NASA Procedural Requirements

NID 7120-81, NRW 7120-27
NPR 7120.5D
NID for NPR 7120.5D
Effective Date:
Expiration Date:

COMPLIANCE IS MANDATORY Standing Review Board Handbook

Responsible Office: Office of the Chief Engineer

NASA SPACE FLIGHT PROGRAM AND PROJECT MANAGEMENT REQUIREMENTS

NASA Interim Directive (NID) for NASA Procedural Requirements (NPR) 7120.5D

DISTRIBUTION:
NODIS

This Document Is Uncontrolled When Printed.
Check the NASA Online Directives Information System (NODIS) Library
to verify that this is the correct version before use: http://nodis3.gsfc.nasa.gov

---

TABLE OF CONTENTS

Preface
- P.1 PURPOSE
- P.2 APPLICABILITY
- P.3 AUTHORITY
- P.4 APPLICABLE DOCUMENTS
- P.5 MEASUREMENT/VERIFICATION
- P.6 CANCELLATION

Chapter 1. Introduction
- 1.1 Background
- 1.2 Overview of Management Process
- 1.3 Document Structure

Chapter 2. NASA Life Cycles for Space Flight Programs and Projects
- 2.1 Programs and Projects
- 2.2 Program Life Cycle
- 2.3 Project Life Cycle
- 2.4 Program and Project Oversight and Approval
- 2.5 Program and Project Reviews

Chapter 3. Program and Project Management Roles and Responsibilities
- 3.1 Overview of Roles and Responsibilities
- 3.2 Specific Roles and Responsibilities
- 3.3 Process for Handling Dissenting Opinions
- 3.4 Technical Authority
- 3.5 Center Reimbursable Space Flight Work
- 3.6 Principles Related to Tailoring Requirements

Chapter 4. Program and Project Requirements by Phase
- 4.1 Programs—Formulation Phase
- 4.2 Programs—Implementation Phase
- 4.3 Projects—Pre-Phase A
- 4.4 Projects—Phase A
- 4.5 Projects—Phase B
- 4.6 Projects—Phase C
- 4.7 Projects—Phase D
- 4.8 Projects—Phase E
- 4.9 Projects—Phase F

APPENDIX A Definitions

APPENDIX B Acronyms

APPENDIX C Formulation Authorization Document Template
C.1 Program FAD Title Page
C.2 Project FAD Title Page
C.3 Program/Project FAD Template
APPENDIX D Program Commitment Agreement Template
D.1 PCA Title Page
D.2 PCA Template
APPENDIX E Program Plan Template
E.1 Template Instructions
E.2 Program Plan Title Page
E.3 Program Plan Template
APPENDIX F Project Plan Template
F.1 Template Instructions
F.2 Project Plan Title Page
F.3 Project Plan Template
APPENDIX G Space Flight Project Work Breakdown Structure
APPENDIX H References

LIST OF TABLES

Table 1-1 Programmatic Requirements Hierarchy
Table 2-1 Project Categorization Guidelines
Table 2-2 Relationship Between Programs/Projects and PMCs
Table 2-3 Major Program/Project Life Cycle Reviews Not Conducted by the SRB
Table 2-4 NASA Convening Authorities for Standing Review Board
Table 2-5 SRB Structure
Table 2-6 Space Flight Program Reviews
Table 2-7 Space Flight Project Reviews
Table 3-1 Roles and Responsibilities Relationships Matrix
Table 3-2 Minimum Attributes for Requests for Requirement Relief
Table 3-3 Tracking Data
Table 3-4 Waiver or Deviation Approval for NPR 7120.5 Requirements
Table 4-1 Program Gate Products Maturity Matrix
Table 4-2 Program Plan Control Plan Maturity Matrix
Table 4-3 Project Gate Products Maturity Matrix
Table 4-4 Project Plan Control Plan Maturity Matrix
Table D-1 Sample Program Commitment Agreement Activities Log

LIST OF FIGURES

Figure 1-1 Separation of Programmatic and Institutional Authority
Figure 1-2 Institutional Requirements Flow Down
Figure 1-3 NASA Core Values
Figure 2-1 Programmatic Authority Organizational Hierarchy
Figure 2-2 Space Flight Program and Project Management Process Overview
Figure 2-3 The NASA Program Life Cycle
Figure 2-4 The NASA Project Life Cycle
Figure 2-5 Program/Project Independent Life Cycle Review Process
Figure C-1 Program Formulation Authorization Document Title Page
Figure C-2 Project Formulation Authorization Document Title Page
Figure D-1 Program Commitment Agreement Title Page
Figure E-1 Program Plan Title Page
Figure F-1 Project Plan Title Page
Figure G-1 Standard Level 2 WBS Elements for Space Flight Projects

Preface

P.1 PURPOSE

This document establishes the requirements by which NASA will formulate and implement space flight programs and projects, consistent with the governance model contained in NASA Policy Directive (NPD) 1000.0, *NASA Governance and Strategic Management Handbook*.

P.2 APPLICABILITY

a. This NASA Interim Directive (NID) for NASA Procedural Requirement (NPR) 7120.5D is applicable to NASA Headquarters and NASA Centers, including Component Facilities and Technical and Service Support Centers. This language applies to JPL, other contractors, grant recipients, or parties to agreements only to the extent specified or referenced in the appropriate contracts, grants, or agreements.

b. This NID applies to all current and future NASA space flight programs and projects (including spacecraft, launch vehicles, instruments developed for space flight programs and projects, research and technology developments funded by and to be incorporated into space flight programs and projects, critical technical facilities specifically developed or significantly modified for space flight systems, and ground systems that are in direct support of space flight operations). This NID also applies to reimbursable space flight programs/projects performed for non-NASA sponsors. For existing programs and projects, the requirements of this document are applicable to the program/project's extant phase as of the effective date of this NID and to phases yet to be completed.

c. This NID can be applied to other NASA investments at the discretion of the responsible manager or the NASA Associate Administrator.

P.3 AUTHORITY

a. 42 U.S.C. 2473(c) (1), Section 203(c) (1) of the *National Aeronautics and Space Act of 1958*, as amended.

b. NPD 1000.0, *NASA Governance and Strategic Management Handbook*.

c. NPD 1000.3, *The NASA Organization*.

d. NPD 1000.5, *Policy for NASA Acquisition*

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

P.4 APPLICABLE DOCUMENTS

a. NPD 1001.0, *NASA Strategic Plan*

b. NPD 8700.1, *NASA Policy for Safety and Mission Success*

c. NPD 8900.5, *NASA Health and Medical Policy for Human Space Exploration*

d. NPR 7120.6, *Lessons Learned Process*

e. NPR 7120.7, *NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements*

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

g. NPR 8000.4, *Agency Risk Management Procedural Requirements*

h. NPR 8705.5, *Probabilistic Risk Assessment (PRA) Procedures for NASA Programs and Projects*

i. NPR 9420.1, *Budget Formulation*

j. NPR 9470.1, *Budget Execution*

P.5 MEASUREMENT/VERIFICATION

Compliance with this document is verified by submission to responsible NASA officials, at key decision points, of the gate products identified in this document and by internal and external controls. Internal controls include audit, review, and assessment processes defined in NPD 1200.1, *NASA Internal Control*. External controls may include external audits and reporting requirements.

P.6 CANCELLATION

None.

Mike Ryschkewitsch

NASA Chief Engineer

DISTRIBUTION:
NODIS

Chapter 1. Introduction

1.1 Background

1.1.1 NASA space flight programs and projects develop and operate a wide variety of spacecraft, launch vehicles, in-space facilities, communications networks, instruments, and supporting ground systems.[1] This document establishes a standard of uniformity for the process by which NASA will formulate and implement space flight programs and projects consistent with the governance model contained in NPD 1000.0, *NASA Governance and Strategic Management Handbook*. The governance model provides an organizational structure that emphasizes mission success by taking advantage of different perspectives that different organizational elements bring to issues. The organizational separation of the Mission Directorates and their respective programs and projects (Programmatic Authorities) and the Headquarters Mission Support Offices, the Center organizations that are aligned with these offices, and the Center Directors (Institutional Authorities) is the cornerstone of this organizational structure and NASA's system of checks and balances. This system is built on the principle that "no one gets to grade his or her own work."

The separation of authorities is illustrated in Figure 1-1.

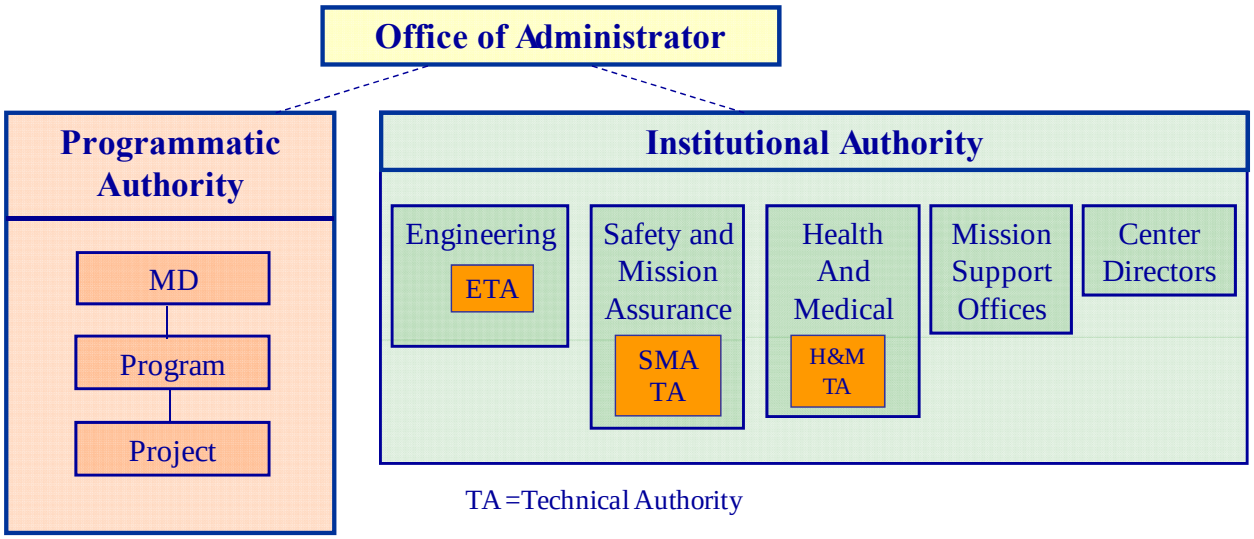


Figure 1-1 Separation of Programmatic and Institutional Authority

1.1.2 Programmatic Authority resides with the Mission Directorates and their respective programs and projects. It is largely described in sections 3.1 and 3.2 by the roles and responsibilities of the NASA Associate Administrator (AA), Mission Directorate Associate Administrators (MDAAs), and program and project managers.

[1] NASA space flight programs and projects often must mature technologies to meet mission goals. These enabling and/or enhancing technologies are also covered by this NPR.

1.1.3 The Institutional Authority encompasses all those organizations not in the Programmatic Authority. Engineering, Safety and Mission Assurance, and Health and Medical organizations are a unique segment of the Institutional Authority. They support programs and projects in two ways:

a) They provide technical personnel and support and oversee the technical work of personnel who provide the technical expertise to accomplish the program or project mission.

b) They provide Technical Authorities, who independently oversee programs and projects. These individuals have a formally delegated Technical Authority role traceable to the Administrator and are funded independent of programs and projects. The Technical Authorities are described in Section 3.4.

1.1.4 Well trained and experienced program and project managers are essential to the successful accomplishment of NASA's overall mission as well as to the success of individual programs and projects. In recognition of this, and in compliance with OMB-promulgated Federal acquisition program/project management certification requirements, NASA has instituted an Agency-wide career development framework and program to certify a cadre of career personnel to meet the Agency's current and future demands for program and project managers.. The development framework and certification are contained in the *NASA Project Management Competency Model* and the *Federal Acquisition Certification for Program/Project Managers—Center Implementation Guidelines*. Certification is required for individuals who manage programs or projects with a life cycle cost greater than $250 million.

1.1.5 Central to the program and project management process are the program and project life cycles, and the Key Decision Points (KDPs) within these life cycles. This document also outlines program/project decision processes and summarizes the roles and responsibilities of key personnel involved in NASA program and project management: the Agency Program Management Council (PMC), the Mission Directorates, the Centers,[2] program managers, and project managers. It further identifies and summarizes the technical authority process as it applies to space flight program and project management[3] and codifies the top-level management requirements for safe and successful program/project formulation and implementation.

1.1.6 This document distinguishes between programmatic requirements and institutional requirements. Both categories of requirements must ultimately be satisfied in program and project formulation and implementation. *Programmatic requirements* are the responsibility of the Programmatic Authorities and focus on the products to be developed and delivered and specifically relate to the goals and objectives of a particular NASA program or project. These requirements flow down from the Agency's strategic planning process. Table 1-1 shows this

---

[2] The term "Center" here and throughout this document is meant to include NASA Component Facilities, Technical and Service Support Centers (per NPD 1000.3), and the Jet Propulsion Laboratory (JPL).

[3] The establishment of a technical authority process represents a direct response to the Columbia Accident Investigation Board (CAIB) recommendations—specifically, CAIB recommendation R7.5-1—and represents a critical shift in NASA's program and project management strategy relating to safety.

flow down from Agency needs, goals, and objectives (described in the NASA Strategic Plan) to programs and projects.

Table 1-1 Programmatic Requirements Hierarchy

Direction	Content	Governing Document	Approver	Originator
Needs, Goals, Objectives	Agency strategic direction based on higher-level direction	NPD 1000.0, NASA Governance and Strategic Management Handbook, NASA Strategic Plan, and Strategic Planning Guidance	Administrator	Support Organizations
Agency Requirements	Structure, relationships, principles governing design and evolution of cross-Agency Mission Directorate systems linked in accomplishing Agency needs, goals, and objectives	Architectural Control Document (ACD)	Administrator	Host MDAA with Inputs from Other Affected MDAAs
Mission Directorate Requirements	High-level requirements levied on a program to carry out strategic and architectural direction including programmatic direction for initiating specific projects	Program Commitment Agreement (PCA)	AA	MDAA
Program Requirements	Detailed requirements levied on a program to implement the PCA and high-level programmatic requirements allocated from the program to its projects	Program Plan	MDAA	Program Manager
Project Requirements	Detailed requirements levied on a project to implement the Program Plan and flow-down programmatic requirements allocated from the program to the project	Project Plan	Program Manager	Project Manager
System Requirements	Detailed requirements allocated from the project to the next lower level of the project	System Requirements Documentation	Project Manager	Responsible System Lead

MDAA = Mission Directorate Associate Administrator; AA = NASA Associate Administrator

1.1.7 *Institutional requirements* are the responsibility of the Institutional Authorities. They focus on how NASA does business and are independent of any particular program or project. These requirements are issued by NASA Headquarters (including the Office of the Administrator, Mission Directorates, and Mission Support Offices) and by Center organizations. Institutional process requirements may respond to Federal statute, regulation, treaty, or executive order. They are normally documented in the following:

a. NASA Policy Directives (NPDs) – NPDs are Agency policy statements that describe what is required by NASA management to achieve NASA's vision, mission, and external mandates and describe who is responsible for carrying out those requirements.

b. NASA Procedural Requirements (NPRs) – NPRs provide Agency-mandatory requirements to implement NASA policy as delineated in an associated NPD.

c. NASA Standards – NASA Standards are formal documents that establish a norm, requirement, or basis for comparison, a reference point to measure or evaluate against. A technical standard, for example, establishes uniform engineering or technical criteria, methods, processes, and practices.

d. Center Policy Directives (CPDs) – CPDs define Center-specific policy requirements and responsibilities that apply only to the issuing Center and operations performed by NASA personnel at that Center (and must comply with requirements delineated in associated NPDs and NPRs).

e. Center Procedural Requirements (CPRs) – CPRs establish Center-specific procedural requirements and responsibilities to implement the policies and procedural requirements defined in related NPDs, NPRs, or CPDs. CPRs apply only to the issuing Center and operations performed by NASA personnel at that Center.

f. Mission Directorate or Programmatic Requirements – Mission Directorate or programmatic requirements contained in Mission Directorate or program documentation apply to activities, products, or services supporting program and project office needs, which could extend across multiple Centers.

1.1.8 This NID for NPR 7120.5 is part of a realignment of governing documents within NASA designed to increase accountability and general clarity in the flow down of both programmatic and institutional requirements. Figure 1-2 shows flow down from NPD 1000.0 through program and project plans. The figure identifies the five types of institutional requirements that flow down to these plans: *engineering*, *program/project management*, *safety and mission assurance*, *health and medical*, and *Mission Support Office (MSO) functional* requirements. These terms are defined in Appendix A.

