/SW-SDMP)
g.	*B/L – Software Configuration Plan (STD/SW-SCMP)
h.	*P – Software Assurance Plan (STD/QE-SAP)
i.	*P – Software Requirements Specification (SRS) (STD/SW-SRS)
j.	*P – Software Data Dictionary (STD/SW-SWDD)

E.4.4 TD Project Preliminary Design Review (PDR)

The PDR demonstrates that the preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described.

TD Project Preliminary Design Review (PDR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all PDR RIDs or a timely closure plan exists.</i> 2. <i>A preliminary PDR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the PDR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. P – International agreements b. I – Environmental Compliance Documentation (see NPR 8580.1 and MPR 8500.1) c. <i>Plans to respond to regulatory requirements (e.g., Environmental Impact Statement), as required.</i> d. P – TD Project Plan e. *SUM – <i>Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and</i> 	<ol style="list-style-type: none"> 1. <i>Top-level requirements – including mission success criteria, TPMs, and any sponsor-imposed constraints – are agreed upon, finalized, stated clearly, and are consistent with the preliminary design.</i> 2. <i>The flow down of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to mission goals and objectives.</i> 3. <i>The program cost, schedule, and JCL analysis (when required) are credible and within program constraints and ready for NASA commitment.</i> 4. <i>The preliminary design is expected to meet the requirements at an acceptable level of risk.</i> 5. <i>Definition of the technical interfaces (both external entities and between internal elements) is consistent with the overall technical maturity and provides an acceptable level of risk.</i> 6. <i>Any required new technology has been developed to an adequate state of readiness, or back-up options exist and are supported to make them viable alternatives.</i>

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TD Project Preliminary Design Review (PDR)	
Entrance Criteria:	Success Criteria
<p><i>status/closure of formal actions from previous KDP</i></p> <ul style="list-style-type: none"> f. P – Schedule, work breakdown structure and allocation of resources g. <i>D – Disposal plan.</i> h. <i>D – Decommissioning Plan</i> i. <i>P – Integration Plans</i> <p>4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i></p> <ul style="list-style-type: none"> a. P – Preliminary design that can be shown to meet requirements and key technical performance measures. b. UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) c. <i>Subsystem design specifications (hardware and software), with supporting trade-off analyses and data, as required, that are ready to be baselined after review comments are incorporated.</i> d. <i>Applicable technical plans (e.g., technical performance measurement plan, contamination control plan, parts management plan, environments control plan, Electromagnetic Interference (EMI)/ EMC control plan, payload-to-carrier integration plan, producibility/manufacturability program plan, reliability program plan, quality assurance plan.</i> e. <i>Applicable standards that have been identified and incorporated.</i> f. <i>Preliminary Engineering drawing tree.</i> g. <i>Interface control documents that are ready to be baselined after review comments are incorporated.</i> h. <i>P-Implementation Plans</i> i. <i>P – V&V plans</i> j. <i>P – Operations Plans</i> k. <i>Updated technical resource utilization estimates/margins.</i> l. <i>Updated Human Systems Integration Plan.</i> m. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i> n. <i>*D – Software Test Plan (STD/SW-STP)</i> o. <i>*D – Software Design Description (Architectural Design (STD/SW-SDD)</i> 	<ul style="list-style-type: none"> 7. <i>The project risks are understood and have been credibly assessed, and plans, a process, and resources exist to effectively manage them.</i> 8. <i>SMA (e.g., safety, reliability, maintainability, quality, and Electrical, Electronic, and Electromechanical (EEE) parts) have been adequately addressed in preliminary designs and any applicable SMA products (e.g., PRA, system safety analysis, and failure modes and effects analysis) meet requirements, are at the appropriate maturity level for this phase of the program’s life-cycle, and indicate that the program safety/reliability residual risks will be at an acceptable level.</i> 9. <i>Adequate technical and programmatic margins (e.g., mass, power, memory) and resources exist to complete the development within budget, schedule, and known risks.</i> 10. <i>The operational concept is technically sound, includes (where appropriate) human systems, and includes the flow down of requirements for its execution.</i> 11. <i>Technical trade studies are mostly complete to sufficient detail and remaining trade studies are identified, plans exist for their closure, and potential impacts are understood.</i> 12. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 13. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 14. <i>Preliminary analysis of the primary subsystems has been completed and summarized, highlighting performance and design margin challenges.</i> 15. <i>Appropriate modeling and analytical results are available and have been considered in the design.</i> 16. <i>Heritage designs have been suitably assessed for applicability and appropriateness.</i> 17. <i>Manufacturability has been adequately included in design.</i> 18. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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TD Project Preliminary Design Review (PDR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> p. *D – Software Design Description (Detail Design (STD/SW-SDD)) q. *D – Interface Design definition (STD/SW-IDD) 	

TD Project PDR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ul style="list-style-type: none"> a. B/L – International agreements b. Final – Environmental Compliance Documentation (see NPR 8580.1 and MPR 8500.1) c. B/L – TD Project Plan d. <i>*SUM – Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP</i> e. B/L – Schedule, work breakdown structure and allocation of resources f. <i>P – Decommissioning Plan</i> g. <i>P – Disposal Plan</i> h. <i>B/L-Integration Plans</i> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. B/L – Preliminary Design Documentation b. UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) c. <i>UPD – Stakeholders and expectations</i> d. <i>UPD – Concept documentation</i> e. <i>UPD – Cost and schedule for technical implementation</i> f. <i>UPD – SEMP</i> g. <i>UPD – Requirements</i> h. <i>UPD – Required leading indicators</i> i. <i>B/L – Interface Definitions</i> j. <i>B/L-Implementation Plans</i> k. <i>B/L – V&V plans</i> l. <i>B/L – Operations Plans</i> m. <i>*P – Software Test Plan (STD/SW-STP)</i> n. <i>*P – Software Design Description (Architectural Design (STD/SW-SDD))</i> o. <i>*P – Software Design Description (Detail Design (STD/SW-SDD))</i> p. <i>*P – Interface Design definition (STD/SW-IDD)</i>

E.4.5 TD Project Critical Design Review (CDR)

CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and test. CDR determines that the technical effort is on track to complete the flight and ground system development and mission operations to meet mission performance requirements within the identified cost and schedule constraints.

TD Project Critical Design Review (CDR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all CDR RIDs or a timely closure plan exists.</i> 	<ul style="list-style-type: none"> 1. <i>The detailed design is expected to meet the requirements with adequate margins at an acceptable level of risk.</i>

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TD Project Critical Design Review (CDR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 2. <i>A preliminary CDR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the CDR.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>*Schedule, work breakdown structure and allocation of resources</i> b. <i>P – Decommissioning Plan</i> c. <i>P – Disposal Plan</i> 4. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>P – Detailed design that can be shown to meet requirements and key technical performance measures.</i> b. <i>UPD – Trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items)</i> c. <i>Product build-to specifications for each hardware and software configuration item, along with supporting trade-off analyses and data.</i> d. <i>Fabrication, assembly, integration, and test plans and procedures.</i> e. <i>Technical Data Package (e.g., Integrated Schematics, Spares Provisioning List, Interface Control Documents, engineering analyses, specifications).</i> f. <i>Operational Limits and Constraints.</i> g. <i>Updated Technical Resource Utilization estimates and margins.</i> h. <i>Acceptance Criteria.</i> i. <i>Command and Telemetry List.</i> j. <i>Launch Site Operations Plan.</i> k. <i>Checkout and Activation Plan.</i> l. <i>D – Transportation criteria & instructions</i> m. <i>D – Operational procedures</i> n. <i>Updated Human Systems Integration Plan (HSIP).</i> o. <i>Update reliability analyses and assessments</i> p. <i>Subsystem-level and preliminary operations hazards analyses.</i> q. <i>Systems and subsystem certification plans and requirements (as needed).</i> r. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i> 	<ol style="list-style-type: none"> 2. <i>Interface control documents are appropriately matured to proceed with fabrication, assembly, integration and test, and plans are in place to manage any open items.</i> 3. <i>The program cost and schedule estimates are credible and within program constraints.</i> 4. <i>High confidence exists in the product baseline, and adequate documentation exists and/or will exist in a timely manner to allow proceeding with fabrication, assembly, integration, and test.</i> 5. <i>The product verification and product validation requirements and plans are complete.</i> 6. <i>The testing approach is comprehensive, and the planning for system assembly, integration, test, and launch site and mission operations is sufficient to progress into the next phase.</i> 7. <i>Adequate technical and programmatic margins (e.g., mass, power, memory) and resources exist to complete the development within budget, schedule, and known risks.</i> 8. <i>Risks to mission success are understood and credibly assessed, and plans and resources exist to effectively manage them.</i> 9. <i>Safety and Mission Assurance (SMA) (e.g., safety, reliability, maintainability, quality, and EEE parts) have been adequately addressed in system and operational designs and any applicable SMA products (e.g., PRA, system safety analysis, and failure modes and effects analysis) meet requirements, are at the appropriate maturity level for this phase of the program's life-cycle, and indicate that the program safety/reliability residual risks will be at an acceptable level.</i> 10. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 11. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 12. <i>Engineering test units, life test units, and/or modeling and simulations have been developed and tested per plan.</i> 13. <i>Material properties tests are completed along with analyses of loads, stress, fracture control, contamination generation, etc.</i> 14. <i>EEE parts have been selected, and planned testing and delivery will support build schedules.</i> 15. <i>The operational concept has matured, is at a CDR level of detail, and has been considered in test planning.</i> 16. <i>Manufacturability has been adequately included in design.</i> 17. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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TD Project Critical Design Review (CDR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> s. *P – Software Interface Description (STD/SW-IDD) t. *P – Software Requirements Specifications (STD/SW-SRS) u. *P = Software Test Plan (STD/SW-STP) v. *P – Software Test Procedure (STD/SW-STPR) w. *P – Software Data Dictionary (STD/SW-SWDD) x. *P – Software Design Description (STD/SW-SDD) 	

TD Project CDR Product Maturity Post Review
<p>Programmatic Products:</p> <ul style="list-style-type: none"> a. *UPD – Schedule, work breakdown structure and allocation of resources b. P – Decommissioning Plan c. P – Disposal Plan d. UPD-Integration Plans <p>Technical Products:</p> <ul style="list-style-type: none"> a. B/L – Detailed Design Documentation b. Updated trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) c. UPD – Concept documentation d. UPD – Cost and schedule for technical implementation e. UPD –SEMP f. UPD –Requirements g. UPD-Required leading indicators h. UPD – Interface Definitions i. UPD-Implementation Plans j. UPD – V&V plans k. Initial – Transportation criteria & instructions l. UPD – Operations Plans m. P – Operational procedure n. *BL – Software Interface Description (STD/SW-IDD) o. *BL – Software Requirements Specifications (STD/SW-SRS) p. *BL = Software Test Plan (STD/SW-STP) q. *BL – Software Test Procedure (STD/SW-STPR) r. *BL – Software Data Dictionary (STD/SW-SWDD) s. *BL – Software Design Description (STD/SW-SDD)

E.4.6 TD Project Systems Integration Review (SIR)

The SIR ensures that the system is ready, or on schedule, to be integrated. Segments, components, and subsystems are available and ready, or on schedule, to be integrated into the system. Integration facilities, support personnel, and integration plans and procedures are ready

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for integration.

TD Project Systems Integration Review (SIR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all SIR RID/RFA's or a timely closure plan exists.</i> 2. <i>A preliminary SIR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the SIR.</i> 3. <i>Integration procedures have been identified and are scheduled for completion prior to their need dates.</i> 4. <i>Segments and/or components are on schedule to be available for integration.</i> 5. <i>Mechanical and electrical interfaces for hardware necessary to start system integration have been verified against the interface control documentation and plans for verification of remaining hardware exist.</i> 6. <i>All applicable functional, unit-level, subsystem, and qualification testing has been conducted successfully or is on track to be conducted prior to scheduled integration.</i> 7. <i>Integration facilities, including clean rooms, ground support equipment, handling fixtures, overhead cranes, and electrical test equipment, are ready and available.</i> 8. <i>Support personnel have been trained.</i> 9. <i>Handling and safety requirements have been documented.</i> 10. <i>All known system discrepancies have been identified, dispositioned, and are on schedule for closure.</i> 11. <i>The quality control organization is ready to support the integration effort.</i> 12. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>*Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP.</i> b. <i>*Schedule, work breakdown structure and allocation of resources.</i> c. <i>P – Decommissioning Plan</i> d. <i>P – Disposal Plan.</i> e. <i>UPD – Integration plan *(STD/SE-IP)</i> 13. <i>The following technical products, for both hardware and software systems elements, have</i> 	<ol style="list-style-type: none"> 1. <i>Integration plans and procedures are on track for approval to support system integration.</i> 2. <i>Previous component, subsystem, system test results form a satisfactory basis for proceeding to integration.</i> 3. <i>The program cost and schedule estimates are credible and within program constraints.</i> 4. <i>Risk are identified and accepted by program/project leadership as required.</i> 5. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 6. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their dispositions.</i> 7. <i>The integration procedures and work flow have been clearly defined and documented or are on schedule to be clearly defined and documented prior to their need date.</i> 8. <i>The review of the integration plans, as well as the procedures, environment, and the configuration of the items to be integrated, provides a reasonable expectation that the integration will precede successfully.</i> 9. <i>Integration personnel have received appropriate training in the integration and health and safety procedures.</i> 10. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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TD Project Systems Integration Review (SIR)	
Entrance Criteria:	Success Criteria
<p><i>been made available to the cognizant participants prior to the review:</i></p> <ol style="list-style-type: none"> a. Updated trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) b. Preliminary Verification and Validation results from any lower tier products that have been verified. c. <i>Initial – Transportation criteria & instructions</i> d. <i>UPD – Operations Plans</i> e. <i>P – Operational procedures</i> 	