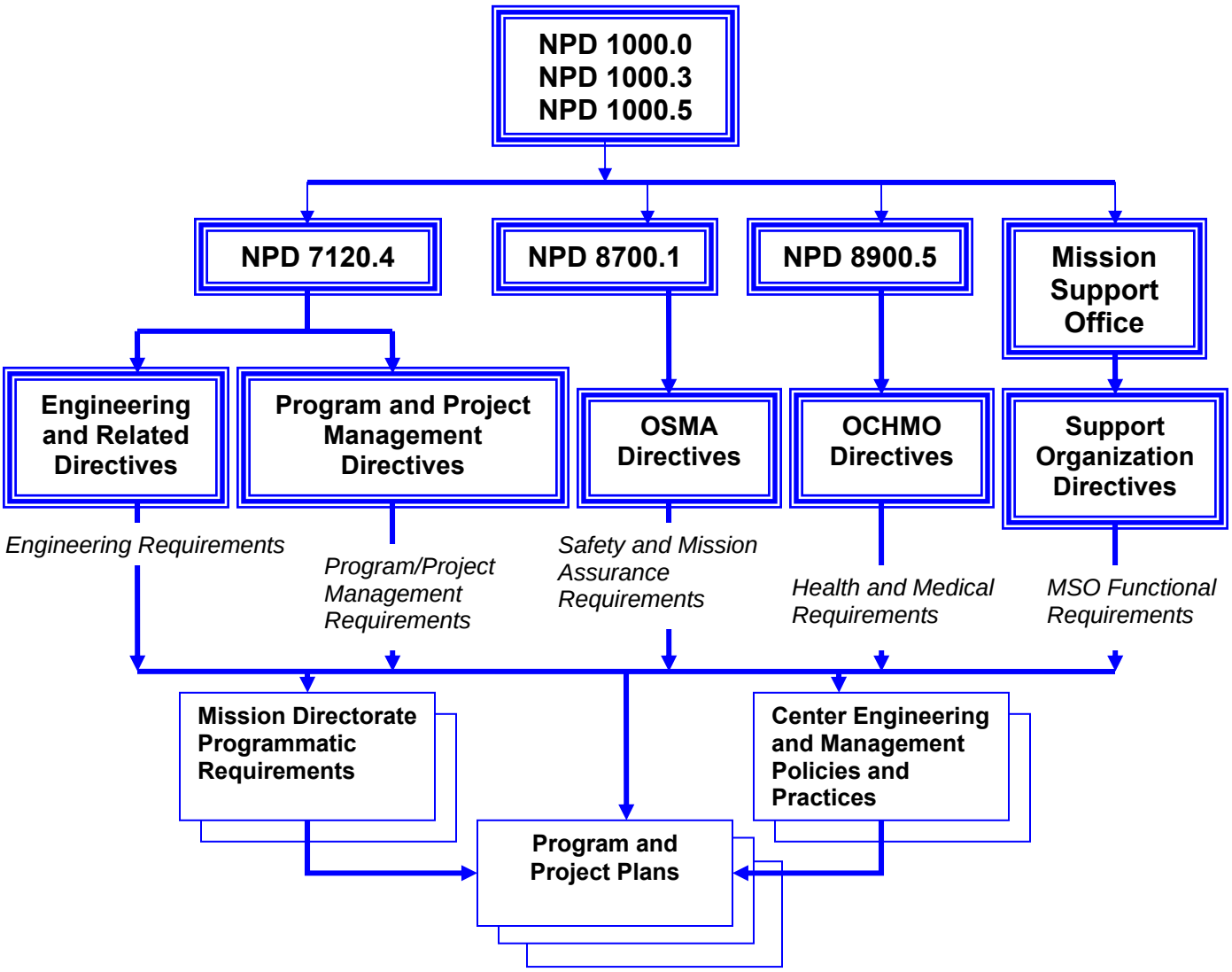


Figure 1-2 Institutional Requirements Flow Down

1.2 Overview of Management Process

1.2.1 Although this document emphasizes program and project management based on life cycles, KDPs, and evolving products during each life cycle phase, these are embedded in NASA's four-part process for managing programs and projects, which consists of:

a. Formulation – the identification of how the program or project supports the Agency's strategic needs, goals, and objectives; the assessment of feasibility, technology, and concepts; risk assessment, team building, and development of operations concepts and acquisition strategies; establishment of high-level requirements and success criteria; the preparation of plans, budgets, and schedules essential to the success of a program or

project; and the establishment of control systems to ensure performance to those plans and alignment with current Agency strategies.

b. Approval (for Implementation) – the acknowledgment by the decision authority that the program/project has met stakeholder expectations and formulation requirements and is ready to proceed to implementation. By approving a program/project, the decision authority commits the budget resources necessary to continue into implementation.

c. Implementation – the execution of approved plans for the development and operation of the program/project, and the use of control systems to ensure performance to approved plans and requirements and continued alignment with the Agency's strategic needs, goals, and objectives.

d. Evaluation – the continual self and independent assessment of the performance of a program or project and incorporation of the assessment findings to ensure adequacy of planning and execution according to approved plans and requirements.

1.2.2 NASA's core values[4], illustrated in Figure 1-3, form the foundation for the program project management process. These values are:

Safety—NASA's constant attention to safety is the cornerstone upon which we build mission success. We are committed, individually and as a team, to protecting the safety and health of the public, our team members, and those assets that the Nation entrusts to the Agency.

Excellence—To achieve the highest standards in engineering, research, operations, and management in support of mission success, NASA is committed to nurturing an organizational culture in which individuals make full use of their time, talent, and opportunities to pursue excellence in both the ordinary and the extraordinary.

Teamwork—NASA's most powerful tool for achieving mission success is a multi-disciplinary team of diverse competent people across all NASA Centers. Our approach to teamwork is based on a philosophy that each team member brings unique experience and important expertise to project issues. Recognition of and openness to that insight improves the likelihood of identifying and resolving challenges to safety and mission success. We are committed to creating an environment that fosters teamwork and processes that support equal opportunity, collaboration, continuous learning, and openness to innovation and new ideas.

Integrity—NASA is committed to maintaining an environment of trust, built upon honesty, ethical behavior, respect, and candor. Our leaders enable this environment by encouraging and rewarding a vigorous, open flow of communication on all issues, in all directions, among all employees without fear of reprisal. Building trust through

[4] Quoted from *NPD 1000.0, NASA Governance and Strategic Management Handbook.*

ethical conduct as individuals and as an organization is a necessary component of mission success.

Mission success requires uncompromising commitment to safety, excellence, teamwork, and integrity.

Figure 1-3 NASA Core Values.

1.3 Document Structure

1.3.1 In this document, a specific requirement is identified by "*shall,*" a good practice by "*should,*" permission by "*may*" or "*can,*" and expectation by "*will.*" In chapters 2 and 3 NASA's required practice is described in indicative mood, i.e., "Programs are baselined or rebaselined and budgeted at a confidence level of 70 percent or the level approved by the decision authority."

1.3.2 The remainder of this document is organized as follows: Chapter 2 defines the life cycles for NASA space flight programs and projects. Chapter 3 defines the roles and responsibilities of program/project team members and their interrelationships. Chapter 4 provides the management requirements on programs and projects by life cycle phase and specifies the gate products required to transition between phases. Chapters 2 and 3 are written in the indicative mood (to affirm statements of fact) because they describe how NASA does program/project work. Chapter 4 is written using verifiable "*shall*" statements that define specific requirements that the program/project also must meet. Programs and projects will conform to chapters 2, 3, and 4 unless a waiver or deviation has been submitted and approved.

1.3.3 Appendices C through G contain templates for key management documents and additional information regarding specific management products, e.g., the work breakdown structure (WBS). See NASA's POLARIS Web site at https://polaris.nasa.gov for electronic versions of the templates. POLARIS also provides a database with a search and sort capability for NPR 7120.5 requirements and interactive program and project life cycle charts with links to guidance on reviews.[5]

[5] The POLARIS Web site also provides the list of NASA programs and projects from the Meta-Data Manager (MDM) and links to general information useful to program and project managers.

1.3.4 Reference documents relevant to program and project management activities are cited in Appendix H. A limited index to subjects in this document appears as Appendix I.

Chapter 2. NASA Life Cycles for Space Flight Programs and Projects

2.1 Programs and Projects

2.1.1 Space flight programs and projects are often the most visible and complex of NASA's strategic investments. These programs and projects flow from the implementation of national priorities, defined in the Agency's Strategic Plan, through the Agency's Mission Directorates as part of the Agency's general work breakdown hierarchy shown in Figure 2-1.

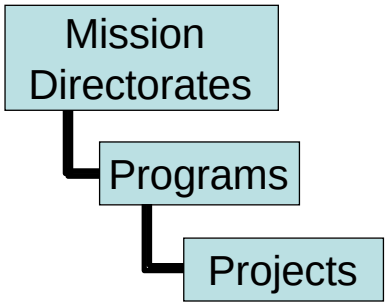


Figure 2-1 Programmatic Authority Organizational Hierarchy

2.1.2 This hierarchical relationship of programs to projects shows that programs and projects are different and their management involves different activities and focus. The following definitions are used to distinguish the two:

a. Program – a strategic investment by a Mission Directorate or Mission Support Office that has a defined architecture, and/or technical approach, requirements, funding level, and a management structure that initiates and directs one or more projects. A *program* defines a strategic direction that the Agency has identified as needed to implement Agency goals and objectives.

b. Project – a specific investment identified in a Program Plan having defined requirements, a life cycle cost, a beginning, and an end. A project also has a management structure and may have interfaces to other projects, agencies, and international partners. A project yields new or revised products and services that directly address NASA's strategic needs.

Regardless of the structure of a program or project meeting the criteria of Section P.2, this NID applies to the full scope of the program and/or project(s) and all activities under the program and/or project(s). Activities that are not identified in a Program Plan are managed by the program or project that established the baseline requirements for the activity. (For example, the program or project establishing the baseline requirements would cover the activity in its own reporting, KDP reviews, etc.)

2.1.3 NASA's strategic acquisition process, flowing from NPD 1000.0 and NPD 1000.5, is a continuous process requiring the earliest possible informed decisions to ensure that programs and projects remain consistent with NASA's strategic plan and Agency commitments, consider pertinent risks, and have the proper budget authorization. The Mission Directorate must work

with the Center to ensure Center policies and processes are recognized in the development of requirements. The Associate Administrator, Mission Directorates, and Center Directors must work together to ensure an integrated approach to resource challenges to help align Center resources and mission architectures over a multiyear timeframe. Three types of acquisition strategy meetings guide these portfolio decisions. These meetings are summarized below. Additional guidance on the acquisition strategic meetings will be available in the OCE section of the “Other Policy Documents” tab in the NASA Online Directive Information System (NODIS) library.

2.1.3.1 The Acquisition Strategy Planning (ASP) meeting - To provide an early view of potential individual program/project acquisitions, and of other selected key acquisitions, new major acquisitions are reviewed at the senior Agency management level at an ASP meeting. Reviews of new major acquisitions include ensuring that they fulfill an identified need that is aligned with the NASA Strategic Plan (NPD 1001.0) and are compatible with expected resources and capabilities. In addition to ASPs that review individual new acquisitions, a broad review is held annually, or more frequently at the Administrator’s discretion, to evaluate the entire Agency mission portfolio. Issues addressed encompass the strategic direction of the Agency as a whole. Topics may include: the appropriate application of new Agency and Administration initiatives, current portfolio risk and implications to the future portfolio, high-level make-buy strategy, and the placement of development or operations work in-house versus out-of-house. ASPs also provide the strategic framework for addressing challenges associated with fully utilizing NASA Centers’ capabilities, including workforce and infrastructure, and shaping the Agency over time. Meeting outcomes include determining or validating roles and responsibilities of Mission Directorate(s), Centers, major partnerships, and associated infrastructure.

2.1.3.2 The Acquisition Strategy Meeting (ASM) - Before authorizing resource expenditures for major acquisitions, the acquisition strategy is reviewed and agreed upon by senior Agency management. This includes consideration of resource availability, implementation of the decisions and guidance that flowed out of the ASP meeting, impact on the Agency workforce, maintaining core capabilities, make-or-buy planning, supporting Center assignments, and potential partners. This is generally accomplished with an ASM review chaired by the Administrator (or designee), based on information provided by the associated Mission Directorate or Mission Support Office, and results in recommending implementation plans for approval.

2.1.3.3 The Procurement Strategy Meeting (PSM) - Procurement regulations (the Federal Acquisition Regulation (FAR) and NASA FAR Supplement (NFS)) require specific activities and decisions to be addressed and documented as part of the acquisition planning process for individual procurements. For major and other selected procurements, this is accomplished at a PSM, chaired by the Assistant Administrator for Procurement (or designee), and is based on information provided by the associated program or project. In addition to the information required by the FAR and the NSF, the PSM should incorporate the strategic guidance and confirm the decisions of the ASP and ASM to assure the alignment of the individual procurement action with the portfolio and mission.

2.1.4 Within NASA, programs are initiated and implemented to accomplish scientific or exploration goals that generally require a collection of mutually supporting projects. Programs

integrate and manage these projects over time and provide ongoing enabling systems, activities, methods, technology developments, and feedback to projects and stakeholders. Programs are generally created by a Mission Directorate with a long-term time horizon in mind, though as the Agency's strategic direction or circumstances change, a Mission Directorate must occasionally replan its programs or combine related programs to increase effectiveness. Programs are generally executed at NASA Centers under the direction of the Mission Directorate and are assigned to Centers based on decisions made by Agency senior management consistent with the results of the Agency's strategic acquisition planning meetings. Because the scientific and exploration goals of programs vary significantly, different program implementation strategies are required, ranging from very simple to very complex. To accommodate these differences, NASA identifies four basic types of programs that may be employed:

a. Single-project programs (e.g., James Webb Space Telescope Program) tend to have long development and/or operational lifetimes, represent a large investment of Agency resources in one program/project, and have contributions to that program/project from multiple organizations/agencies.

b. Uncoupled programs (e.g., Discovery Program) are implemented under a broad scientific theme and/or a common program implementation concept, such as providing frequent flight opportunities for cost-capped projects selected through Announcements of Opportunity or NASA Research Announcements. Each such project is independent of the other projects within the program.

c. Loosely coupled programs (e.g., Mars Exploration Program or Lunar Precursor and Robotic Program) address specific scientific or exploration objectives through multiple space flight projects of varied scope. While each individual project has an assigned set of mission objectives, architectural and technological synergies and strategies that benefit the program as a whole are explored during the formulation process. For instance, Mars orbiters designed for more than one Mars year in orbit are required to carry a communication system to support present and future landers.

d. Tightly coupled programs (e.g., Constellation Program) have multiple projects that execute portions of a mission or missions. No single project is capable of implementing a complete mission. Typically, multiple NASA Centers contribute to the program. Individual projects may be managed at different Centers. The program may also include other agency or international partner contributions.

2.1.5 As with programs, projects vary in scope and complexity and thus require varying levels of management requirements and Agency attention and oversight. Consequently, project categorization will be used in the remainder of this document. Project categorization defines Agency expectations of project managers by determining both the oversight council and the specific approval requirements. Projects are either *Category 1, 2, or 3* and are assigned to a category based initially on: (1) the project life cycle cost (LCC) estimate, the use of nuclear power sources, and whether or not the system being developed is for human space flight; and (2) priority level, which is related to the importance of the activity to NASA, the extent of international participation (or joint effort with other government agencies), the degree of uncertainty surrounding the application of new or untested technologies, and spacecraft/ payload

development risk classification (see NPR 8705.4, *Risk Classification for NASA Payloads)*. Guidelines for determining project categorization are shown in Table 2-1, but categorization may be changed based on recommendations by the MDAA that consider additional risk factors facing the project. The NASA Associate Administrator (AA) approves final project categorization. The Office of the Chief Engineer (OCE) is responsible for the official listing and categorization of NASA programs and projects subject to NPD 7120.4.[6] For purposes of project categorization, the project life cycle cost estimate includes Phases A through F, all WBS Level 2 elements (see Appendix G), and is measured in real-year (nominal) dollars.

Table 2-1 Project Categorization Guidelines

Priority Level	LCC < $250M	$250M ≤ LCC ≤ $1B	LCC > $1B, use of nuclear power source, or human space flight
High	Category 2	Category 2	Category 1
Medium	Category 3	Category 2	Category 1
Low	Category 3	Category 2	Category 1

2.1.6 When projects are initiated, they are assigned to a NASA Center by the MDAA consistent with direction/guidance from the strategic planning meetings. These assignments are made as part of the strategic acquisition planning process. They are either assigned directly to a Center by the Mission Directorate or are selected through a competitive process such as an Announcement of Opportunity (AO).[7] For Category 1 projects, the assignment is with the concurrence of the NASA AA. For Category 2 and 3 projects within tightly coupled programs, the assignment may be recommended by the program manager with the concurrence of the MDAA. Once assigned, projects may be performed wholly in-house, by Government-industry-academia teams, or nearly completely under contract to industry.

2.1.7 Figure 2-2 is a summary of the NASA life cycles for space flight programs and projects and provides an overview of their interrelated life cycle management processes with pointers for key events to sections in this document where more information is provided.

[6] This data is maintained by the Office of Chief Financial Officer in a database called the Meta-Data Manager (MdM). This database is the basis for the Agency's work break down and forms the structure for program and project status reporting across all Mission Directorates and Mission Support Offices.