TD Project SIR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ol style="list-style-type: none"> a. <i>*SUM – Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP.</i> b. <i>*UPD – Schedule, work breakdown structure and allocation of resources\</i> c. <i>P – Decommissioning Plan</i> d. <i>P – Disposal Plan</i> e. <i>UPD – Integration plan *(STD/SE-IP)</i> <p><u>Technical Products:</u></p> <ol style="list-style-type: none"> a. Updated trending information on the mass margins (for projects involving hardware), power margins (for projects that are powered), and closure of review actions (RFA, RID, and/or Action Items) b. P – Verification/Validation results from any lower tier products that have been verified. c. <i>UPD – Cost and schedule for technical implementation</i> d. <i>UPD –SEMP</i> e. <i>UPD – Detailed design documentation</i> f. <i>UPD – Interface Definitions</i> g. <i>UPD – V&V plans</i> h. <i>Final – Transportation criteria & instructions</i> i. <i>UPD – Operations Plans</i> j. <i>B/L – Operational procedures</i>

E.4.7 TD Project Design Certification Review (DCR)

The DCR ensures that the qualification verifications demonstrate CI design compliance with the functional and performance requirements (hardware and software).

TD Project Design Certification Review (DCR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>*Successful completion of CI DCR.</i> 2. <i>*Summary of findings from DCRs conducted on lower level assemblies (if done).</i> 	<ol style="list-style-type: none"> 1. <i>*Verification results satisfy functional and performance requirements.</i> 2. <i>*The pedigrees of the test articles directly traceable to the production unit.</i>

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TD Project Design Certification Review (DCR)	
Entrance Criteria:	Success Criteria
<p>3. <i>*A preliminary DCR agenda, plan, success criteria, and charge to the board have been agreed to by the technical team, PM, and DCR review board chair prior to the DCR.</i></p> <p>4. <i>*The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i></p> <ul style="list-style-type: none"> a. <i>Documentation of as-built configuration versus as-designed configuration (equivalent to a PCA). (STD/CM-AD)</i> b. <i>Documentation demonstrating CI compliance to functional and performance requirements, including verification /validation requirements (equivalent to a FCA).</i> (STD/CM-AD). c. <i>Summary of the CI design.</i> d. <i>CDR pre-board/board briefing and RID status.</i> e. <i>Hardware changes since CDR.</i> f. <i>Findings from DCRs conducted on lower-level assemblies (if done).</i> g. <i>Baselined V&V plan and requirements (including success criteria) (Reference Data).</i> h. <i>Safety and Reliability Assessment Package including Hazard Analyses; PRA; FMEA/CIL; Risk Assessments.</i> i. <i>Problems encountered during fabrication, assembly, and verification.</i> j. <i>Waivers and deviations.</i> k. <i>Material Usage Agreements (MUAs).</i> l. <i>Flight and ground test software.</i> m. <i>Preliminary Handling, Transportation, and Storage Plan</i> n. <i>Any other documentation included in the DCR Plan, such as:</i> <ul style="list-style-type: none"> i. <i>ICDs.</i> ii. <i>Configuration Control Board Directives (CCBDs).</i> iii. <i>Drawings/EOs.</i> iv. <i>Certificate of Configuration Compliance (CoCC).</i> v. <i>Design requirements (including requirements, manufacturing records, traceability).</i> vi. <i>Verification/validation reports (STD/SE-VVREP)</i> vii. <i>Verification/validation compliance (STD/SE-VVC)</i> viii. <i>Verification/validation procedures (STD/SE-VVPROC)</i> ix. <i>Open Work List</i> 	<p>3. <i>*Test procedures and environments used comply with those specified in design to specification.</i></p> <p>4. <i>*Design changes in the CI resulting from the verification process (as run – test, etc.) have been incorporated and/or appropriately addressed (successfully retested as required).</i></p> <p>5. <i>*Verify the approach is compliant with requirements relative to SMA and reliability.</i></p> <p>6. <i>*All issues and concerns raised during the DCR process are documented, discussed and provided with a plan for resolution and implementation.</i></p>

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TD Project Design Certification Review (DCR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> x. <i>Engineering analyses</i> xi. <i>Non-conformance reports/status</i> xii. <i>Certification of Qualification (CoQs)</i> xiii. <i>Vendors' Certification of Flight Worthiness (CoFW)</i> xiv. <i>Mission constraints</i> xv. <i>All software development documentation</i> xvi. <i>Fracture Control Plan</i> xvii. <i>Strength and fracture mechanics for as-built hardware</i> 	

TD Project DCR Product Maturity Post Review
<p><u>Programmatic Products:</u> <i>*UPD – Schedule, work breakdown structure and allocation of resources</i></p> <p><u>Primary & Other technical products:</u></p> <ul style="list-style-type: none"> a. <i>*CoQs</i> b. <i>*Vendors WQCoFW</i> c. <i>*B/L – Handling, Transportation, and Storage Plan</i>

E.4.8 TD Project System Acceptance Review (SAR)/Pre-Ship Review

The SAR verifies the completeness of the specific end item products in relation to their expected maturity level and to assess compliance to stakeholder expectations. The SAR examines the system, its end items and documentation, and test data and analyses that support verification. It also ensures that the system has sufficient technical maturity to authorize its shipment to the designated operational facility or launch site.

TD Project System Acceptance Review (SAR)/Pre-Ship Review	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> 1. <i>The project has successfully completed the previous planned milestone reviews, RFA/RIDs have been closed, and plans to complete open work are defined.</i> 2. <i>A preliminary SAR agenda, success criteria, and instructions to the review team have been agreed to by the technical team, project manager, and review chair prior to the review</i> 3. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ul style="list-style-type: none"> a. <i>Results of the SARs conducted at the major suppliers</i> b. <i>Product verification results</i> c. <i>Product validation results</i> d. <i>Documentation that the delivered system complies with the established acceptance criteria</i> 	<ul style="list-style-type: none"> 1. <i>Required tests and analyses are complete and indicate that the system will perform properly in the expected operational environment.</i> 2. <i>Risks are known and manageable.</i> 3. <i>System meets the established acceptance criteria.</i> 4. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 5. <i>TBD and TBR items are resolved.</i> 6. <i>Technical data package is complete and reflects the delivered system.</i> 7. <i>All applicable lessons learned for organizational improvement and system operations are captured.</i> 8. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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TD Project System Acceptance Review (SAR)/Pre-Ship Review	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> e. <i>Documentation that the system will perform properly in the expected operational environment</i> f. <i>Technical data package that has been updated to include all test results</i> g. <i>Final certification package</i> h. <i>Baselined as-built hardware and software documentation</i> i. <i>Updated risk assessment and mitigation</i> j. <i>Required safe shipping, handling, checkout, and operational plans and procedures</i> k. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook</i> l. <i>*P – Software User Manual (STD/SW-SUM)</i> m. <i>*P – Software Test Report (STD/SW-STR)</i> 	

TD Project SAR Product Maturity Post Review
<p><u>Programmatic Products:</u> <i>*UPD – Schedule, work breakdown structure and allocation of resources</i></p> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. <i>*Upon successful completion of all activities, a certificate of acceptance is signed by the Project Manager.</i> b. <i>*BL – Software User Manual (STD/SW-SUM)</i> c. <i>*F – Software Test Report (STD/SW-STR)</i>

E.4.9 TD Project Operational Readiness Review (ORR)

The ORR examines the actual system characteristics and the procedures used in the system or end product’s operation, and it ensures that all system and support (flight and ground) hardware, software, personnel, procedures, and user documentation accurately reflect the deployed state of the system.

TD Project Operational Readiness Review (ORR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all ORR RID/RFAs or a timely closure plan exists.</i> 2. <i>A preliminary ORR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the ORR.</i> 3. <i>All planned ground based testing has been completed *except launch site activities.</i> 4. <i>Test failures and anomalies from verification and validation testing have been resolved and the results/mitigations/workarounds have been incorporated into all supporting and enabling operational products.</i> 	<ul style="list-style-type: none"> 1. <i>The system, including any enabling products, is determined to be ready to be placed in an operational status.</i> 2. <i>All applicable lessons learned for organizational improvement and systems operations have been captured.</i> 3. <i>All waivers and anomalies have been closed.</i> 4. <i>Systems hardware, software, personnel, and procedures are in place to support operations.</i> 5. <i>Operations plans and schedules are consistent with mission objectives.</i> 6. <i>Mission risks have been identified, planned mitigations are adequate, and residual risks are accepted by the program/project manager.</i>

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TD Project Operational Readiness Review (ORR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 5. <i>All operational supporting and enabling products (e.g., facilities, equipment, documents, software tools, databases) that are necessary for the nominal and contingency operations have been tested and delivered/ installed at the site(s) necessary to support operations.</i> 6. <i>Operations documentation (handbook, procedures, etc.) has been written, verified, and approved.</i> 7. <i>Users/operators have been trained on the correct operation of the system.</i> 8. <i>Operational contingency planning has been completed, and operations personnel have been trained on their use.</i> 9. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>*Schedule, work breakdown structure and allocation of resources.</i> b. <i>Preliminary decommissioning plan.</i> c. <i>P – Disposal Plans</i> 10. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Updated operations plans.</i> b. <i>Updated operational procedures.</i> c. <i>P – V&V results</i> d. <i>D – Certification (Flight/use)</i> e. <i>UPD – As-built hardware/software documentation.</i> f. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i> 	<ol style="list-style-type: none"> 7. <i>Testing is consistent with the expected operational environment.</i> 8. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 9. <i>TBD and TBR items are resolved.</i> 10. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

TD Project ORR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ol style="list-style-type: none"> a. <i>*UPD – Schedule, work breakdown structure and allocation of resources</i> b. <i>Preliminary decommissioning plan.</i> c. <i>P – Disposal Plans</i> <p><u>Technical Products:</u></p> <ol style="list-style-type: none"> a. <i>Updated operations plans.</i> b. <i>Updated operational procedures.</i> c. <i>UPD – Cost and schedule for technical implementation</i> d. <i>UPD – Detailed design documentation</i> e. <i>P – V&V results</i> f. <i>UPD – Transportation criteria & instructions</i>

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TD Project ORR Product Maturity Post Review
g. <i>P – Certification (Flight/use)</i>

E.4.10 TD Project Flight Readiness Review/Mission Readiness Review (FRR/MRR)

The FRR examines tests, demonstrations, analyses, and audits that determine the system’s readiness for a safe and successful flight or launch and for subsequent flight operations. It also ensures that all flight and ground hardware, software, personnel, and procedures are operationally ready.

TD Project Flight Readiness Review/Mission Readiness Review (FRR/MRR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>Successful completion of the previously planned milestone reviews, including all lower level reviews, and responses has been made to all FRR/MRR RID/RFAs or a timely closure plan exists.</i> 2. <i>A preliminary FRR/MRR agenda, success criteria, and charge to the board have been agreed to by the technical team, PM, and review chair prior to the FRR/MRR.</i> 3. <i>The system and support elements are ready and have been confirmed as properly configured for flight.</i> 4. <i>System and support element interfaces have been demonstrated to function as expected.</i> 5. <i>The system state supports a lunch “go” decision based on based on the established go/no go criteria.</i> 6. <i>Flights failures and anomalies from previous completed flights and reviews have been resolved and the results /mitigations/workarounds have been incorporated into supporting and enabling operational products.</i> 7. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>*Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP.</i> b. <i>Preliminary decommissioning plan.</i> c. <i>P – Disposal Plan</i> 8. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Final certification for flight use</i> b. <i>P – Verification/Validation Results *(STD/SE-VVREP) (STD/SE-VVC)</i> 	<ol style="list-style-type: none"> 1. <i>The flight vehicle is ready for flight.</i> 2. <i>The hardware is deemed acceptably safe for flight.</i> 3. <i>Certification that flight operations can safely proceed with acceptable risk has been achieved.</i> 4. <i>Flight and ground software elements are ready to support flight and flight operations.</i> 5. <i>Interfaces have been checked and demonstrated to be functional.</i> 6. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 7. <i>TBD and TBR items are resolved.</i> 8. <i>Open items and waivers have been examined and residual risk from these is deemed to be acceptable.</i> 9. <i>The flight and recovery environmental factors are within constraints.</i> 10. <i>All open safety and mission risk items have been addressed, and the residual risk is deemed acceptable.</i> 11. <i>Supporting organizations are ready to support flight.</i> 12. <i>Software components meet the exit criteria defined in NASA-HDBK-2203, NASA Software Engineering Handbook.</i>

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TD Project Flight Readiness Review/Mission Readiness Review (FRR/MRR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> c. <i>Updated cost and schedule for technical implementation.</i> d. <i>Updated as-built hardware and software documentation.</i> e. <i>Updated operations procedures</i> f. <i>Software criteria and products, per NASA-HDBK-2203, NASA Software Engineering Handbook.</i> 	

TD Project FRR/MRR Product Maturity Post Review
<p><u>Programmatic Products:</u> <i>*SUM – Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP.</i></p> <ul style="list-style-type: none"> a. <i>UPD – preliminary decommissioning plan.</i> b. <i>B/L – Disposal Plan</i> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. <i>Final certification for flight/use</i> b. <i>B/L – Verification/Validation Results *(STD/SE-VVREP, STD/SE-VVC)</i> c. <i>UPD – cost and schedule for technical implementation.</i> d. <i>UPD – operations procedures.</i>

E.4.11 TD Project Post Launch Assessment Review (PLAR)

The PLAR is a post-deployment evaluation of the readiness of the spacecraft systems to proceed with full-up, routine operations. The review evaluates the status, performance, and capabilities of the project evident from the flight operations experience since launch. Post launch assessment can also mean assessing readiness to transfer responsibility from the development organization to the operations organization. The review also evaluates the status of the project plans and the capability to conduct the mission with emphasis on near-term operations and mission-critical events. The PLAR is typically held after the early flight operations and initial checkout.