[7] As part of the process of assigning projects to NASA Centers, the affected Program Manager may recommend project assignments to the MDAA.

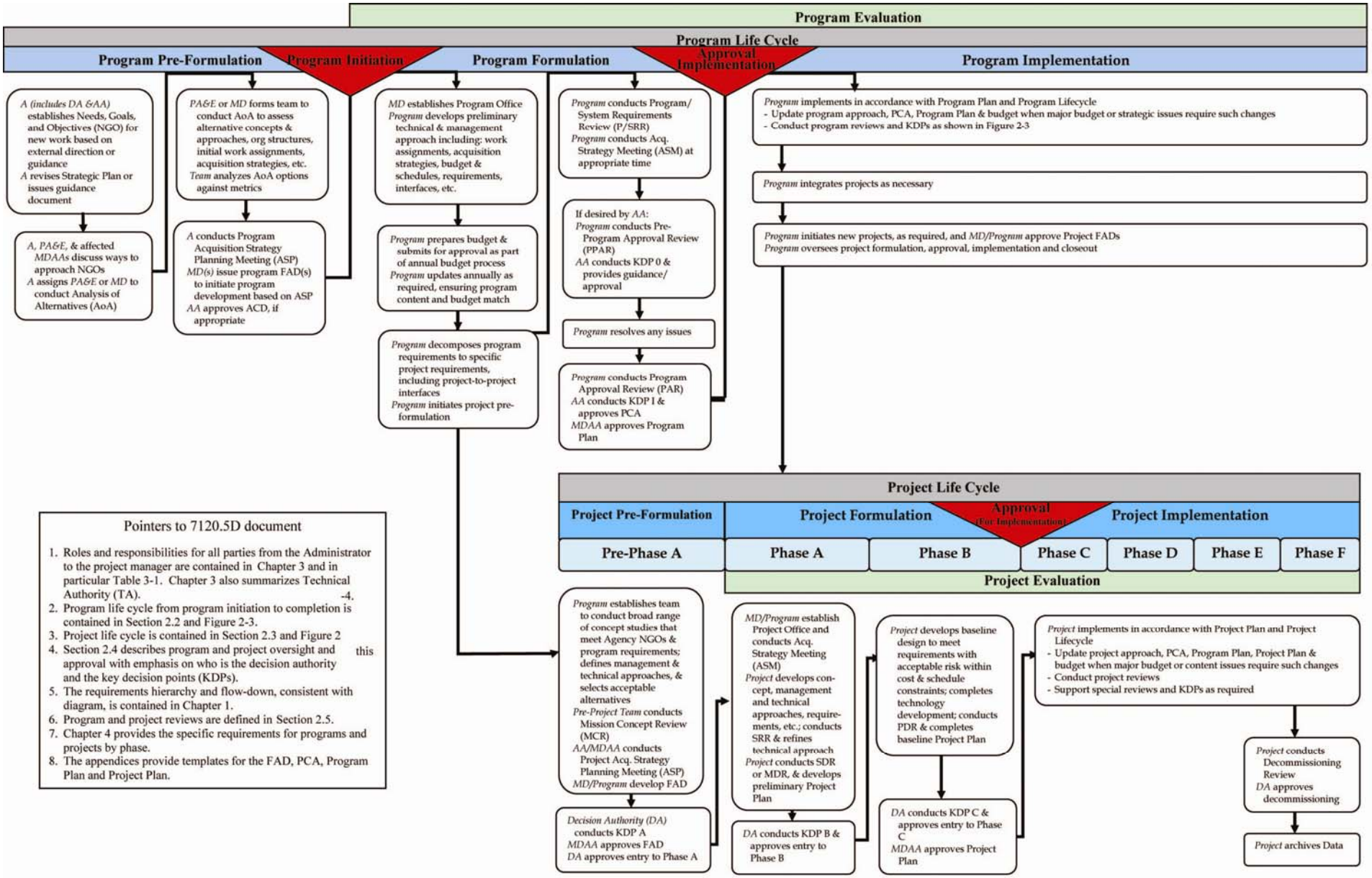


Figure 2-2 Space Flight Program and Project Management Process Overview

2.1.8 **Baselines and Cost and Schedule Estimates**

2.1.8.1 Program and project acquisition planning is based on realistic cost estimates and achievable schedules that are consistent with:

a. Coverage of all costs associated with obtaining a specific product or service including:

    (1) Costs such as institutional funding requirements, technology investments, and multi-Center operations.

    (2) Costs associated with Agency constraints (e.g., workforce allocations at Centers).

    (3) Efficient use of Agency capital investments, facilities, and workforce.

b. Resources projected to be available in future years based on the NASA budget process (i.e., PPBE).

c. Evaluation of suppliers' qualifications and past performance and the realism embodied in the suppliers' cost and schedule proposals.

d. Reconciled independent estimates when required by the decision authority.

2.1.8.2 Baselines are an agreed-to set of requirements, cost, schedule, designs, documents, etc. that will have changes controlled through a formal approval and monitoring process. NASA has established two baselines to differentiate between commitments to OMB and Congress (Commitment Baseline) and baselines that form the foundation for program/project execution and reporting done as part of NASA's governance and strategic management processes (Management Baseline). Key attributes of these baselines are:

A **Commitment Baseline** establishes and documents an integrated set of project requirements, cost, schedule, technical content, and an agreed-to Joint Cost and Schedule Confidence Level (JCL)_ that forms the basis for NASA's commitment to OMB and Congress. The Commitment Baseline is established at the Key Decision Point (KDP) that initiates the Implementation Phase as approved by the decision authority. Only one official NASA baseline exists for a project, and it is the Commitment Baseline. The Commitment Baseline is documented in the Program Plan. The sponsoring Mission Directorate provides PA&E Commitment Baseline information in a complete and timely manner. PA&E records, maintains, and reports as necessary all Commitment Baselines. All projects are budgeted at their Commitment Baseline. Changes to the Commitment Baseline occur via a rebaselining process and require coordination with OMB and Congress. Rebaselining occurs as a result of drivers that are either internal or external to the Agency. Examples of external drivers include a difference between appropriated and requested funding, directed changes to the Agency's mission, changes in partner contribution, changes in the industrial base, or a natural and unavoidable catastrophe that interrupts the expected course of events. Examples of internal drivers include insufficient

staffing, inadequate skill mix, inability to access NASA facilities when scheduled, or a major test failure.

A **Management Baseline** is an integrated set of requirements, cost, schedule, technical content, and associated JCL that forms the foundation for program/project execution. The initial program and project Management Baselines are established at the Key Decision Point (KDP) that initiates the Implementation Phase as approved by the decision authority. The program Management Baseline is the aggregate of the project Commitment Baselines plus the program operating expenses. The project Management Baseline equals the Commitment Baseline less any portion of Unallocated Future Expenses (UFE) not released to the project manager for execution. (See Appendix A: Glossary for definition of "Unallocated Future Expenses.") The Management Baseline is documented in the Program/Project Plan.

The program/project manager has the authority to replan within the approved Management Baseline, but must obtain the approval of the decision authority to change the Management Baseline. Changes to the Management Baseline will be recorded in the Program/Project Plan.

2.1.8.3 Projects go through a rebaselining process when: (1) the development cost[8] portion of the Commitment Baseline is exceeded by 30 percent or (2) when the decision authority judges that events external to the Agency make a rebaseline appropriate.

2.1.8.4 If the program manager judges the project will be unable to meet its Commitment Baseline, the program manager notifies the decision authority. This will result in a determination by the decision authority to either replan or rebaseline (including an updated, approved Management Baseline) or terminate the project.

2.1.8.5 Cost and schedule estimates for each major program segment (e.g., Constellation segments - full International Space Station (ISS) capability and lunar exploration), and for each project will be developed such that at the start of the Implementation Phase, the baseline estimates will be based on a joint cost and schedule confidence level per the following.

a. Programs are baselined or rebaselined and budgeted at a confidence level of 70 percent or the level approved by the decision authority. (A 70 percent confidence level is the point on the joint cost and schedule probability distribution where there is a 70 percent probability that the program or project will be completed at or lower than the estimated amount and at or before the projected schedule.) The basis for a confidence level less than 70 percent is formally documented.

b. Projects are baselined or rebaselined and budgeted at a confidence level consistent with the program's confidence level.

[8] "Development cost" is the total of all costs from the period beginning with the approval to proceed to implementation through the achievement of operational readiness.

c. As a minimum, projects are funded at a level that is equivalent to a confidence level of 50 percent or as approved by the decision authority.

d. Commitments made to OMB and Congress are based on the budgeted cost, schedule, content, and the joint cost and schedule confidence level approved by the decision authority.

e. Joint cost and schedule confidence levels are developed and maintained for the life cycle cost and schedule associated with the initial life cycle baseline established at implementation.

(1) The initial life cycle baselines may include development of an initial operational capability, initial operations, and sustaining engineering consistent with the definition of the content of the life cycle, along with the traditional development effort.

(2) The cost estimating methodology used for operational phases may be different than those used for other portions of the life cycle. The operations phase methodology will be reviewed and utilized as a component of the integrated program/project life cycle confidence level calculations.

(3) Programs and projects that are in extended operational phases generally are not required to develop or maintain confidence level estimates. The adequacies of budget requests for extended operational phases are demonstrated and evaluated through the annual budget cycle processes. However, the Agency policy on joint cost and schedule confidence level estimating applies to significant developments related to new or upgraded capabilities included in extended operations.

(4) Significant changes to funding strategy are reviewed with and approved by the decision authority.

(5) Programs and projects are to be annually reviewed by the responsible Mission Directorate to confirm to the decision authority that their current baseline life cycle cost estimates and funding strategy and the annual NASA budget submissions are consistent.

2.1.8.6 The program or project's proposed cost and schedule baselines are assessed by an SRB, which will provide review results to the program/project. The program or project is to present and justify its resulting cost and schedule to the decision authority. The SRB is to discuss with the decision authority its key concerns with the plans and baselines proposed by the program or project.

2.2 Program Life Cycle

2.2.1 As a strategic management structure, the program construct is extremely important within NASA. Programs provide the critically important linkage between the Agency's ambitious needs, goals, and objectives and the projects that are the specific means for achieving them. Although programs vary significantly in scope, complexity, cost, and criticality, within NASA they have a generic risk-informed life cycle management process (see NPR 8000.4, *Agency Risk Management Procedural Requirements*) that is divided into two distinct phases:

a. Formulation – *Pre-Program Acquisition,* in which a technical approach is derived from an Analysis of Alternatives (AoA); program requirements are developed and allocated to initial projects; project pre-formulation is initiated; organizational structures are developed and work assignments initiated; program acquisition strategies are defined and approved; interfaces to other programs are developed; required annual funding levels are established, preliminary cost and schedule estimates are developed, a plan for implementation is designed, and management systems put in place; and formal program documentation is approved, all consistent with the NASA Strategic Plan and other higher level requirements.

b. Implementation – *Program Acquisition, Operations and Sustainment,* in which constituent projects are initiated through direct assignment or competitive process (e.g., request for proposal (RFP) and AO) and their formulation, approval, implementation, integration, operation, and ultimate decommissioning are constantly monitored and the program is adjusted as resources and requirements change. For tightly coupled programs, the implementation phase will coincide with the project life cycle to ensure that the program and all its projects are properly integrated, including proper interface definition and resource allocation across all internal projects and with external programs and organizations.

2.2.2 To formalize the management process, the program life cycle is established in Figure 2-3. This figure is used to illustrate:

a. The program life cycle phases;

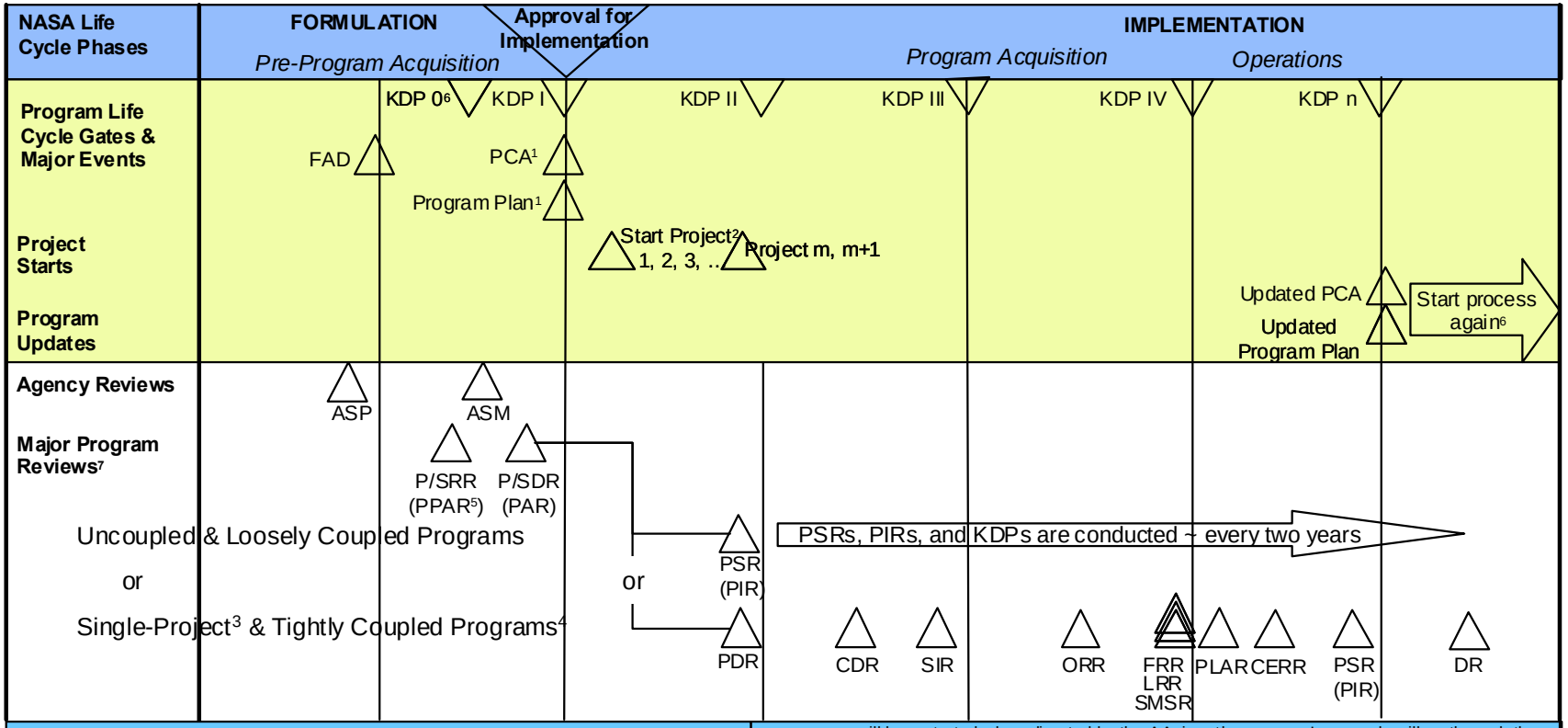
b. Program life cycle gates and major events, including KDPs, and

c. Major program reviews (see Section 2.5) that precede the KDPs.

2.2.2.1 The Formulation Phase for all program types is the same, involving one or more program reviews, followed by KDP I, where a decision is made on program approval to begin implementation. As shown in Figure 2-3, the program life cycle has two different implementation paths, depending on program type. Each implementation path has different types of major reviews. For uncoupled and loosely coupled programs, the Implementation Phase only

requires Program Status Reviews (PSRs)/Program Implementation Reviews[9] (PIRs), described in Section 2.5, to assess the program's performance and authorize its continuation at biennial KDPs.

[9] Program Status Reviews (PSRs) and Program Implementation Reviews (PIRs) are described in Section 2.5.



FOOTNOTES

1. PCA and Program Plans are baselined at KDP I and reviewed and updated, as required, to ensure program content, cost, and budget remain consistent.
2. Projects, in some instances, may be approved for formulation prior to KDP II. Initial project pre-formulation generally occurs during program Formulation.
3. Single-project program reviews from PDR until operations are the same reviews as the project reviews (not duplicates). Single-project programs are approved at KDP II.
4. Tightly-coupled program reviews generally differ from other program types because they are conducted to ensure the overall integration of all program elements (i.e., projects). Once in operations, PSRs/PIRs are conducted ~ every two years.
5. KDP 0 and the PPAR may be required by the Decision Authority to ensure major issues are understood and resolved prior to formal program approval at KDP I.
6. When programs require upgrades (e.g., new program capabilities), the life-cycle process will be restarted when directed by the AA, i.e., the program's upgrade will go through the same formulation and implementation steps as originally done.
7. These reviews are conducted by the program for the independent SRB (with the exception of the FRR and SMSR). See Section 2.5 and Table 2-5.