TD Project Post Launch Assessment Review (PLAR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> 1. <i>The launch and early operations performance, including (when appropriate) the early propulsive maneuver results, are available.</i> 2. <i>The observed spacecraft and science instrument performance including instrument calibration plans and status are available.</i> 3. <i>The launch vehicle performance assessment and mission implications including launch sequence assessment and launch operations experience with lessons learned are completed.</i> 4. <i>The mission operations and ground data system experience, including tracking and data acquisition support and spacecraft telemetry data analysis is available.</i> 	<ul style="list-style-type: none"> 1. <i>The observed spacecraft and science payload performance agrees with prediction, or, if not, it is adequately understood such that future behavior can be predicted with confidence.</i> 2. <i>All anomalies have been adequately documented, and their impact on operations assessed. Further, anomalies impacting spacecraft health and safety or critical flight operations have been properly dispositioned.</i> 3. <i>The mission operations capabilities, including staffing and plans are adequate to accommodate the actual flight performance.</i>

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TD Project Post Launch Assessment Review (PLAR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 5. <i>The mission operations organization including status of staffing, facilities, tools, and mission software (e.g., spacecraft analysis, sequencing) is available.</i> 6. <i>In-flight anomalies and the response taken, including any autonomous fault protection actions taken by the spacecraft, or any unexplained spacecraft telemetry including alarms are documented.</i> 7. <i>The need for significant changes to procedures, interface agreements, software, and staffing has been documented.</i> 8. <i>Documentation is updated, including any updates originating from the early operations experience.</i> 9. <i>Plans for post-launch development have been addressed.</i> 	<ol style="list-style-type: none"> 4. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 5. <i>Open items, if any, on operations, identified as part of the ORR, have been satisfactorily disposed.</i>

TD Project PLAR Product Maturity Post Review
<i>*Post Launch Assessment Report</i>

E.4.12 TD Project Critical Event Readiness Review (CERR)

The CERR confirms the project’s readiness to execute the mission’s critical activities during flight operation.

TD Project Critical Event Readiness Review (CERR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>Critical event/activity requirements and constraints have been identified.</i> 2. <i>Critical event/activity design and implementation are complete.</i> 3. <i>Critical event/activity testing is complete.</i> 4. <i>Critical event/activity operations planning, including contingencies, is complete.</i> 5. <i>Operations personnel training for the critical event/activity has been conducted.</i> 6. <i>Critical event/activity sequence verification and validation is complete.</i> 7. <i>Flight system is healthy and capable of performing the critical event/activity.</i> 8. <i>Flight failures and anomalies from critical event/activity testing have been resolved, and the results/mitigations/workarounds have been incorporated into supporting and enabling operational products.</i> 9. <i>The following technical products have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Final certification for critical event readiness.</i> 	<ol style="list-style-type: none"> 1. <i>The critical activity design complies with requirements. The preparation for the critical activity, including the verification and validation, is thorough.</i> 2. <i>The project (including all the systems, supporting services, and documentation) is ready to support the activity.</i> 3. <i>The requirements for the successful execution of the critical event(s) are complete and understood and have flowed down to the appropriate levels for implementation.</i> 4. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 5. <i>Any TBD and TBR items have been resolved.</i> 6. <i>All open risk items have been addressed and the residual risk is deemed acceptable.</i>

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TD Project Critical Event Readiness Review (CERR)	
Entrance Criteria:	Success Criteria
b. <i>Updated operations procedures.</i>	

TD Project CERR Product Maturity Post Review:
<i>*Approval to Execute the Critical Event</i>

E.4.13 TD Project Post Flight Assessment Review (PFAR)

The PFAR evaluates the activities from the flight after recovery. The review identifies all anomalies that occurred during the flight and mission and determines the actions necessary to mitigate or resolve the anomalies for future flights.

TD Project Post Flight Assessment Review (PFAR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>All anomalies that occurred during the mission as well as during preflight testing, countdown, and ascent identified.</i> 2. <i>All flight and post-flight documentation applicable to future flights of the spacecraft or the design is available.</i> 3. <i>All planned activities to be performed post-flight have been completed.</i> 4. <i>Problem reports, corrective action requests, Post Flight Anomaly Records, and final post-flight documentation completed.</i> 5. <i>All post-flight hardware and flight data evaluation reports completed.</i> 6. <i>Plans for retaining assessment documentation and imaging have been made.</i> 	<ol style="list-style-type: none"> 1. <i>Formal final report documenting flight performance and recommendations for future missions is complete and adequate.</i> 2. <i>All anomalies have been adequately documented and dispositioned.</i> 3. <i>The impact of anomalies on future flight operations has been assessed and documented.</i> 4. <i>Reports and other documentation have been retained for performance comparison and trending.</i>

TD Project PFAR Product Maturity Post Review
<i>*Post-flight Assessment Report</i>

E.4.14 TD Project Decommissioning Review (DR)

The DR confirms the decision to terminate or decommission the system and assesses the readiness of the system for the safe decommissioning and disposal of system assets.

TD Project Decommissioning Review (DR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>Requirements associated with decommissioning are defined.</i> 2. <i>Plans are in place for decommissioning, and any other removal from service activities.</i> 3. <i>Resources are in place to support and implement decommissioning.</i> 	<ol style="list-style-type: none"> 1. <i>The rationale for decommissioning is documented.</i> 2. <i>The decommissioning plan is complete, approved by appropriate management, and compliant with applicable Agency safety, environmental, and health regulations.</i> 3. <i>Operations plans for decommissioning, including contingencies, are complete and approved.</i>