ACRONYMS

ASP—Acquisition Strategy Planning meeting
ASM—Acquisition Strategy Meeting
CDR—Critical Design Review
CERR—Critical Events Readiness Review
DR—Decommissioning Review
FAD—Formulation Authorization Document
FRR—Flight Readiness Review
KDP—Key Decision Point
LRR—Launch Readiness Review
ORR—Operational Readiness Review
PAR—Program Approval Review
PCA—Program Commitment Agreement
PDR—Preliminary Design Review
PIR—Program Implementation Review
PLAR—Post-Launch Assessment Review
PPAR—Preliminary Program Approval Review
P/SDR—Program/System Definition Review
P/SRR—Program/System Requirements Review
PSR—Program Status Review
SIR—System Integration Review
SRB—Standing Review Board
SMSR—Safety and Mission Success Review

Figure 2-3 The NASA Program Life Cycle

2.2.2.2 Single-project and tightly coupled programs are more complex. For single-project programs, the Implementation Phase program reviews shown in Figure 2-3 are synonymous (not duplicative) with the project reviews in the project life cycle (see Figure 2-4 in Section 2.3) through Phase D. Once in operations, these programs have biennial KDPs preceded by attendant PSRs/PIRs. Tightly coupled programs during implementation have program reviews tied to the project reviews to ensure the proper integration of projects into the larger system. Once in operations, tightly coupled programs also have biennial PSRs/PIRs/KDPs to assess the programs' performance and authorize their continuation.

2.2.3 Program formulation and implementation require the preparation and approval of three key documents—a program Formulation Authorization Document (FAD), a Program Commitment Agreement (PCA), and a Program Plan—each of which is described as follows.

2.2.3.1 To initiate planning for individual programs, a Mission Directorate prepares a program FAD following an ASP meeting. The program FAD authorizes a program manager to initiate the planning of a new program and to perform the Analysis of Alternatives (AoA) required to formulate a sound Program Plan that contains project elements, requirements, schedules, risk assessments, and budgets.

2.2.3.2 The FAD template is found in Appendix C. Because the creation of a new program represents a major commitment of the Agency and may require coordination with OMB and/or the Congress, the FAD requires the approval of the MDAA. The program FAD contains a statement of purpose for the proposed program and defines its relationship to the Agency's strategic goals and objectives; establishes the scope of work to be accomplished; provides initial constraints (including resources and schedule) and proposed program participants within and external to NASA (including international partnerships); and defines the approach and resources required to conduct program formulation.

2.2.3.3 The Program Commitment Agreement (PCA) is an agreement between the MDAA and the NASA AA (Decision Authority) that authorizes transition from formulation to implementation. The PCA is prepared by the Mission Directorate with support from the program manager, as requested. The PCA documents Agency requirements, program objectives, management and technical approach and associated architecture, technical performance, safety and risk factors, internal and external agreements, independent reviews, and all attendant top-level program requirements.

2.2.3.4 A PCA can be considered an executive summary of the Program Plan and is updated and approved during the program life cycle. As a minimum, a program rebaselining or a significant change in program content, including the addition or deletion of a constituent project, warrants a change in the PCA. Changes to the PCA must remain consistent with the NASA Strategic Plan, higher level architectures, budget authority, and external reporting. The content of the PCA baselined at KDP I reflects the maturity of the program at that point in time and includes acknowledgment of those areas that cannot be defined without further development. The baseline and confidence level approved by the decision authority form the basis for the confidence levels for the program's projects. When needed, the PCA is updated for subsequent KDPs. Program

and project managers support the Mission Directorate in keeping the program's current baseline life cycle cost estimates and funding strategy, the annual NASA budget submissions, and external commitments consistent. The PCA template is found in Appendix D.

2.2.3.5 The Program Plan is an agreement between the MDAA (who has approval authority for the plan), the Center Director(s), and the program manager that documents at a high level the program's objectives and requirements, scope, implementation approach, interfaces with other programs, the environment within which the program operates, budget by fiscal year, and the commitments of the program. The Program Plan is prepared by the program manager with the support of program personnel. Implementation of a program, project, or task at a NASA Center is performed in accordance with the Program Plan and consistent with that Center's best practices and institutional requirements, as negotiated and documented in the Program Plan. The agreements between the program manager and Center Directors of participating NASA Centers are documented in the Program Plan along with the program manager's approach to ensuring that interfaces do not increase risk to mission success. Program Plan concurrence by the participating NASA Center Directors demonstrates their commitment to support the program in terms of Center resources needed by the program.

2.2.3.5.1 The Program Plan is used by the governing PMC in the review process to determine if the program is fulfilling its agreements. The draft Program Plan is reviewed at KDP 0 (when required) and approved at KDP I. It is updated and approved during the program life cycle, as appropriate, similar to PCA updates. The content of the initial Program Plan baselined at KDP I reflects the maturity of the program at that point in time and acknowledges those areas (such as schedule and cost) that cannot be fully defined without further development. The Program Plan is updated for subsequent KDPs with any program replans or rebaselines as the program matures.

2.2.3.5.2 The Program Plan details how the program will be managed and contains the list of specific projects (updated as needed) that are officially approved as part of the program and, therefore, subject to the requirements on projects in this document. The Program Plan also documents the high-level program requirements, including performance, safety and programmatic requirements, correlated to Agency and Mission Directorate strategic objectives and any approved tailoring of requirements. These requirements are documented in the Program Plan, in a subsequent appendix, or in a separate, configuration-controlled program requirements document. The Program Plan template is found in Appendix E.

2.3 Project Life Cycle

2.3.1 For NASA space flight projects, the NASA life cycle phases of formulation and implementation are divided into incremental pieces that allow managers to assess management and technical progress. The NASA project life cycle is shown in Figure 2-4. The phases are separated by major reviews and KDPs. In practice, however, the activities described for each phase below are not always carried out in exclusively that phase; their timing will depend on the particular schedule requirements of the project. For example, some projects procure long-lead flight hardware in Phase B to enable them to achieve their launch dates.

2.3.1.1 Project formulation consists of two sequential phases, traditionally denoted as Phases A (*Concept & Technology Development*) and B (*Preliminary Design & Technology Completion*).

The primary activities in these phases are to develop and define the project requirements and cost/schedule basis and to design a plan for implementation (including an acquisition strategy, contractor selection, and long-lead procurement). While not formally a part of formulation, some formulation-type activities will naturally occur as part of earlier advanced studies. These fall into a part of the project life cycle known as Pre-Phase A (*Concept Studies*).

2.3.1.2 Project implementation consists of Phases C, D, E, and F. Approval marks the transition from Phase B of formulation to Phase C of implementation. During Phases C (*Final Design and Fabrication*) and D (*System Assembly, Integration and Test, and Launch*), the primary activities are developmental in nature, including acquisition contract execution. Phase C includes the fabrication and testing of components, assemblies, and subsystems. All activities are executed as per the Project Plan developed during formulation. The transition from Phase C to Phase D is uniquely a "soft gate," in which the project may initiate Phase D work immediately upon completion of the Phase C work products, absent a notice of discontinuance by the program manager (rather than waiting for affirmative direction from the program manager to begin Phase D). The start of Phase E (*Operations and Sustainment*) marks the transition from system development and acquisition activities to primarily systems operations and sustainment activities. In Phase F (*Closeout*), project systems are taken out of service and safely disposed, although scientific and other analyses might still continue under project funding. Independent evaluation activities occur throughout all phases.

2.3.2 To initiate a new project, a Mission Directorate, working through a program office, usually provides a small amount of discretionary resources for concept studies (i.e., Pre-Phase A). These pre-formulation activities involve design reference mission analysis, feasibility studies, technology needs analyses, and analyses of alternatives that should be performed before a specific project concept emerges. These trade studies are not considered part of formal project planning since there is no certainty that a specific project proposal will emerge.

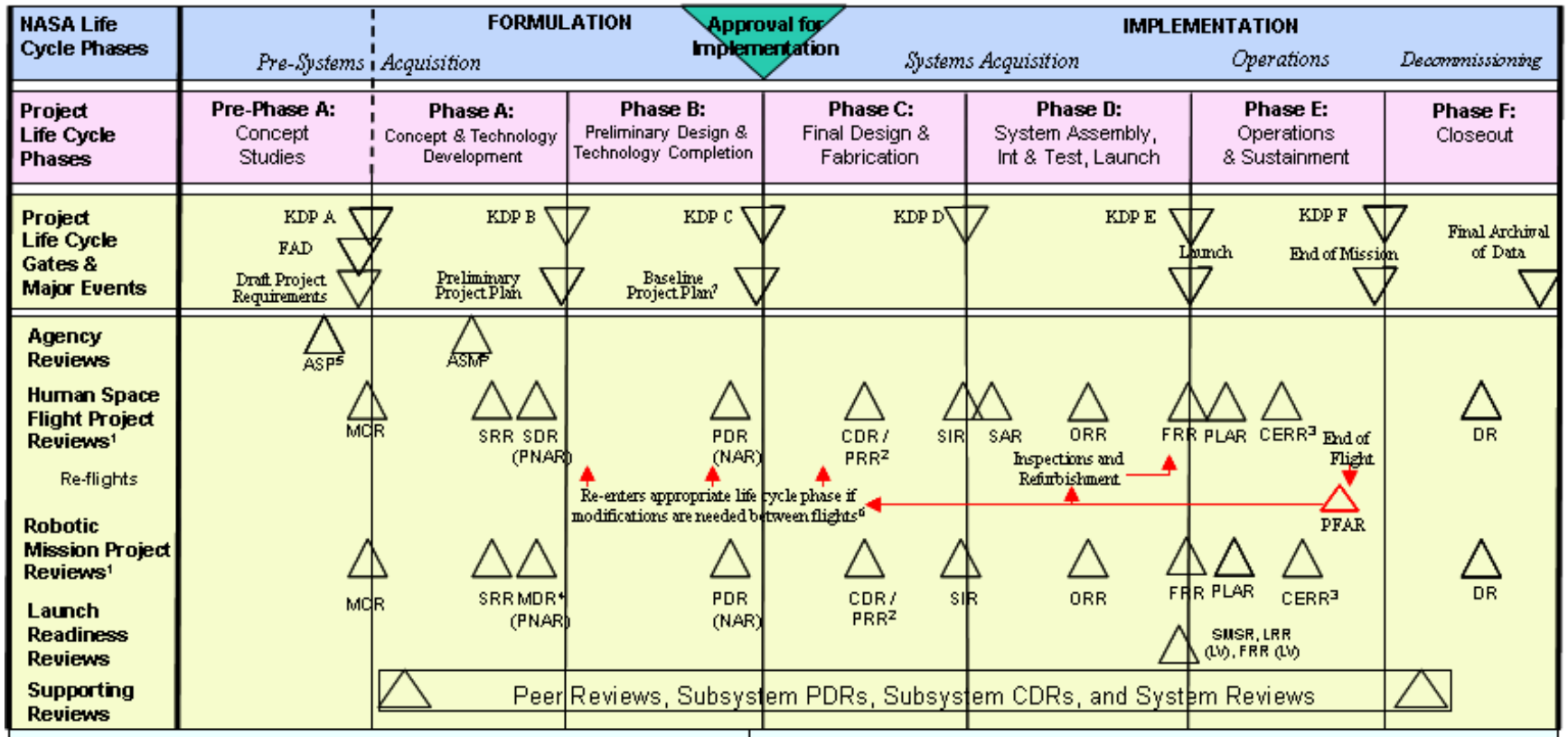
2.3.2.1 An MDAA has the authority to initiate a project and begin pre-formulation activities. To initiate a project's official entry into formulation, the program manager prepares a draft project FAD or equivalent (such as a Program Plan section, MDAA letter selecting a specific AO proposal, or a Program Directive (used in the Space Station and Shuttle programs)) and, for non-competed missions, an ASP is convened if project initiation has not been addressed in previous ASPs. Following the ASP meeting, the FAD will be updated and forwarded to the MDAA for final signature. Once the MDAA signs the project FAD, a project formally enters formulation.

2.3.2.2 For competed missions, some Mission Directorates have chosen to establish several new space flight programs that use a one- or two-step AO process to initiate projects. In a one-step AO process, projects are competed and selected for implementation in a single step. In two-step competitions, several projects may be selected in Step 1 and given time to mature their concepts in a funded Phase A before the Step 2 down selection to one or more projects for further formulation. Program resources are invested (following Step 1 selections) to bring these projects to a state in which their science content, cost, schedule, technical performance, project

implementation strategies, safety and mission assurance strategies, and management approach can be better judged.[10] These projects are often referred to as “competed” or “AO-driven.”

2.3.3 The project manager supports, as requested, the Mission Directorate and program manager in the development of program-level documentation, and the project manager flows information down into project-level documentation. If requested by the program manager, the project manager assists in preparing a revised PCA and/or Program Plan. The project manager also supports, as requested, generation of the program requirements on the project and their formal documentation in the Program Plan (or as an appendix to the Program Plan). After the program requirements on the project are established, the project manager and the project team develop technical approaches and management plans to implement the requirements. These products are formally documented in the Project Plan. The project manager is then responsible for the evolution of the project concept and ultimate project success. The project manager supports the program manager and the Mission Directorate in keeping the project’s baseline life cycle cost estimates and funding strategy and the annual NASA budget submissions consistent.

[10] From the point of view of the selected AO-driven project, the proposing teams are clearly doing formal project formulation (e.g., putting together a detailed WBS, schedules, cost estimates, and implementation plan) during the funded Phase A concept study and the preparation of the Step 2 proposal. From the point of view of the program, no specific project has been chosen, a FAD is not written, the cost is unknown, and the project-level requirements are not yet identified, yet formulation has begun. The first KDP is the down selection process, and following selection, the process becomes conventional.



FOOTNOTES

1. Flexibility is allowed in the timing, number, and content of reviews as long as the equivalent information is provided at each KDP and the approach is fully documented in the Project Plan. These reviews are conducted by the project for the independent SRB. See Section 2.5 and Table 2-6.
2. PRR needed for multiple (≥4) system copies. Timing is notional.
3. CERRs are established at the discretion of Program Offices.
4. For robotic missions, the SRR and the MDR may be combined.
5. The ASP and ASM are Agency reviews, not life-cycle reviews.
6. Includes recertification, as required.
7. Project Plans are baselined at KDP C and are reviewed and updated as required, to ensure project content, cost, and budget remain consistent.

ACRONYMS

ASP—Acquisition Strategy Planning Meeting
ASM—Acquisition Strategy Meeting
CDR—Critical Design Review
CERR—Critical Events Readiness Review
DR—Decommissioning Review
FAD—Formulation Authorization Document
FRR—Flight Readiness Review
KDP—Key Decision Point
LRR—Launch Readiness Review
MCR—Mission Concept Review
MDR—Mission Definition Review
NAR—Non-Advocate Review
ORR—Operational Readiness Review
PDR—Preliminary Design Review
PFAR—Post-Flight Assessment Review
PLAR—Post-Launch Assessment Review
PNAR—Preliminary Non-Advocate Review
PRR—Production Readiness Review
SAR—System Acceptance Review
SDR—System Definition Review
SIR—System Integration Review
SMSR—Safety and Mission Success Review
SRR—System Requirements Review

Figure 2-4 The NASA Project Life Cycle

2.3.4 NASA places significant emphasis on project formulation because adequate preparation of project concepts and plans is vital to success. During formulation, the project establishes performance metrics, explores the full range of implementation options, defines an affordable project concept to meet requirements specified in the Program Plan, develops needed technologies, and develops and documents the Project Plan. Formulation is an iterative set of activities rather than discrete linear steps. System engineering plays a major role during formulation, exercising an iterative set of activities as described in NPR 7123.1, *NASA Systems Engineering Processes and Requirements*. Activities include developing the system architecture and system design; flowing down requirements to the system/subsystem level; establishing the internal management control functions that will be used throughout the life of the project; assessing the technology requirements and developing the plans for achieving them; identifying options for partnering and commercialization; performing life cycle cost and mission effectiveness analyses for concepts deemed to have a high degree of technical and operational feasibility; and identifying margins consistent with project risk. Formulation continues with interactive execution of its activities, normally concurrently, until formulation output products, like the Project Plan, have matured and are acceptable to the program manager, Center Director, and MDAA.

2.3.4.1 The Project Plan is an agreement among the program manager, participating Center Director(s), the project manager, and for AO-driven missions, the Principal Investigator (PI). (The MDAA may be added to the signature list for the plan at his/her discretion.) The Project Plan is prepared by the project manager with the support of the project team. It defines, at a high level, the project's objectives, technical and management approach, the environment within which the project operates, and the commitments of the project to the program. The Project Plan is required by the governing PMC and is used in the review process to determine if the project is fulfilling its agreements. The Project Plan must be consistent with the Program Plan. The Project Plan is updated and approved during the project life cycle if warranted by changes in the stated commitments or program requirements on the project.

2.3.4.2 The Project Plan is the key document that captures formulation results. Larger and more complex projects may find it necessary or desirable to write separate *control plans* to convey project approaches and strategies. In these cases, the Project Plan summarizes the key elements of such separate plans. In smaller projects, separate and detailed control plans may not be needed to document project approaches, and the Project Plan itself serves as the single source for such information. The Project Plan template is found in Appendix F.

2.4 Program and Project Oversight and Approval

2.4.1 This section describes NASA's oversight approach for programs and projects; defines KDPs, when approval is given or denied; and identifies the decision authority (DA), the responsible official who provides that approval or disapproval.

2.4.2 The DA is the Agency's responsible individual who authorizes the transition at a KDP to the next life cycle phase for a program/project. For programs and Category 1 projects, the decision authority is the NASA Associate Administrator (AA). For Category 1 projects, this authority may be delegated to the MDAA. For Category 2 and 3 projects, the DA is the MDAA.

This authority may also be delegated to a lower level. The delegation of this authority for projects is documented in the PCA.

2.4.3 To ensure the appropriate level of management oversight, NASA has established two levels of Program Management Councils (PMCs)—the Agency PMC and Mission Directorate PMCs. The PMCs have the responsibility of periodically evaluating the cost, schedule, risk, technical performance, and content of a program or project under its purview. The evaluation focuses on whether the program or project is meeting its commitments to the Agency. Each program and project has a governing PMC, which acts as the highest PMC for that program or project. For all programs, the governing PMC is the Agency PMC; for projects, the governing PMC is determined by the established project category. Table 2-2 shows the relationship between programs and projects (by category) and the PMCs.

Table 2-2 Relationship Between Programs/Projects and PMCs

	Agency PMC	Mission Directorate PMC
Programs	○	■
Category 1 Projects	○	■
Category 2 Projects		○
Category 3 Projects		○

○ indicates governing PMC (for Category 3 projects see also 2.4.3.2); ■ indicates PMC evaluation

2.4.3.1 The *Agency PMC* is the governing PMC for all programs and Category 1 projects. In that capacity, it evaluates them immediately prior to KDPs and then recommends approval or disapproval to the decision authority regarding entrance to the next life cycle phase. The Agency PMC also performs program oversight during implementation.

2.4.3.2 A *Mission Directorate PMC* (MDPMC) evaluates all programs and projects executed within that Mission Directorate and provides input to the MDAA. For programs and Category 1 projects, the MDAA carries forward the MDPMC findings and recommendations to the *Agency PMC*. For Category 2 and 3 projects, the MDPMC serves as the governing PMC and recommends approval or disapproval to the DA regarding entry to the next phase. For Category 3 projects, the DA may designate a division within the Mission Directorate or Program Office as the governing authority and may even delegate decision authority to the chairperson of the designated governing board. Such designations and delegations are described in the relevant Program Plan.

2.4.4 Oversight of programs and projects is also performed by a *Center Management Council* (CMC), which evaluates all program and project work (regardless of category) executed at that Center. The CMC evaluation focuses on whether Center engineering, SMA, health and medical, and management best practices (i.e., resources, procurement, institutional) are being followed by the program/project under review, and whether Center resources can support program/project requirements. The CMC also assesses program and project risk and evaluates the performance of activities to identify trends and provide technical guidance to the Agency and affected programs and projects. The CMC provides its findings and recommendations to program/project managers and to the appropriate PMCs regarding the technical and management viability of the

program/project prior to KDPs.[11] For tightly coupled programs, the MDAA, Center Director(s), and NASA Chief Engineer establish the program approach for the CMC-equivalent process and documents the approach in the Program Plan.

2.4.5 A KDP is an event where the decision authority determines the readiness of a program/project to progress to the next phase of the life cycle. As such, KDPs serve as gates through which programs and projects must pass. KDPs associated with programs are designated with numerals, starting with zero; KDPs associated with projects are labeled with capital letters, the letter corresponding to the project phase that will be entered after successfully passing through the gate. Within each phase, the KDP is preceded by one or more reviews, including the governing PMC review. These reviews enable a disciplined approach to assessing programs and projects. Allowances are made within a phase for the differences between human and robotic space flight programs and projects, but phases always end with the KDP. The potential outcomes at a KDP include:

a. Approval for continuation to the next KDP.

b. Approval for continuation to the next KDP, pending resolution of actions.

c. Disapproval for continuation to the next KDP. In such cases, follow-up actions may include a request for more information and/or a delta independent review; a request for a Termination Review for the program or the project (Phases B, C, D, and E only); direction to continue in the current phase; or re-direction of the program/project.

2.4.5.1 To support the decision process, appropriate supporting materials are submitted to the decision authority. These materials include:

a. The governing PMC review recommendation.

b. The Standing Review Board (SRB) report (see Section 2.5).

c. The MDAA recommendation (for programs and Category 1 projects).

d. The program manager recommendation.

e. The project manager recommendation (for project KDPs).

f. The CMC recommendation.

g. Program/project documents (FAD, Program Plan, PCA, Project Plan, or updates) that are ready for signature and agreements (MOUs, MOAs, waivers, etc.).

2.4.6 The decision authority makes his/her decision by considering a number of factors, including continued relevance to Agency strategic needs, goals, and objectives; adequacy of cost and schedule baselines and the resulting joint cost and schedule confidence level; continued

[11] For competed projects approaching KDP A, readiness to advance to the next phase can take the form of the Center Director's signature on the proposal.

affordability with respect to the Agency's resources; the viability and the readiness to proceed to the next phase; and remaining program or project risk (cost, schedule, technical, management, programmatic, and safety).

2.4.7 To complete formal actions at a KDP, the decision authority makes and documents the decision and its basis (including materials presented, major issues, options, and open action items); signs the ensuing KDP decision memo; and archives the documents. If changes are required, the KDP decision memos are revised, all necessary signatures obtained, and the KDP decision memo resubmitted to the decision authority for final signature. Appeals must go to the next higher decision authority.

2.5 Program and Project Reviews

2.5.1 The program and project reviews identified in the program and project life cycles (Figures 2-3 and 2-4) are essential elements of conducting, managing, evaluating, and approving space flight programs and projects.

2.5.2 Programs and projects conduct internal reviews to initially establish and then manage the program or project to the baselines. These internal reviews are the decisional meetings wherein the program/projects solidify their plans, technical approaches, and programmatic commitments. This is accomplished as part of the normal systems engineering work processes as defined in NPR 7123.1, *NASA Systems Engineering Processes and Requirements* wherein major technical and programmatic requirements are assessed along with the system design and other implementation plans. Major technical and programmatic performance metrics are reported and assessed against predictions.

The independent life cycle review process is an important part of NASA's check and balance system. Independent reviews provide the Agency with a valuable periodic non-advocate assessment of the status and health of a program or project at key points in the life cycle. Independent life cycle reviews are conducted under documented Agency and Center review processes. NASA accords special importance to maintaining the integrity of the independent reviews conducted by an independent Standing Review Board (SRB)[12]. The reviews shown on Figures 2-3 and 2-4 are conducted by an SRB with the exceptions noted in Table 2-3. Programs and projects are required to document in their Program and Project Plans their approach to conducting program/project internal reviews and how they will support the independent life cycle reviews. Consistent with these processes and plans, the Terms of Reference (ToR) for each independent life cycle review are jointly developed and approved or concurred in by the respective individuals shown in Table 2-4.

2.5.3 The independent life cycle review process provides:

a. The program/project with a credible, objective assessment of how they are doing.

b. NASA senior management with an understanding of whether

[12] A project already in Phase D (or beyond) at the effective date of NPR 7120.5D (March 2007) need not have a new review board established.

(1) The program/project is on the right track to meet program/project objectives,

(2) The program/project is performing according to plan, and

(3) Impediments to program/project success are being removed.

c. A credible basis for the decision authority to approve or disapprove the transition of the program/project at a KDP to the next life cycle phase.

Table 2-3 Major Program/Project Life Cycle Reviews Not Conducted by the SRB

• The ASP and the ASM • The Safety and Mission Success Review (SMSR) • The Flight Readiness Review (FRR), Launch Readiness Review (LRR), and Post-Flight Assessment Review (PFAR) for tightly coupled programs at the discretion of the MDAA. (Rather than utilizing a complete independent review board for these flight and mission operations reviews, the program SRB chair and project SRB chairs that are part of the mission are included as advisory members to the flight and mission operations review boards. The SRB input is provided during the board meeting.) • For human space flight, the Post-Launch Assessment Review (PLAR) and Critical Events Readiness Review (CERR), which are conducted by the Mission Management Team (MMT) • Decommissioning Reviews (DRs)

2.5.4 The independent life cycle review is convened by the same individuals (see Table 2-4) who develop the ToR. The independent life cycle review is convened to objectively assess the program/project's progress against the Program/Project Plan; its readiness to proceed to the next phase in accordance with NPR 7120.5 and NPR 7123.1; and for projects, the adequacy and credibility of the Management Baseline (at PDR and later). For the program and project reviews leading to program and project approval— P/SRR (PPAR) and P/SDR (PAR) for programs and SRR/SDR/MDR (PNAR) and PDR (NAR) for projects—a more integrated technical and programmatic review and evaluation is conducted. All reviews use the following criteria:[13]

a. Alignment with and contribution to Agency needs, goals, and objectives and the adequacy of requirements flow down from those.

b. Adequacy of technical approach, as defined by NPR 7123.1 entrance and success criteria.

[13] These criteria are used consistent with the life cycle review objectives defined in the ToR.

c. Adequacy of the integrated cost and schedule estimate and funding strategy in accordance with NPD 1000.5.

d. Adequacy and availability of resources other than budget.

e. Adequacy of the risk management approach and risk identification and mitigation per NPR 8000.4.

f. Adequacy of management approach.

Table 2-4 NASA Convening Authorities for Standing Review Board

		Decision Authority		Technical Authority*		Associate Administrator, PA&E
		NASA AA	MDAA	NASA CE	Center Director	
Establish SRB, Develop ToR. Approve Chairperson, RM, and Other Board Members	Programs	Approve	Approve	Approve		Approve
	Category 1 Projects	Approve	Approve	Concur	Approve	Approve
	Category 2 Projects		Approve		Approve	Approve**
	Category 3 Projects		Approve		Approve	

* When applicable and at the request of the OCE, the OCHMO/HMTA will determine the need for health and medical participation on the SRB.
** Only for Category 2 projects that are $250M or above.

2.5.5 The SRB is charged with the responsibility of making an independent assessment. The SRB's role is to provide the convening authorities with an expert judgment concerning the adequacy of the program/project technical and programmatic approach, risk posture, and progress against the Management Baseline and the readiness against criteria in this NID and NPR 7123.1. The depth of an SRB review is the responsibility of the SRB and must be sufficient to meet the ToR and to permit the SRB to understand whether the program/project design is adequate and the analyses, development work, systems engineering, and programmatic plans support the design and key decisions that were made. In the case of a special review (see 2.5.15), the depth must be sufficient to fulfill the task assigned. When appropriate, individual members may offer the convening authorities their views as to what would improve performance and/or reduce risk. The SRB does not have authority over any program/project content. SRB outputs are briefed to the program/project under review prior to being provided to the next higher level of management.

2.5.6 The SRB has a single chairperson and a NASA Review Manager (RM)[14]. The chairperson and the RM are approved or concurred with by the same individuals who convene the

[14] The NASA RM may come from JPL.

independent life cycle reviews. (See Table 2-4.) The RM for programs and Category 1 and 2 projects that have a life cycle cost of $250M and above is assigned by the Associate Administrator for PA&E. The RM for Category 2 projects below $250M and Category 3 projects is assigned by the Technical Authority. (See Table 2-4.) The chairperson, with support from the RM, organizes the SRB and submits the names of proposed board members to the same individuals who convened the independent life cycle review for approval or concurrence.

2.5.7 The SRB remains intact, with the goal of having the same core membership for the duration of the program or project, although it may be augmented over time with specialized reviewers as needed. Board members must be competent, current, and independent (not dependent on or affiliated with the program/project), and some members must be independent of the program's or project's participating Centers. All individuals selected to serve on SRBs must be highly qualified and must have the ability to make a broad assessment of the implementation of the program/project, which employ numerous engineering and other disciplines. The NASA Standing Review Board Handbook was written to provide guidance for the development of the SRB and its membership. It can be found in the "Other Policy Documents" section of the NODIS library.

2.5.7.1 There are three allowable structures for the SRB, a Civil Service Board (CS), a Civil Service Board with expert support (CS2), or a Non-Consensus Board (NC). The key attributes of each form of SRB are delineated in Table 2-5. The option selected is based on the needs of the program/project and is documented in the ToR.

2.5.7.2 For programs and Category 1 and 2 projects, board members responsible for assessing the program/project's cost and schedule are provided by the IPAO. For Category 2 projects under $250,000 and Category 3 projects, board members responsible for independent assessments of cost and schedule may be provided by the IPAO, the Center Systems Management Office (SMO), or Center systems management function, as appropriate.

2.5.7.3 The RM actively supports each program/project independent life cycle review by assisting the SRB chairperson, DA, MDAA (if not the DA), and TA in preparing the ToR; preparing team nomination letters; interfacing with the program/project manager; managing review team administrative functions; ensuring that documented Agency and Center review policies and practices are followed; ensuring that Review Item Discrepancies (RIDs) and Requests for Action (RFAs) are tracked and closed; documenting and distributing SRB findings and recommendations; and preparing SRB reports and management briefings.

Table 2-5 SRB Structure

Option	***CS***	***CS2***	***NC***
Description	Civil Service (CS) Consensus Board – No Expert Support	Civil Service Consensus Board with Expert Support	Non-Consensus Mixed Board
SRB Chair	CS	CS	Either CS or non-CS
SRB Review Manager	CS or JPL*	CS or JPL*	CS or JPL
SRB Composition	CS Only	CS Only; Experts provide analyses to SRB	Either CS or non-CS
SRB Product	SRB produces a report and briefings with findings of fact and recommendations; RFAs (or equivalent) from individual members**; chair briefs report.	SRB produces report and briefings with findings of fact and recommendations; RFAs (or equivalent) from any individual**; reports from individual experts**; chair briefs SRB report.	Review manager assists the chair in assembling the report based on inputs and RFAs from all individuals**; chair briefs personal findings and recommendations.
Minority Report	Minority reports documented in SRB report and in RFAs.	Minority reports documented in SRB report and RFAs.	No minority report.***
SRB Interaction	Consensus is reached by the Civil Service board members under the civil service consensus (CS) and the civil service with consult support (CS2) SRB configurations. Consultants supporting CS2 boards may interact with the projects or programs on behalf of the SRB members to gather information used to support SRB pre-consensus discussions. All board members can participate in open discussion with the project and within the SRB. Everyone can openly discuss individual points of view.		
Independence	Normal CS ethics rules apply.	Experts providing support are not on the SRB. Apply independence standards to experts.	Apply independence standards to experts but allow some impairments, if approved.
* JPL review managers are not members and do not have a vote. ** Reports and RFAs can contain individual recommendations. *** The minority report requirements do not abridge NASA's Dissenting Opinion process per NPD 1000.0.			

2.5.8 To maintain the integrity of independent review process and the SRB reports, it is NASA policy that:

a. All individuals selected to serve on SRBs are highly qualified in terms of knowledge, training, expertise, and experience to properly address the tasks assigned to the SRB. (Diversity and balance in design/development and organizational experience also helps ensure the independent perspective of the SRB.)

b. SRB members are free and remain free of financial or other conflicts of interest that have the potential to:

(1) Significantly impair the individual's objectivity or

(2) Create an unfair competitive advantage for any person or organization.

Conflicts of interest may be personal, based on the personal interests of the individual, or organizational, based upon the interests of the individual's employer.

c. The responsible independent review office manages the determination and maintenance of SRB member independence. To ensure independence :

(1) Proposed members submit background and conflict of interest information. Proposed non-Federal members' organizations provide approved "Background Information and Confidential Conflict of Interest Disclosure" forms. The responsible independent review office makes an initial determination whether any organizational conflict of interest exists and potentially works on mitigation. Subpart 9.5 of the FAR contains guidance on organizational conflicts of interest, which the agency must follow any time the agency uses a contract to obtain the services of an individual for an SRB. Proposed civil service members fill out the Office of Government Ethics (OGE) Form 450 or Standard Form (SF) 278 (as appropriate).

(2) Individuals employed by an organization that institutionally supports the program or project (e.g., a NASA Center, Mission Directorate, or contractor) may serve as a member of an SRB where the following requirements are met:

(i) The service of the individual on the SRB must be based upon the unique scientific, technical, or programmatic expertise that the individual brings to the SRB;

(ii) With regard to civil servant members of an SRB, the individual and the individual's supervisory chain must not be located within the chain of command for programmatic-level decisions made at the program or project level; and

(iii) There must be a specific determination during the SRB appointment process that service by the individual will not compromise the independence or objectivity of the review.

d. All SRB members selected to serve on SRBs have an approved Non-Disclosure Agreement that limits the individual's use of Restricted Information obtained during the course of SRB activities. (See the NASA SRB Handbook and NASA organizational conflict of interest policy.)