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TD Project Decommissioning Review (DR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 4. <i>Health, safety, environmental, and any other constraints have been identified.</i> 5. <i>Current system capabilities related to decommissioning are understood.</i> 6. <i>Off-nominal operations, all contributing events, conditions, and changes to the originally expected baseline have been considered and assessed.</i> 7. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>*Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP</i> b. <i>P – Decommissioning Plan</i> c. <i>Updated disposal plan</i> 8. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Updated Cost for technical implementation.</i> b. <i>Updated Schedule for technical implementation.</i> 	<ol style="list-style-type: none"> 4. <i>Adequate resources (schedule, budget, and staffing) have been identified and are available to successfully complete all decommissioning activities.</i> 5. <i>All required support systems for decommissioning are available.</i> 6. <i>All personnel have been properly trained for the nominal and contingency decommissioning procedures.</i> 7. <i>Safety, health, and environmental hazards have been identified and controls have been verified.</i> 8. <i>Risks associated with the decommissioning have been identified and adequately mitigated.</i> 9. <i>Residual risks have been accepted by the required management.</i> 10. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 11. <i>Any TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 12. <i>Plans for archival and subsequent analysis of mission data have been defined and approved, and arrangements have been finalized for the execution of such plans.</i> 13. <i>Plans for the capture and dissemination of appropriate lessons learned during the project life-cycle have been defined and approved.</i> 14. <i>Plans for transition of personnel have been defined and approved.</i>

TD Project DR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <p><i>*SUM – Documentation of performance against plans for work to be accomplished during next implementation phase, including performance against baselines and status/closure of formal actions from previous KDP.</i></p> <ol style="list-style-type: none"> a. <i>B/L – Decommissioning Plan</i> b. <i>UPD – Disposal Plan</i> <p><u>Technical Products:</u></p> <ol style="list-style-type: none"> a. <i>UPD – Cost and schedule for technical implementation</i>

E.4.15 TD Project Disposal Readiness Review (DRR)/Close-Out Review (COR)

A DRR confirms the readiness for the final disposal of the system assets. The COR examines project’s accomplishments, including an independent assessment of the final TRL, and other maturity measures, and ensures that sufficient data is archived so that future users can assess the technology maturity (e.g. TRL) and incorporate the technology into future system designs.

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TD Project Disposal Readiness Review (DRR)/Close-Out Review (COR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>Requirements associated with disposal are defined.</i> 2. <i>Plans are in place for disposal and any other removal from service activities.</i> 3. <i>Resources are in place to support disposal.</i> 4. <i>Safety, environmental, health, and any other constraints are described.</i> 5. <i>Current system capabilities related to disposal are described and understood.</i> 6. <i>Off-nominal operations, all contributing events, conditions, and changes to the originally expected baseline have been considered and assessed.</i> 7. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Final Report from Close-Out Review</i> b. <i>UPD – Disposal Plan</i> 8. <i>The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Updated cost for technical implementation.</i> b. <i>Updated schedule for technical implementation.</i> 	<ol style="list-style-type: none"> 1. <i>The rationale for disposal is documented.</i> 2. <i>The disposal plan is complete, meets requirements, is approved by appropriate management, and is compliant with applicable Agency safety, environmental, and health regulations.</i> 3. <i>Operations plans for disposal, including contingencies, are complete and approved.</i> 4. <i>All required support systems for disposal are available.</i> 5. <i>All personnel have been properly trained for the nominal and contingency disposal procedures.</i> 6. <i>Safety, health, and environmental hazards have been identified, and controls have been verified.</i> 7. <i>Risks associated with the disposal have been identified and adequately mitigated.</i> 8. <i>Residual risks have been accepted by the required management.</i> 9. <i>If hardware is to be recovered from orbit:</i> <ol style="list-style-type: none"> a. <i>Return site activity plans have been defined and approved.</i> b. <i>Required facilities are available and meet requirements, including those for contamination control, if needed.</i> c. <i>Transportation plans are defined and approved.</i> d. <i>Shipping containers and handling equipment, as well as contamination and environmental control and monitoring devices, are available.</i> 10. <i>Plans for disposition of mission-owned assets (e.g., hardware, software, and facilities) have been defined and approved.</i> 11. <i>Adequate resources (schedule, budget, and staffing) have been identified and are available to successfully complete all disposal activities.</i> 12. <i>All mission and project data and documentation has been archived per disposal plan.</i> 13. <i>The program/project is compliant with NASA and Implementing Center requirements, standards, processes, and procedures.</i> 14. <i>TBD and TBR items have all been dispositioned.</i>

TD Project DRR/COR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ol style="list-style-type: none"> a. <i>Final – Report from Close-Out Review</i> b. <i>UPD – Disposal Plan</i> <p><u>Technical Products:</u></p> <ol style="list-style-type: none"> a. <i>UPD – Cost and schedule for technical implementation</i>

E. 4.16 R&T Program Formulation Review (FR)

The FR assesses the program’s readiness and planning to enter the implementation phase.

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R&T Program Formulation Review (FR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>The Program has successfully completed any prior reviews, any higher level reviews (if applicable), and responses have been made to all RFAs and RIDs, or a timely closure plan exists for those remaining open.</i> 2. <i>A preliminary agenda, success criteria, and instructions to the review board have been agreed to by the technical team, the program manager, and the review chair prior to the review.</i> 3. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. B/L – Formulation Authorization Document (FAD) <i>*(Reference Data)</i> b. P – R&T Program Commitment Agreement (PCA) c. P – R&T Program Plan d. P – Inter-Agency and international agreements e. P – Gap Analysis (literature search) f. P – Terms of Reference (TOR) g. <i>*P – Systems Engineering Applicability Assessment (EMC approval)</i> h. SUM – Documentation (from subordinate projects) of performance against plan/baseline, including status/closure of formal actions from previous KDP. i. Plans for work to be accomplished during next life-cycle phase (for subordinate projects) 	<ol style="list-style-type: none"> 1. <i>Program requirements have been defined and support Mission Directorate strategic objectives.</i> 2. <i>The program requirements are adequately levied on either the TD project or the Portfolio projects.</i> 3. <i>The technical performance metrics identified with goals and minimum thresholds needed to achieve the R&T Program objectives.</i> 4. <i>Schedule, cost, safety, and risk factors defined and are acceptable.</i> 5. <i>Customers/beneficiaries/stakeholders identified with their requirements/objectives.</i> 6. <i>Architecture with major components defined Requirements/objectives/performance requirements/success criteria acceptable</i> 7. <i>Project requirements/objectives verified/validated for compliance.</i>

R&T Program FR Product Maturity Post Review
<p><u>Programmatic Products:</u></p> <ol style="list-style-type: none"> a. B/L – R&T Program Commitment Agreement (PCA) b. B/L – R&T Program Plan c. B/L – Inter-Agency and international agreements d. B/L – Gap Analysis (literature search) e. B/L – Terms of Reference (TOR) f. <i>*B/L – Systems Engineering Applicability Assessment (EMC approval)</i> g. SUM – Documentation (from subordinate projects) of performance against plan/baseline, including status/closure of formal actions from previous KDP. h. Plans for work to be accomplished during next life-cycle phase (for subordinate projects) <p><u>Technical Products:</u></p> <p>None</p>

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E.5 Other Technical Reviews

E.5.1 Test Readiness Review (TRR)

The TRR ensures that the test article (hardware/software), test facility, support personnel, and test procedures are ready for testing and data acquisition, reduction, and control. Completion of the TRR is not a prerequisite for KDP E (approving transition from Phase D to Phase E).