(1) Any use, intended use, or disclosure of Restricted Information during the course of an SRB activity for an individual's own direct and substantial economic benefit constitutes a breach of the Non-Disclosure Agreement and are grounds for removal from the SRB. The same rule applies if the individual discloses, or intends to disclose, such information to other individuals or to organizations that may confer a direct and substantial economic benefit on such individuals or organizations. These restrictions do not apply to information once it has become publicly available.

e. The responsible independent review office (typically IPAO for all programs and projects with a life cycle cost greater than $250 million) is responsible for ensuring that all potential members provide the necessary information and work with appropriate

procurement, legal, and convening authorities to determine proposed SRB members' suitability for SRB service and appropriate SRB diversity and balance. For Category 2 projects below $250M and Category 3 projects, this responsibility is assigned to the Technical Authority. (See Table 2-4.)

f. Final approval of SRB appointments rests with the convening authorities for the particular program or project under review.

(1) The resolution of questions of SRB composition, balance, and independence will be based upon the independent judgment of the convening authorities in conjunction with contracting officers, legal offices, and IPAO staff.

(2) However, nothing in this section authorizes the convening authority or decision authority to make determinations required by or reserved to another official by statute, regulation, or NASA directive.

g. SRBs discuss at the first kick-off meeting and annually thereafter each member's continuing responsibility to not disclose restricted information. SRB members are required to identify immediately to the appropriate NASA authority any change in circumstances that may affect previous conflict of interest determinations.

2.5.9 A summary of the independent life cycle review process shown in Figure 2-5 is discussed in detail below. See tables 2-6 and 2-7 for a brief description of acquisition, program, and project reviews, respectively, with the caveat that not all reviews are applicable to every program and project.

2.5.10 Relationship Between Internal and Independent Life Cycle Reviews

2.5.10.1 Internal reviews are performed by the program/project to establish the baseline design and to firm up plans for completing the definition of the program/project including the integrated cost, schedule and technical parameters at a particular point in the lifecycle. The internal reviews are not synonymous with the independent life cycle review. However, the project may elect to perform the internal and the independent life cycle review simultaneously (as is customarily done in robotics program/projects) when the Management Baseline is completely defined as intended for approval by the decision authority at the time of the internal review.

2.5.10.2 To support an effective, efficient independent review, SRB members may participate, as mutually agreed between the program/project and the SRB, as observers in the program/project's internal review process. This may include attendance at specific subsystem, module, and other levels, and, if held, system-, mission-, or project-level review.

2.5.10.3 Because of the time required to perform an independent, integrated cost and schedule analysis and the formal SRB reporting constraints directed by the Agency, the SRB's cost and schedule analysts will work with the program/project to understand the integrated cost and schedule estimates, including models, developed by the program/project in accordance with the requirements of NPD 1000.5 prior to the independent life cycle review. This pre-work is completed at a time mutually agreed to between the program/project and the SRB but in any case prior to the start of the independent life cycle review.

2.5.10.4 When the internal reviews and the independent life cycle review are not performed simultaneously, at the completion of internal system/project review, the program/project prepares a “one-pager” that summarizes any significant issues resulting from the internal review and the plan leading to the life cycle review of the governing PMC. This plan will include the establishment of technical, cost, and schedule baselines and the completion of the requirements of NPR 1000.5. This one-pager will be presented to the DA.

2.5.10.5 During the program/projects preparation of the one-pager, the SRB presents to the program/project their assessment of program/project readiness to meet the criteria for the life cycle review milestone. The program/project will address any concerns expressed by the SRB in the one-pager’s plan to get to independent life cycle review and to the associated presentation to the DA.

2.5.10.6 The DA provides direction to the program/project for issues arising out of the one-pager.

2.5.10.7 The maximum interval between the internal system/project review and the independent life cycle review is 6 months. The program/project may elect not to have this interval between the internal review and the independent life cycle review. However, if that election is made, all the requirements of the independent life cycle review are required to be satisfied: in particular, the provisions stated earlier pertaining to early coordination of the cost and schedule models. This interval is used to complete the work to prepare the integrated cost, schedule, and technical baseline for final assessment by the SRB at the independent life cycle review as described in the internal review “one-pager”. Note that this interval is zero if the independent life cycle review is held concurrently with the internal system/project review.

2.5.11 The program/project manager determines when the program/project will be ready for the independent life cycle review. As a prerequisite for scheduling the review, the program/project manager will review with the SRB chair the program/project’s readiness for the review per this NID and NPR 7123.1. In a situation where the program/project manager judges that extenuating circumstances warrant going ahead with the independent review with unfilled criteria, the program/project manager is responsible to provide adequate justification for proceeding with the independent review and identify appropriate compensatory actions. The SRB chair provides the convening authorities with the results of the chair’s assessment of the program/project’s readiness for the review. This will include:

a. Identification of where expected technical or programmatic content may not be available at the review (e.g., maturity at that point in the life cycle, missing or incomplete documents or plans, inability to demonstrate closure to key requirements, etc),

b. The program/project’s justification for proceeding with the independent review and the program/project’s planned compensatory actions, and

c. The SRB chair’s assessment of whether the SRB review can meet the ToR for the review and any associated recommendations.

The decision authority determines the proper course of action with respect to scheduling the independent review, and the ToR is updated to reflect that action (e.g., delay the review, proceed

with the expectation of full or partial delta review, convene an appropriate special review, proceed with the expectation of major RFAs).

2.5.12 Independent Life Cycle Review

2.5.12.1 The independent life cycle review has three parts: (1) a presentation of the program/project's integrated technical, cost, and schedule baseline; risk status (including performance); and future plans; (2) the preparation of a preliminary SRB briefing/report with program/project responses to the major issues. Part 2 of the independent life cycle review may be as long as 5-10 working days depending on the complexity of the program/project; and (3) presentation of the findings to the convening authority/decision authority.

2.5.12.2 Within 48 hours of the completion of the independent life cycle review, an SRB "one-pager" is prepared for the DA that summarizes the major SRB findings and project responses and the SRB assessment of the project readiness to proceed to the governing PMC for a final decision by the DA. If there are disagreements about major issues/responses, the DA may require the program/project to present more details about the issues and their responses at an Agency BPR.

2.5.12.3 Under normal circumstances (i.e., no requirement for presentation at an agency BPR), within one month of the completion of the independent life cycle review or as specified in the ToR, the SRB presents its report in a briefing to the DA. This will be an integrated, holistic technical, cost, schedule, and risk assessment of the program/project. The convening authorities, working with the program/project, are responsible for defining and completing any pre-DA reviews. The SRB will be available to support the convening authorities' requirements.

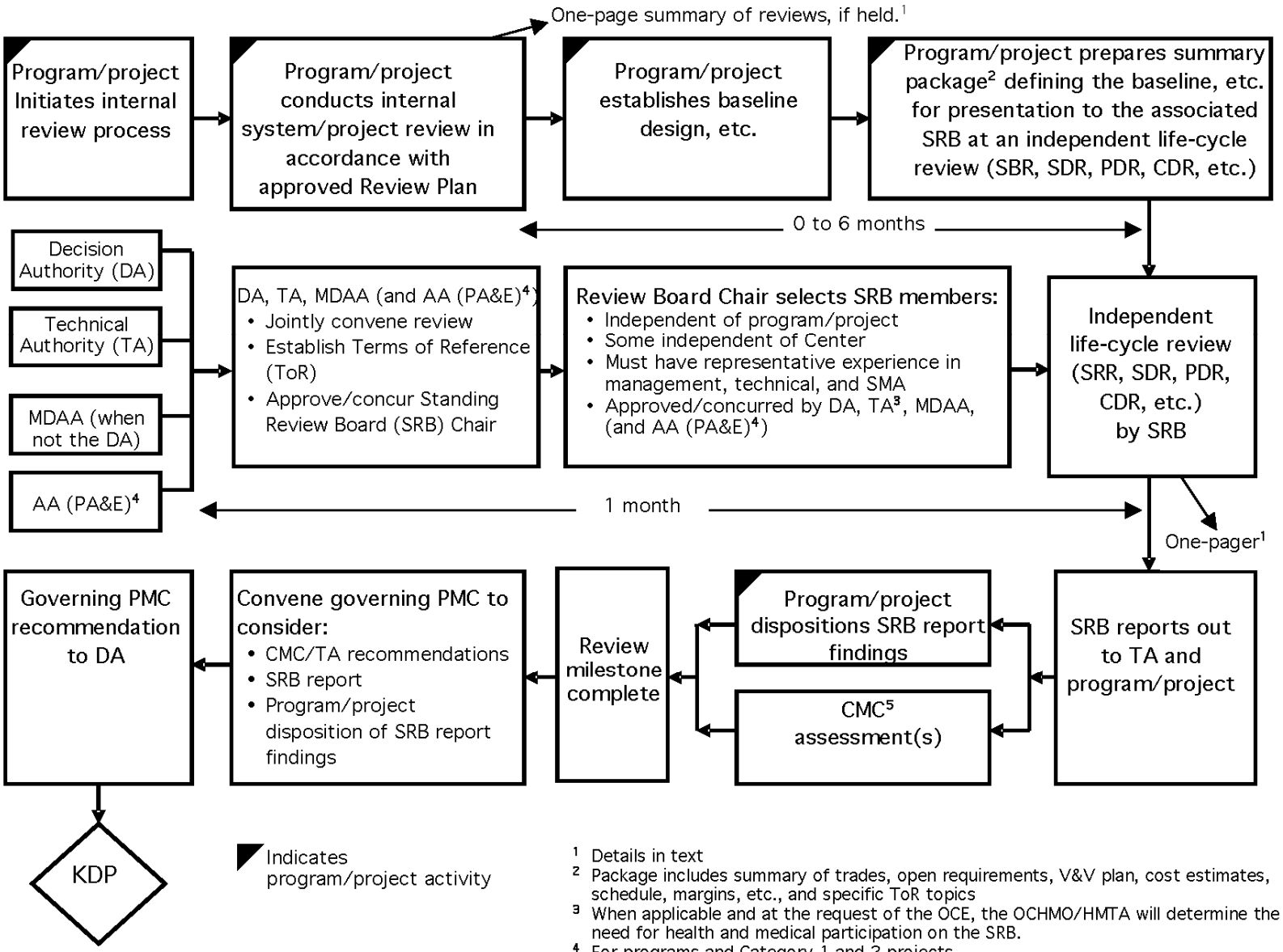
2.5.12.4 The independent life cycle review is complete when the DA approves the program/project to proceed past life cycle review. In the case where the life cycle review is associated with a Key Decision Point (KDP), the KDP memo will be issued by the DA.

2.5.13 Special notes:

2.5.13.1 It should be clear that the internal system/project review and the independent life cycle review, while identified as separate reviews may not be so. The internal system/project review may be performed simultaneously with the independent life cycle review held after the completion of lower level reviews.

2.5.13.2 The requirements for early coordination of the cost and schedule estimates/models are a necessity for the successful completion of the independent life cycle review. In the event that this early coordination is not performed, the SRB may recommend to the DA that a delta review be completed before the independent life cycle review is considered to have been completed.

2.5.13.3 When the internal system/project review is held simultaneously with the independent life cycle review, only a single one-pager is produced.



1 Details in text
2 Package includes summary of trades, open requirements, V&V plan, cost estimates, schedule, margins, etc., and specific ToR topics
3 When applicable and at the request of the OCE, the OCHMO/HMTA will determine the need for health and medical participation on the SRB.
4 For programs and Category 1 and 2 projects
5 May be multiple Centers consistent with their technical authority

Figure 2-5 Program/Project Independent Life Cycle Review Process

2.5.14 The Office of the Administrator, MDAA, or the Technical Authority may also convene special reviews as they determine the need. Circumstances that may warrant special reviews include an expectation of programs/projects not meeting technical, cost, or schedule requirements, inability to develop an enabling technology, or some unanticipated change to the program or project baseline. In these cases, the MDAA or the Technical Authority forms a special review team composed of relevant members of the SRB and additional outside expert members, as needed. The MDAA or the Technical Authority provides the chair of the review with the ToR for the special review. The process followed for these reviews is the same as for other reviews. The special review team is dissolved following resolution of the issue(s) that triggered its formation.

2.5.15 NASA HQ SMA also has a Programmatic Audit and Review (PA&R) process described in NPR 8705.6, *Safety and Mission Assurance Audits, Reviews, and Assessments*. That process provides independent compliance verification for the applicable NASA SMA process and technical requirements within the program/project safety and mission assurance plan, the program baseline requirements set, and appropriate contract documentation. Program/project managers directly support the PA&R process (either Headquarters-led or Center-led) by providing the logistics and resource support required for the successful execution of and response to PA&R process activities. They also coordinate with Center SMA and Center procurement officials to ensure that contracts provide for adequate contractor support for all PA&R activities, and they direct and authorize program/project contractors to support PA&R process activities.

2.5.16 If the decision authority is considering the termination of a program or project in Phases B, C, D, or E, then a special termination KDP may be initiated. Circumstances such as the anticipated inability of the program or project to meet its commitments, an unanticipated change in Agency strategic planning, or an unanticipated change in the NASA budget may be instrumental in triggering a termination KDP. For Category 2 and 3 projects, the decision authority notifies the NASA Associate Administrator at least 45 days (Category 2 projects) or 21 days (Category 3 projects) in advance of a termination KDP; for programs and Category 1 projects, the MDAA provides recommendations to the decision authority on the need for a termination KDP. The decision authority commissions an independent assessment, and following its completion, the governing PMC holds a Termination Review. For operating missions, terminations are handled in accordance with NPD 8010.3, *Notification of Intent to Decommission or Terminate Operating Space Systems and Terminate Missions*.

2.5.16.1 At the Termination Review, the program and the project teams present status, including any material requested by the decision authority. A Center Technical Authority (see Section 3.4) presents an assessment at the program or project level, or an OCE assessment is presented as the Technical Authority for tightly-coupled programs with multiple Centers implementing the projects. Appropriate support organizations are represented (e.g., procurement, external affairs, legislative affairs, and public affairs), as needed. The decision and basis of decision are fully documented and reviewed with the NASA Associate Administrator prior to final implementation.

Table 2-6 Space Flight Program Reviews

Review	Description
Program/System Requirements Review (P/SRR)/ Preliminary Program Approval Review (PPAR)	The P/SRR examines the functional and performance requirements defined for the program (and its constituent projects) and ensures that the requirements and the selected concept will satisfy the program and higher level requirements. It is an internal review. (The SRB may not have been formed.) Rough order-of-magnitude (ROM) budgets and schedules are presented. The PPAR is conducted (when requested by the DA) as part of this review to ensure that major issues are understood and resolved early and to provide Agency management with an independent assessment of the readiness of the program to continue with formulation.
Program/System Definition Review (P/SDR)/Program Approval Review (PAR)	The P/SDR examines the proposed program architecture and the flow down to the functional elements of the system. The PAR is conducted as part of this review to provide Agency management with an independent assessment of the readiness of the program to proceed into implementation. The proposed program's objectives and the concept for meeting those objectives are assessed. Key technologies and other risks are identified and assessed. The baseline Program Plan, budgets, and schedules are presented.
Program Status Review (PSR)/ Program Implementation Review (PIR)	PSRs are conducted by the program to examine the program's continuing relevance to the Agency's Strategic Plan, the progress to date against the approved Management Baseline, the implementation plans for current and upcoming work, budget, schedule, and all risks and their mitigation plans. PIRs are conducted as part of this review to provide Agency management with an independent assessment of the readiness of the program to continue with implementation.
Preliminary Design Review (PDR)	The PDR demonstrates that the overall program preliminary design meets all requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It shows that the correct design options have been selected, interfaces have been identified, and verification methods have been described. Integrated baseline cost and schedules, as well as all risk assessment, management systems, and metrics are presented.
Critical Design Review (CDR)	The CDR demonstrates that the maturity of the program's design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and test and that the technical effort is on track to complete the flight and ground system development and mission operations to meet overall performance requirements within the identified cost and schedule constraints. Progress against management plans, budget, and schedule, as well as risk assessment, are presented.
System Integration Review (SIR)	The SIR evaluates the readiness of the overall system (all projects working together) to commence integration and test. Verification and validation (V&V) plans, integration plans, and test plans are reviewed. Test articles (hardware/software), test facilities, support personnel, and test procedures are ready for testing and data acquisition, reduction, and control.
Operations Readiness Review (ORR)	The ORR examines the actual overall system (all projects working together) characteristics and the procedures used in the system or product's operation and ensures that all project and support (flight and ground) hardware, software, personnel, and procedures are ready for operations and that user documentation accurately reflects the deployed state of the entire system.

Review	Description
Safety and Mission Success Review (SMSR)*	SMSRs are conducted prior to launch or other mission-critical events/activities by the Chief SMA Officer, Chief Engineer, and when applicable Chief Health and Medical Officer (or senior Center-based SMA, engineering and health and medical officials) to prepare for SMA, engineering, and health and medical participation in critical program/project reviews/decision forums. The SMA lead, lead Project Chief Engineer (PCE), and designated health and medical representative are the focal points for planning, coordinating, and providing the program/project elements of these reviews.
Flight Readiness Review (FRR)	The FRR examines tests, demonstrations, analyses, and audits that determine the overall system (all projects working together) readiness for a safe and successful flight/launch and for subsequent flight operations. It also ensures that all flight and ground hardware, software, personnel, and procedures are operationally ready.
Launch Readiness Review (LRR)	Final review prior to actual launch to verify that Launch System and Spacecraft/Payloads are ready for launch.
Post-Launch Assessment Review (PLAR)	Assessment of system in-flight performance. For human space flight, the PLAR is performed by the Mission Management Team (MMT).
Critical Events Readiness Review (CERR)	Review to confirm readiness to execute a critical event during flight operations. For human space flight, the CERR is performed by the Mission Management Team (MMT).