Test Readiness Review (TRR)	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>A preliminary TRR agenda, success criteria, and instructions to the review team have been agreed to by the technical team, project manager, and review chair prior to the TRR.</i> 2. <i>The objectives of the testing have been clearly defined and documented.</i> 3. <i>Approved test plans, test procedures, test environment, and configuration of the test item(s) that support test objectives are available.</i> 4. <i>All test interfaces have been placed under configuration control or have been defined in accordance with an agreed to plan, and version description document(s) for both test and support systems have been made available to TRR participants prior to the review.</i> 5. <i>All known system discrepancies have been identified and dispositioned in accordance with an agreed-upon plan.</i> 6. <i>All required test resources—people (including a designated test director), facilities, test articles, test instrumentation, test software, and other test-enabling products—have been identified and are available to support required tests.</i> 7. <i>Roles and responsibilities of all test participants are defined and agreed to.</i> 8. <i>Test safety planning has been accomplished, and all personnel have been trained.</i> 9. <i>*Ensure compliance to ED-OWI-004, Test Program Control, sections; 4.4, 4.20, 10, and 15.1.</i> 10. <i>The programmatic products listed below have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>Emergency Procedures and Pre-Mishap Contingency Planning (see MWI 8621.1 and NPR 8621.1)</i> 11. <i>*The following technical products, for both hardware and software systems elements, have been made available to the cognizant participants prior to the review:</i> <ol style="list-style-type: none"> a. <i>P – Test Plan</i> 	<ol style="list-style-type: none"> 1. <i>Adequate test plans are completed and approved for the system under test.</i> 2. <i>Adequate identification and coordination of required test resources are completed.</i> 3. <i>The program/project has demonstrated compliance with applicable NASA and implementing Center requirements, standards, processes, and procedures.</i> 4. <i>TBD and TBR items are clearly identified with acceptable plans and schedule for their disposition.</i> 5. <i>Risks have been identified, credibly assessed, and appropriately mitigated.</i> 6. <i>Residual risk is accepted by program/project leadership as required.</i> 7. <i>Plans to capture any lessons learned from the test program are documented.</i> 8. <i>The objectives of the testing have been clearly defined and documented, and the review of all the test plans, as well as the procedures, environment, and configuration of the test item, provides a reasonable expectation that the objectives will be met.</i> 9. <i>The test cases have been analyzed and are consistent with the test plans and objectives.</i> 10. <i>Test personnel have received appropriate training in test operation and health and safety procedures.</i> 11. <i>*Measuring equipment is properly calibrated, or adequate plans exist to ensure proper calibration prior to test.</i> 12. <i>*Adequate test and checkout/verification procedures are completed and approved, or actions items have been created to document and track any remaining procedure approvals.</i>

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Test Readiness Review (TRR)	
Entrance Criteria:	Success Criteria
<ul style="list-style-type: none"> b. <i>P – Test Cases (Matrix of specific environmental conditions the test article will be subjected to)</i> c. <i>P – Verification/Validation Procedures (STD/SE-VVPROC) (e.g. Test, Inspection, Demonstration Procedures)</i> d. <i>P– Test Equipment/Software Checkout & Verification Procedures</i> e. <i>SUM – Test Objectives</i> f. <i>SUM – Hazard Analysis/Safety Assessment identifying hazards, controls/mitigations, and assessed risk levels, with documented management acceptance.</i> g. <i>SUM – Test article configuration and design/manufacture pedigree.</i> h. <i>SUM – Test facility/equipment/software activation/verification, calibration, and certification status.</i> i. <i>SUM – Test personnel roles/responsibilities, training/certification status, and test resource availability.</i> j. <i>SUM – Approach for Quality Assurance</i> k. <i>SUM – Any non-conformances/discrepancies on test article/facility/equipment/software, and any waivers/deviations, if applicable.</i> l. <i>SUM – Results from previous test of lower level subsystems/components.</i> m. <i>SUM – Resolution of any issues from previous design reviews.</i> n. <i>SUM – Results of integration of test article with test facility, and test software (measurement/control) systems.</i> o. <i>Draft – Software test plans (STD/SW-STP)</i> p. <i>Draft – Software test procedures (STD/SW-STPR)</i> 	

TRR Product Maturity Post Review
<p><u>Programmatic Products:</u> None</p> <p><u>Technical Products:</u></p> <ul style="list-style-type: none"> a. <i>*B/L – Test Plan</i> b. <i>*B/L – Test Cases</i> c. <i>*B/L – Verification/Validation Procedures (STD/SE-VVPROC) (e.g. Test, Inspection, Demonstration Procedures)</i> d. <i>*B/L – Test Equipment/Software Checkout & Verification Procedures</i> e. <i>*FINAL – TRR Meeting minutes, and records of material presented during review</i> f. <i>*FINAL – Test Readiness/Risk Assessment Statement</i> g. <i>*TRR Actions – Any open work/issues to be tracked to completion, including identification of those that are a “constraint” to begin testing.</i> h. <i>*FINAL – Software test plans (STD/SW-STP)</i> i. <i>*FINAL – Software test procedures (STD/SW-STPR)</i>

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E.5.2 Peer Review

Peer reviews provide the technical insight essential to ensure product and process quality. Peer reviews are focused, in-depth technical reviews that support the evolving design and development of a product, including critical documentation or data packages. The participants in a peer review are the technical experts and key stakeholders for the scope of the review. Another purpose of the peer review is to add value and reduce risk through expert knowledge infusion, confirmation of approach, identification of defects, and specific suggestions for product improvements.

Peer Review	
Entrance Criteria:	Success Criteria
<ol style="list-style-type: none"> 1. <i>The product to be reviewed (document, process, model, design details, etc.) has been identified and made available to the review team.</i> 2. <i>Peer reviewers independent from the project have been selected for their technical background related to the product being reviewed.</i> 3. <i>A preliminary agenda, success criteria, and instructions to the review team have been agreed to by the technical team and project manager.</i> 4. <i>Rules have been established to ensure consistency among the team members involved in the peer review process.</i> 	<ol style="list-style-type: none"> 1. <i>Peer review has thoroughly evaluated the technical integrity and quality of the product.</i> 2. <i>Any defects have been identified and characterized.</i> 3. <i>Results of the Peer Review are communicated to the appropriate project personnel.</i>

Peer Review Product Maturity Post Review
<p><u>Programmatic Products:</u> None</p> <p><u>Technical Products:</u></p> <ol style="list-style-type: none"> a. <i>*Documented discrepancies from Peer Review</i> b. <i>*Peer Review Results Report</i>

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APPENDIX F.