*This review is not subject to an SRB independent review.

Table 2-7 Space Flight Project Reviews

Review	Description
Mission Concept Review (MCR)	The MCR affirms the mission need and examines the proposed mission's objectives and the concept for meeting those objectives. Key technologies are identified and assessed. It is an internal review that usually occurs at the responsible system development organization. (The SRB may not have been formed.) ROM budget and schedules are presented.
System Requirements Review (SRR)	The SRR examines the functional and performance requirements defined for the system and the preliminary Program or Project Plan and ensures that the requirements and the selected concept will satisfy the mission.
Mission Definition Review (MDR) or System Definition Review (SDR)/ Preliminary Non-Advocate Review (PNAR)	The MDR (or SDR) examines the proposed requirements, the mission/system architecture, and the flow down to all functional elements of the system. The PNAR is conducted as part of this review to provide Agency management with an independent assessment of the readiness of the project to proceed to Phase B.

Review	Description
Preliminary Design Review (PDR)/ Non-Advocate Review (NAR)	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 shows that the correct design option has been selected, interfaces have been identified, and verification methods have been described. Full integrated cost and schedule estimates, as well as risk assessments, management systems, and metrics are presented. The NAR is conducted as part of this review to provide Agency management with an independent assessment of the readiness of the project to proceed to implementation. The NAR will also assess alignment of project investments with Agency strategy and future architecture and avoid duplicative investments. Sound justification is required for waivers or deviations.
Critical Design Review (CDR)	The CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and test, and 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. Progress against management plans, budget, and schedule, as well as risk assessments are presented.
Production Readiness Review (PRR)	The PRR is held for projects developing or acquiring multiple similar or identical flight and/or ground support systems. The purpose of the PRR is to determine the readiness of the system developer(s) to efficiently produce (build, integrate, test, and launch) the required number of systems. The PRR also evaluates how well the production plans address the system's operational support requirements.
System Integration Review (SIR)	The SIR evaluates the readiness of the project to start flight system assembly, test, and launch operations. V&V plans, integration plans, and test plans are reviewed. Test articles (hardware/software), test facilities, support personnel, and test procedures are ready for testing and data acquisition, reduction, and control.
System Acceptance Review (SAR)	The SAR verifies the completeness of the specific end item with respect to the expected maturity level and assesses 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.
Operations Readiness Review (ORR)	The ORR examines the actual system characteristics and the procedures used in the system's or product's operation and ensures that all system and support (flight and ground) hardware, software, personnel, and procedures are ready for operations and that user documentation accurately reflects the deployed state of the system.
Safety and Mission Success Review (SMSR)*	SMSRs are conducted prior to launch or other mission-critical events/activities by the Chief SMA Officer, Chief Engineer, and when applicable Chief Health and Medical Officer (or senior Center-based SMA, engineering and health and medical officials) to prepare for SMA, engineering, and health and medical participation in critical program/project reviews/decision forums. The SMA lead, lead PCE, and designated health and medical representative are the focal points for planning, coordinating, and providing the program/project elements of these reviews.

Review	Description
Flight Readiness Review (FRR)	The FRR examines tests, demonstrations, analyses, and audits that determine the system's readiness for a safe and successful flight/launch and for subsequent flight operations. It also ensures that all flight and ground hardware, software, personnel, and procedures are operationally ready.
Launch Readiness Review (LRR) (Launch Vehicle)	Final review prior to actual launch to verify that Launch System and Spacecraft/Payloads are ready for launch.
Post-Launch Assessment Review (PLAR)	Assessment of system in-flight performance. For human space flight, the PLAR is performed by the Mission Management Team (MMT).
Critical Event Readiness Review (CERR)	Review to confirm readiness to execute a critical event during flight operations. For human space flight, the CERR is performed by the Mission Management Team (MMT).
Post-Flight Assessment Review (PFAR)	The PFAR is a human space flight review that occurs after a flight mission to assess whether mission objectives were met and the status of the returned vehicle.
Decommissioning Review (DR)*	The purpose of the DR is to confirm the decision to terminate or decommission the system and assess the readiness for the safe decommissioning and disposal of system assets.

* This review is not subject to an SRB independent review.

Chapter 3. Program and Project Management Roles and Responsibilities

3.1 Overview of Roles and Responsibilities

3.1.1 This chapter defines the roles and responsibilities of the key officials in the program/ project management process. Terms such as *approval* and *concurrence*, used in connection with these roles and responsibilities, are defined in Appendix A.

3.1.2 The roles and responsibilities of senior NASA management, along with fundamental principles of governance, are defined in NPD 1000.0, *NASA Governance and Strategic Management Handbook*, and further outlined in NPD 1000.3, *The NASA Organization*. The key roles and responsibilities specific to programs and projects consistent with NPD 1000.0 can be summarized as follows:

a. NASA Administrator—Chair of the Strategic Management Council (SMC) and Acquisition Strategic Planning Meeting and approves key aspects of major acquisitions including assignment of programs and Category 1 projects to Centers.

b. NASA Associate Administrator—responsible for the technical and programmatic integration of programs at the Agency level, chairing the Agency PMC, serving as KDP decision authority for programs and Category 1 projects, and approving the PCA.

c. Associate Administrator, PA&E— responsible for providing objective, transparent, and multidisciplinary analysis on all aspects of NASA programs, Category 1 and 2 projects, and other projects as assigned to inform strategic decision making. PA&E's responsibilities include evaluating cost effectiveness, quality, and performance in achieving strategic objectives. .

d. Chief Engineer—establishes policy, oversight, and assessment of the NASA engineering and program/project management process; implements the engineering technical authority process; serves as principal advisor to the Administrator and other senior officials on matters pertaining to the technical capability and readiness of NASA programs and projects to execute according to plans; directs the NASA Engineering and Safety Center (NESC), and directs programs/projects to respond to requests from the NESC for data and information needed to make independent technical assessments and to respond to these assessments.

e. Chief, Safety and Mission Assurance—ensures the existence of robust safety and mission assurance processes and activities through the development, implementation, assessment, and functional oversight of Agency-wide safety, reliability, maintainability, and quality policies and procedures; serves as principal advisor to the Administrator and other senior officials on Agency-wide safety, reliability, maintainability, and quality; performs independent program and project compliance verification audits; implements the SMA technical authority process; monitors, collects, and assesses Agency-wide safety and mission assurance financial and performance results.

f. Chief Health and Medical Officer—establishes policy, oversight, and assessment on all health and medical matters associated with NASA missions and is responsible for implementation of medical/health technical authority process; serves as principal advisor to the Administrator and other senior officials on health and medical issues related to the Agency workforce.

g. Chief Financial Officer— provides leadership for the planning, analysis, justification, control, and reporting of all Agency fiscal resources. Oversees all financial management activities relating to the programs and operations of the Agency. Leads the budgeting and execution phases of the planning, programming, budgeting, and execution process. Monitors and reports the financial execution of the Agency budget.

h. Mission Directorate Associate Administrator—primarily responsible for managing programs within the Mission Directorate; recommends the assignment of programs and Category 1 projects to Centers; assigns Category 2 and 3 projects to Centers; serves as the KDP Decision authority for Category 2 and 3 projects; and has responsibility for all programmatic requirements, including budgets, schedules, and the high-level programmatic requirements levied on projects within the Mission Directorate. The MDAA may designate a Program Director or Program Executive to support the MDAA and the program manager in defining, integrating, and assessing program/project activities and to provide policy direction and guidance to the program/project. The Mission Directorate confirms to the decision authority that their current baseline life cycle cost estimates and funding strategy and the annual NASA budget submissions are consistent. Significant changes to funding strategy are to be reviewed with and approved by the decision authority.

i. Center Director—responsible for establishing, developing, and maintaining the institutional capabilities (processes and procedures, human capital, facilities, and infrastructure) required for the execution of programs and projects, including the system of checks and balances to ensure the technical integrity of programs and projects assigned to the Center.

j. Program manager—responsible for the formulation and implementation of the program per the governing agreement with the sponsoring Mission Directorate.

k. Project Manager—responsible for the formulation and implementation of the project per the governing agreement with the program manager.

l. Mission Support Office Assistant Administrators—establish policy and procedures for the oversight and assessment of their particular functional area (e.g., procurement).

3.1.3 Programmatic Authority flows from the Administrator through the Associate Administrator to the Mission Directorate Associate Administrator, to the program manager and finally to the project manager per NPD 1000.0, *NASA Governance and Strategic Management Handbook*. Because there are different types of programs that require different management approaches, the MDAA may delegate some of his/her Programmatic Authority to Deputy Associate Administrators, Division Directors, or equivalent, such as Program Directors,

depending on the mission directorate organizational structure, consistent with the following principles:

a. As a general rule, the MDAA will not delegate responsibility beyond his/her immediate organization for strategic planning; policy formulation and approval; definition and approval of programs, projects, and missions; assignment of programs, projects, and selected managers; mission directorate budget development, approval, and allocation; and assessment and reporting of performance. Delegations will be documented to ensure roles and responsibilities are understood and accountability is clear.

b. As a minimum, the program manager is expected to be responsible and accountable for the safety, technical integrity, performance, and mission success of the program; develop and present budget/funding requirements; develop and implement the program plan, including managing program resources; implement a risk management process that incorporates risk-informed decision-making; oversee project implementation; resolve program and project risks, including allocation of margins to mitigate risks; periodically report progress to the MD; and support MD activities.

c. The responsibilities and authority of the MDAA and those individuals with delegated Programmatic Authority are to be documented in the Program Plan such that they are unambiguous and not overlapping.

3.1.4 The project manager reports to the program manager and both are supported by one or more NASA Centers (with facilities and experts from line or functional organizations). Each, however, is responsible and accountable for the safety, technical integrity, performance, and mission success of the program or project, while also meeting programmatic (technical, cost, and schedule) commitments. Accomplishing this requires a breadth of skills, so he/she must be knowledgeable about governing laws, acquisition regulations, policies affecting program and project safety, training of direct-report personnel, risk management, environmental management, resource management, program- and project-unique test facilities, software management, responding to external requests for audits (e.g., OMB), protecting intellectual property and technology, and other aspects of program and project management.

3.2 Specific Roles and Responsibilities

3.2.1 Table 3-1, Roles and Responsibilities Relationships Matrix, provides a summary of the roles and responsibilities covered in this directive for the key program/project management officials. The table is informational only and is not intended to specify, levy, or remove requirements. As such, implementation of the specific roles and responsibilities is determined on a case-by-case basis and is documented in the Program or Project Plan.

Table 3-1 Roles and Responsibilities Relationships Matrix

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Strategic Planning	• Establish Agency strategic priorities and direction • Approve Agency Strategic Plan and programmatic architecture and top-level guidance • Approve implementation plans developed by Mission Directorates.	• Develop Agency Strategic Plan (PA&E). • Develop annual strategic planning guidance (PA&E) • Develop Annual Performance Plan (PA&E)	• Support Agency strategic planning • Develop directorate implementation plans and cross-directorate architecture plans consistent with Agency strategic plans, architecture, and top- level guidance	• Support Agency and Mission Directorate strategic planning and supporting studies		• Support Mission Directorate strategic implementation plan	

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Program Initiation (Center Assign-ment and FAD)	• Approve assignment of programs to Centers	• Approve Program Chief Engineers* (Technical Authority) (OCE) • When applicable, approve program's approach to Health and Medical Technical Authority based on Center's HMTA infrastructure (OCHMO)	• Initiate new programs via FAD • Recommend assignment of programs to Centers • Approve appointment of Program Managers	• Provide human and other resources to execute FAD • Recommend Program Managers to MDAA	• Appoint Program Chief Engineers* (Technical Authority) in consultation with and after approval by OCE • Appoint Center Lead Discipline Engineers (LDEs)	• Establish the program office and structure to direct/monitor projects within program	

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Project Initiation (Center Assign-ment and FAD)	• Approve assignment of Category 1 projects to Centers	• Approve Project Chief Engineers* (Technical Authority) appointment to Category 1 projects (OCE) • Is notified of Project Chief Engineers* (Technical Authority) assigned to Category 2 and 3 projects (OCE) • When applicable, approve project's approach to Health and Medical Technical Authority based on Center's HMTA infrastructure (OCHMO)	• Initiate new projects via FAD • Recommend assignment of Category 1 projects to Centers • Assign Category 2 and 3 projects to Centers. • Approve appointment of Category 1 and selected Category 2 Project Managers	• Provide human and other resources to execute FAD • Recommend Category 1 Project Managers to MDAA • Appoint Category 2 and 3 Project Managers	• Appoint Project Chief Engineers* (Technical Authority) on Category 1 projects in consultation with and after approval by OCE • Appoint Project Chief Engineers* (Technical Authority) on Category 2 and 3 projects with OCE concurrence	• Concur with appointment of Project Managers	• Establish the project office and structure to direct and monitor tasks/activities within project

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Policy Develop-ment		• Establish Agency policies and ensure support infrastructure is in place for: Technical Authority (OCE), SMA functions (OSMA), Health and Medical functions (OCHMO) • Develop and maintain Agency-wide engineering standards applicable to programs and projects (OCE) • **Develop and maintain Agency-wide health and medical standards applicable to programs and projects (OCHMO)**	• Establish Directorate policies (e.g. guidance, risk posture, and priorities for acquisition) applicable to program, projects, and supporting elements	• Ensure Center policies are consistent with Agency and Mission Directorate policies • Establish policies and procedures to ensure program and projects are implemented consistent with sound technical and management practices	• Establish institutional engineering design and verification/validation best practices for products and services provided by the Center • Develop implementation plan for technical authority at the Center		

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Program/ Project Concept Studies		• Provide technical expertise for advanced concept studies, as required (OCE/NESC)	• Develop direction and guidance specific to concept studies for formulation of programs and non-competed projects	• Develop direction and guidance specific to concept studies for formulation of competed projects		• Initiate, support, and conduct program-level concept studies consistent with direction and guidance from MDAA	• Initiate, support, and conduct project-level concept studies consistent with direction and guidance from program (or Center for competed projects)
Develop-ment of Program-matic Require-ments			• Establish, coordinate, and approve high-level program requirements • Establish, coordinate, and approve high-level project requirements, including success criteria	• Provide support to program and project requirements development as assigned	• Approves changes to and deviations and waivers from those requirements that are the responsibility of the TA and have been delegated to the CD for such action	• Originates requirements for the program consistent with the PCA • Approve program requirements levied on the project	• Originates project requirements consistent with the Program Plan

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Resources Manage-ment (Program Budgets)	• Establish budgets for Mission Directorates and Mission Support Offices	• Manage and coordinate Agency annual budget submission (OCFO)	• Establish program and project budgets • Allocate budget resources to Centers for assigned projects • Conduct annual program and project budget submission reviews	• Support annual program and project budget submissions, and validate Center inputs • Provide the personnel, facilities, resources, and training necessary for implementing assigned programs and projects	• Ensure independence of resources to support the implementation of technical authority • Provide resources for review, assessment, development, and maintenance of the core competencies required to ensure technical and program/project management excellence	• Implement program consistent with budget • Coordinate development of cost estimates to support budget • Provide annual program budget submission input • Manage program resources	• Develop mission options, conduct trades, and develop cost estimates to support budget. • Implement project budget • Provide annual project budget submission input • Manage project resources
PCA	• Approve Program Commitment Agreement (NASA AA)	• Concur with Program Commitment Agreement (OCE)	• Develop and approve Program Commitment Agreement			• Support development of the Program Commitment Agreement	
Program Plans			• Approve Program Plans	• Concur on Program Plans	Concur in the implementation of Technical Authority	• Develop and approve Program Plan • Execute Program Plan	
Project Plans			• Approve Project Plans, if required	• Approve Project Plans	Concur in the implementation of Technical Authority	• Approve Project Plans	• Develop and approve Project Plan • Execute Project Plan

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Program/ Project Perfor-mance Assess-ment	• Assess program and Category 1 project technical, schedule, and cost performance through Quarterly Status Reviews • Conduct Agency PMC (NASA AA)	• Conduct special studies for the Administrator (PA&E)	• Assess program technical, schedule, and cost performance and take action, as appropriate, to mitigate risks • Conduct Mission Directorate PMC	• Assess program and project technical, schedule, and cost performance as part of the Center Management Council		• Assess program and project technical, schedule, and cost performance and take action, as appropriate, to mitigate risks	• Assess project technical, schedule, and cost performance and take action, as appropriate, to mitigate risks
Program/ Project Perfor-mance Issues			• Communicate program and project performance issues and risks to Agency management and present plan for mitigation or recovery	• Provide support and guidance to programs and projects in resolving technical and programmatic issues and risks • Communicate program and project technical performance and risks to Mission Directorate and Agency management and provide recommendatio ns for recovery		• Communicate program and project performance issues and risks to Center and Mission Directorate management and present recovery plans	• Communicate project performance, issues and risks to program, Center, and Mission Directorate management and present recovery plans