MSFC COMPLIANCE MATRIX

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NPR 7123.1 Req ID	NPR 7123.1 Paragraph	Requirement Statement	Comply (Full, Tailored)	Rationale for Decisions, Comments, Deviations
SE-01	2.1.4.3.a	Center Directors shall perform the following activities: establish policies, procedures, and processes to execute the requirements of this SE NPR.	Full	MPD 1150.1, MPR 7120.1, MPR 7123.1, MSFC-HDBK-3173, MGM 7120.3
SE-02	2.1.4.3.b	Center Directors shall perform the following activities: assess and take corrective actions to improve the execution of the requirements of this SE NPR.	Full	MGM 1280.1, Program/Project Management Advisory Committee Charter
SE-03	2.1.4.3.c	Center Directors shall perform the following activities: select appropriate standards applicable to projects under their control.	Full	MPR 7120.1, MPR 7123.1, MPR 8070.1
SE-04	2.1.4.3.d	Center Directors shall perform the following activities: Complete the compliance matrix, as tailored, in AppendixG.1 for those requirements owned by the Office of Chief Engineer, and provide upon request.	Full	MPR 7123.1, Appendix G
SE-07	3.2.2.1	Center Directors or designees shall establish and maintain a Stakeholder Expectations Definition process to include activities, requirements, guidelines, and documentation for the definition of stakeholder expectations for the applicable product layer.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-08	3.2.3.1	Center Directors or designees shall establish and maintain a Technical Requirements Definition process to include activities, requirements, guidelines, and documentation for the definition of technical requirements from the set of agreed upon stakeholder expectations for the applicable product layer.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-09	3.2.4.1	Center Directors or designees shall establish and maintain a Logical Decomposition process to include activities, requirements, guidelines, and documentation for logical decomposition of the validated technical requirements of the applicable product layer.	Full	MPR 7123.1, MSFC – HDBK-3173

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NPR 7123.1 Req ID	NPR 7123.1 Paragraph	Requirement Statement	Comply (Full, Tailored)	Rationale for Decisions, Comments, Deviations
SE-10	3.2.5.1	Center Directors or designees shall establish and maintain a Design Solution Definition process to include activities, requirements, guidelines, and documentation for designing product solution definitions within the applicable product layer that satisfy the derived technical requirements.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-11	3.2.6.1	Center Directors or designees shall establish and maintain a Product Implementation process to include activities, requirements, guidelines, and documentation for implementation of a design solution definition by making, buying, or reusing an end product of the applicable product layer.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-12	3.2.7.1	Center Directors or designees shall establish and maintain a Product Integration process to include activities, requirements, guidelines, and documentation for the integration of lower level products into an end product of the applicable product layer in accordance with its design solution definition.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-13	3.2.8.1	Center Directors or designees shall establish and maintain a Product Verification process to include activities, requirements/specifications, guidelines, and documentation for verification of end products generated by the product implementation process or product integration process against their design solution definitions.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-14	3.2.9.1	Center Directors or designees shall establish and maintain a Product Validation process to include activities, requirements, guidelines, and documentation for validation of end products generated by the product implementation process or product integration process against their stakeholder expectations.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-15	3.2.10.1	Center Directors or designees shall establish and maintain a Product Transition process to include activities, requirements, guidelines, and documentation for transitioning end products to the next higher level product layer customer or user.	Full	MPR 7123.1, MSFC – HDBK-3173

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NPR 7123.1 Req ID	NPR 7123.1 Paragraph	Requirement Statement	Comply (Full, Tailored)	Rationale for Decisions, Comments, Deviations
SE-16	3.2.11.1	Center Directors or designees shall establish and maintain a Technical Planning process to include activities, requirements, guidelines, and documentation for planning the technical effort.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-17	3.2.12.1	Center Directors or designees shall establish and maintain a Requirements Management process to include activities, requirements, guidelines, and documentation for management of requirements throughout the system life-cycle.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-18	3.2.13.1	Center Directors or designees shall establish and maintain an Interface Management process to include activities, requirements, guidelines, and documentation for management of the interfaces defined and generated during the application of the system design processes.	Full	MPR 7123.1, MSF – HDBK-3173
SE-19	3.2.14.1	Center Directors or designees shall establish and maintain a Technical Risk Management process to include activities, requirements, guidelines, and documentation for management of the risk identified during the technical effort.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-20	3.2.15.1	Center Directors or designees shall establish and maintain a Configuration Management process to include activities, requirements, guidelines, and documentation for configuration management.	Full	MPR 7123.1, MSFC – HDBK-3173, MGM-8040.1
SE-21	3.2.16.1	Center Directors or designees shall establish and maintain a Technical Data Management process to include activities, requirements, guidelines, and documentation for management of the technical data generated and used in the technical effort.	Full	MPR 7123.1, MSFC – HDBK-3173, MGM 7120.3
SE-22	3.2.17.1	Center Directors or designees shall establish and maintain a Technical Assessment process to include activities, requirements, guidelines, and documentation for making assessments of the progress of planned technical effort and progress toward requirements satisfaction.	Full	MPR 7123.1, MSFC – HDBK-3173
SE-23	3.2.18.1	Center Directors or designees shall establish and maintain a Decision Analysis process to include activities, requirements, guidelines, and documentation for making technical decisions.	Full	MPR 7123.1, MSFC – HDBK-3173

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APPENDIX G

REFERENCES

NASA/SP-2007-6105, NASA Systems Engineering Handbook

NASA-HDBK-2203, NASA Software Engineering Handbook

MGM 7120.3, MSFC Data Management Guidance

MGM 8040.1, MSFC Configuration Management Guidance

MSFC-HDBK-2221, Verification Handbook Volume 2

MSFC-HDBK-3173, MSFC Project Management and Systems Engineering Handbook

ED-OWI-004, Test Program Control

STD/CM-CMP, Configuration Management Plan (CMP)

STD/DM-DMP, Data Management Plan (DMP)

STD/SE-SARCH, System Architecture (SARCH)

STD/SE-CONOPS, Concept of Operations (CONOPS)

STD/SE-ICD, Interface Control Documents (ICD)

STD/SE-IRD, Interface Requirements Document (IRD)

STD/SE-REQSPEC, Requirement Document/Specification (REQSPEC)

STD/SE-RST, Requirements/Specifications Trees (RST)

STD/SE-RT, Requirements Traceability (RT)

STD/SE-SEMP, Systems Engineering Management Plan (SEMP)

STD/SE-VVC, Verification/Validation Compliance (VVC) Assessment

STD/SE-VVPLAN, Verification/Validation Planning (VVPLAN)

STD/SE-VVPROC, Verification/Validation Procedures (VVPROC)

STD/SE-VVREP, Verification/Validation Reports (VVREP)

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STD/SE-VVREQ, Verification/Validation Requirements (VVREQ)

STD/SE-VVSC, Verification/Validation Success Criteria (VVSC)