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Termina-tion Reviews	• Determine and authorize termination of programs and Category 1 projects through Agency PMC		• Determine and authorize termination of programs and Category 2 and Category 3 projects through MD PMC and coordinate final decision with Administrator	• Support Termination Reviews • Perform supporting analysis to confirm termination, if required		• Conduct program and project analyses to support Termination Reviews	• Support Termination Reviews

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Indepen-dent Reviews	• Authorize implementation of programs and Category 1 projects through PMC, based on NAR and other inputs	• Convene and support independent reviews for programs and Category 1 and 2 projects (PA&E) • Provide SRB Review Manager for programs and Category 1 and 2 projects (PA&E) • Provide cost and management system SRB members through the PDR/NAR (PA&E) • Support independent reviews or technical assessments, as required (OCE/NESC)	• Convene and support independent reviews	• Ensure adequate checks and balances (e.g., technical authority) are in place	• Convene and support independent reviews	• Prepare for and provide assessment of program and project readiness to enter Implementation	• Prepare for and provide assessment of project readiness to enter Implementation

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
KDPs (all)	• Authorize program and Category 1 projects to proceed past KDPs (NASA AA)		• Authorize program and Category 2 and 3 projects to proceed past KDPs (MDAA may delegate Category 3 project KDPs as documented in the Program Plan) • Provide recommendation to NASA AA for program and Category 1 projects at KDPs	• Perform supporting analysis to confirm readiness leading to KDPs for programs and Category 1, 2, and 3 projects • Conduct readiness reviews leading to KDPs for Category 1, 2, and selected Category 3 projects • Certify readiness to proceed past KDPs		• Conduct readiness reviews leading to KDPs for program • Conduct readiness reviews leading to KDPs for Category 1, 2, and 3 projects • Certify program and project readiness to proceed past KDPs	• Conduct readiness reviews leading to KDPs for projects • Certify readiness to proceed past KDPs
International and Intergovernmental Agreements		• Support the development and negotiate international and inter-governmental agreements (OER)	• Negotiate content of agreements with international and other external organizations			• Support development of content of agreements with international and other government Agencies	• Support development of content of agreements with international and other government Agencies

	Office of the Administrator	Administrator Staff and Mission Support Offices	Mission Directorate Associate Administrator	Center Director		Program Manager	Project Manager
				Institutional	Technical Authority		
Launch Criteria for Nuclear and Human-Rated Missions	• Approve launch request • Forward request for nuclear launch approval to OSTP as required	• Validate, certify, and approve human rating and launch readiness to Administrator (OCE, OSMA, and OCHMO)	• Approve launch readiness	• Validate launch readiness for assigned programs and projects		• Develop program launch readiness criteria	• Develop project launch readiness criteria

* Centers may use an equivalent term for these positions, such as Program/Project Systems Engineer.

3.2.2 It is important for the program and project manager to coordinate early and throughout the program/project life cycle with mission support organizations at NASA Headquarters through the sponsoring Mission Directorate and the implementing Centers. These mission support organizations include legal, procurement, security, finance, export control, human resources, public affairs, international affairs, property, facilities, environmental, aircraft operations, IT security, planetary protection, and others. They provide essential expertise and ensure compliance with relevant laws, treaties, executive orders, and regulations. It is also important to ensure that organizations having a substantive interest (these might include supporting activities such as facilities, logistics, etc.) are effectively integrated into the program's or project's activities as early as appropriate and throughout the duration of the organizations' interest to include their needs, benefit from their experience, and encourage communication.

3.3 Process for Handling Dissenting Opinions

3.3.1 NASA teams must have full and open discussions, with all facts made available, to understand and assess issues. Diverse views are to be fostered and respected in an environment of integrity and trust with no suppression or retribution. In the team environment in which NASA operates, team members often have to determine where they stand on a decision. In assessing a decision or action, a member has three choices: agree, disagree but be willing to fully support the decision, or disagree and raise a Dissenting Opinion. For disagreements that rise to the level of importance that warrant a specific review and decision by a higher level of management, NASA has formalized the Dissenting Opinion process. (Additional considerations that relate to Dissenting Opinions raised by a Technical Authority (TA) are set forth in Section 3.4.)

3.3.2 Unresolved issues of any nature (e.g., programmatic, safety, engineering, health and medical, acquisition, accounting) within a team should be quickly elevated to achieve resolution at the appropriate level. A Dissenting Opinion is a substantive disagreement with a decision or action that an individual judges is not in the best interest of NASA and is of sufficient importance that it warrants a timely review and decision by higher level management. A Dissenting Opinion must be supportable and based on a sound rationale (not solely on unyielding opposition). The individual must specifically request that the dissent be recorded and resolved by the Dissenting Opinion process. The decision on whether the issue in question is of the significance that warrants the use of the Dissenting Opinion process is the responsibility and personal decision of the dissenting individual.

3.3.3 When time permits, the disagreeing parties <u>jointly</u> document the issue, including agreed-to facts, discussion of the differing positions with rationale and impacts, and the parties' recommendations. The joint documentation must be approved by the representative of each view, concurred with by affected parties, and provided to the next higher level of the involved authorities with notification to the second higher level of management. This may involve a single authority (e.g., the Programmatic Authority) or multiple authorities (e.g., Programmatic and Technical Authorities). In cases of urgency, the disagreeing parties may jointly present the information stated above orally with all affected organizations represented, advance notification to the second-higher level of management, and documentation follow-up.

3.3.4 Management's decision/action on the memorandum (or oral presentation) is documented and provided to the dissenter and to the notified managers and becomes part of the program/project record. If the dissenter is not satisfied with the process or outcome, the dissenter may appeal to the next higher level of management. The dissenter has the right to take the issue upward in the organization, even to the NASA Administrator, if necessary.

3.4 Technical Authority

3.4.1 The NASA governance model prescribes a management structure that employs checks and balances between key organizations to ensure that decisions have the benefit of different points of view and are not made in isolation. (See NPD 1000.0.) NASA has established the technical authority process as part of its system of checks and balances to provide independent oversight of programs and projects in support of safety and mission success through the selection of specific individuals at delegated levels of authority. These individuals are the Technical Authorities. In this document, the term Technical Authority is used to refer to such an individual, but is also used (without capitalization) to refer to elements of the technical authority process. The responsibilities of a program or project manager are not diminished by the implementation of Technical Authority. The program or project manager is ultimately responsible for the safe conduct and successful outcome of the program or project in conformance with governing requirements. This includes meeting programmatic, institutional, technical, safety, cost, and schedule commitments.

3.4.1.1 Technical Authority originates with the Administrator and is formally delegated to the NASA AA and then to the NASA Chief Engineer for Engineering Technical Authority, the Chief, Safety and Mission Assurance for SMA Technical Authority, and the Chief Health and Medical Officer for Health and Medical Technical Authority. Subsequent Technical Authority delegations are formal and traceable to the Administrator. Individuals with Technical Authority are funded independently of a program or project. Technical Authorities located at Centers remain part of their Center organization, and their personnel performance appraisal is signed by the management of that Center organization.

3.4.1.2 On decisions related to technical and operational matters involving safety and mission success risk, formal concurrence by the responsible Technical Authorities (Engineering, Safety and Mission Assurance, and Health and Medical) is required. This concurrence is to be based on the technical merits of the case and includes agreement that the risk is acceptable. For matters involving human safety risk, the actual risk taker(s) (or official spokesperson(s) and their supervisory chain) must formally consent to taking the risk; and the responsible program, project, or operations manager must formally accept the risk. (See NPD 1000.0.)

3.4.1.3 The responsibilities of individuals with delegated Technical Authority at the program or project level include:

a. Being the single point of contact for Technical Authority matters.

b. Serving as members of program or project control boards, change boards, and internal review boards.

c. Working with the Center Management and other Technical Authority personnel, as necessary, to ensure direction provided to the program or project reflects the view of the Center or, where appropriate, the view of the NASA Technical Authority community.

d. Assuring that requests for waivers or deviations from Technical Authority requirements are submitted to and acted upon by the appropriate level of Technical Authority.

e. Providing the program or project with a view of matters based on his or her knowledge and experience and raising a Dissenting Opinion on a decision or action when appropriate.

f. Serving as an effective part of the overall check and balance system. (This includes conforming to the principle that serves as the foundation of NASA's system of checks and balances that states "an individual cannot grade his or her own work".)

3.4.1.4 The day-to-day involvement of the TAs in program/project activities as members of the program/project's control, change, and internal review boards should ensure that any significant views from TAs will be available to the program/project in a timely manner and should be handled during the normal program/project processes.

3.4.1.5 Infrequent circumstances may arise when a Technical Authority or the program/project manager may disagree on a proposed programmatic or technical action and judges that the issue rises to a level of significance that the next higher level of management should be involved (i.e., a Dissenting Opinion exists). In such circumstances:

a. Resolution occurs prior to implementation whenever possible. However, if deemed in the best interest of the program/project, the program/project manager has the authority to proceed at risk in parallel with pursuit of resolution. In such circumstances, the next higher level of Programmatic and Technical Authority is informed of the decision to proceed at risk.

b. Resolution is jointly attempted at successively higher levels of Programmatic Authority and Technical Authority until resolved. Final appeals are made to the NASA Administrator.

3.4.2 The *Engineering Technical Authority* establishes and is responsible for the engineering design processes, specifications, rules, best practices, etc., necessary to fulfill programmatic mission performance requirements.

3.4.2.1 The NASA Chief Engineer provides overall leadership of the engineering technical authority process for programs/projects, including Agency engineering policy direction, requirements, and standards. The NASA Chief Engineer approves the appointment of the Center Engineering Directors (or equivalent) and of Engineering Technical Authorities on programs and Category 1 projects and is notified of the appointment of other Engineering Technical Authorities. NASA Chief Engineer hears appeals of the Engineering Technical Authority's decisions when they cannot be resolved at lower levels.

3.4.2.2 The Center Director (or designee) develops the Center's engineering technical authority policies and practices, consistent with Agency policies and standards. The following individuals are responsible for implementing Engineering Technical Authority at the Center:

a. Center Director (CD) – The CD (or the Center Engineering Director, or designee) is the Center Engineering Technical Authority responsible for Center engineering design processes, specifications, rules, best practices, etc., necessary to fulfill mission performance requirements for projects or major systems implemented by the Center. (The CD may delegate Center engineering technical authority implementation responsibility to an individual in the Center's engineering leadership.) The Center Engineering Technical Authority supports the program and project level Technical Authorities in processing changes to and waivers or deviations from Technical Authority responsible requirements. This includes all applicable Agency and Center directives, requirements, procedures, and standards. The CD appoints, with the approval of the NASA Chief Engineer, individuals for the position of Center Engineering Director (or equivalent) and for the Engineering Technical Authority positions down to and including Program Chief Engineers and Category 1 Project Chief Engineers (or equivalents).[15] The CD appoints Category 2 and 3 Project Chief Engineers and Lead Discipline Engineers.

b. Program/Project Chief Engineer (PCE) –These are the Engineering Technical Authorities at the program/project level. See the responsibilities delineated in Section 3.4.1.3.

c. Lead Discipline Engineer (LDE) – The LDE is a senior technical engineer in a specific discipline at the Center. The LDE assists the program/project through direct involvement with working-level engineers to identify engineering requirements and develop solutions that comply with the requirements. The LDE works through and with the PCE to ensure the proper application and management of discipline-specific engineering requirements and Agency standards. Those LDEs that have formal delegations traceable to the Administrator and are funded independent of programs and projects are Technical Authorities.

3.4.2.3 On some programs and projects, the program- and project-level Engineering Technical Authority may also serve as the program/project Systems Engineering Manager or Systems Engineering and Integration Manager. In these instances:

a. The program/project manager concurs in the appointment of the Engineering Technical Authorities.

b. The Engineering Technical Authority can't be the decision-maker on a Board or panel that provides relief to a derived requirement. This provision does not preclude such an Engineering Technical Authority from chairing preliminary boards that provide input to the Change or Control Board.

[15] Centers may use an equivalent term for these positions, such as Program/Project Systems Engineer.

c. As a minimum, two Engineering Technical Authorities (e.g., the PCE and the applicable LDE) must agree with the action to accept a change to or a waiver or deviation from a Technical Authority requirement.

3.4.3 Although a limited number of individuals make up the Engineering Technical Authorities, their work is enabled by the contributions of the program/project's working-level engineers and other supporting personnel (e.g., contracting officers). The working-level engineers are funded by the program/project and consequently may not serve in an Engineering Technical Authority capacity. These engineers perform the detailed engineering and analysis for the program/project, with guidance from their Center management and/or LDEs and support from the Center engineering infrastructure. They deliver the program/project hardware/software that conforms to applicable programmatic, Agency, and Center requirements. They are responsible for raising issues to the program/project manager, Center engineering management, and/or the PCE, as appropriate, and are a key resource for resolving these issues.

3.4.4 The *SMA Technical Authority* establishes and is responsible for the SMA design processes, specifications, rules, best practices, etc., necessary to fulfill programmatic mission performance requirements.

3.4.4.1 For tightly coupled programs, SMA Technical Authority starts with the NASA Chief SMA Officer and then flows to the Center SMA Director and Chief Safety Officer. For other programs, SMA Technical Authority starts with the NASA Chief SMA Officer and flows down to the Center SMA Director, and then to the Program SMA Lead. For projects, SMA Technical Authority originates with the NASA Chief SMA Officer and flows down to the Center Director, and then to the Center SMA Director, and from there, to the Project SMA Lead. The Chief SMA Officer hears appeals of SMA decisions when issues cannot be resolved below the Agency level.

3.4.4.2 The Center SMA Director is responsible for establishing and maintaining institutional SMA policies and practices, consistent with Agency policies and standards. The Center SMA Director is also responsible for assuring that the program/project complies with both the program/project and Center SMA requirements. The program/project SMA Plan, which describes how the program/project will comply with these requirements, is part of the Program/Project Plan. The Center SMA Director also monitors, collects, and assesses Institutional, program, and project safety and mission assurance financial and performance results.

3.4.5 The *Health and Medical Technical Authority* (HMTA) is the NASA Chief Health and Medical Officer (CHMO). The CHMO establishes and is responsible for the Health and Medical Agency-level requirements, specifications, rules, best practices, etc., necessary to fulfill programmatic mission performance requirements

3.4.5.1 Due to Center infrastructure differences, HMTA flow down from the CHMO varies between Centers. The HMTA flow-down processes, including roles and responsibilities, are specified in NPR 8900.1, *NASA Health and Medical Requirements for Human Space Exploration* and further described in the Center HMTA implementation plan.

3.4.5.2 When applicable, the Program/Project Plan will describe how the program/project will comply with HMTA requirements and processes. The CHMO hears appeals of HM**T**A decisions when issues cannot be resolved below the Agency level.

3.5 Center Reimbursable Space Flight Work

3.5.1 A Center negotiating reimbursable work for another agency must propose NPR 7120.5 as the basis by which it will perform the space flight work. If the sponsoring agency does not want NPR 7120.5 requirements (or a subset of those requirements) to be followed, then the inter-agency MOU/MOA or the contract must explicitly identify those requirements that will not be followed, along with the substitute requirements for equivalent processes and any additional program/project management requirements the sponsoring agency wants. The Center must obtain a formal waiver by the NASA Chief Engineer for those NPR 7120.5 requirements that are not to be followed, or the Agency will direct the Center not to accept the work.

3.6 Principles Related to Tailoring Requirements

3.6.1 It is NASA's policy to have an acquisition process that complies with all applicable Agency and Center directives, requirements, procedures, and processes unless relief is formally granted in accordance with the principles related to tailoring requirements delineated in this section. Tailoring is the process used to adjust or seek relief from a prescribed requirement to accommodate the needs of a specific task or activity (e.g., program or project). The evaluation and disposition of requests for tailoring prescribed requirements (including Agency-level requirements and standards) comply with the following:

a. The organization at the level that established the requirement approves the request for tailoring of that requirement unless this authority has been formally delegated elsewhere. The organization approving the tailoring disposition consults with the other organizations that were involved in the establishment of the specific requirement and obtains the concurrence of those organizations having a substantive interest.

b. The involved management at the next higher level is informed in a timely manner of the request for tailoring of a prescribed requirement.

3.6.1.1 The *Tailoring* process results in the generation of *Deviations* and *Waivers* depending on the timing of the request. The following definitions apply:

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

b. Waiver—A documented authorization releasing a program or project from meeting a requirement <u>after</u> the requirement is put under configuration control at the level the requirement will be implemented.

3.6.1.2 Relief from a prescribed requirement that is not relevant and/or not capable of being applied to a specific program, project, system or component is identified as a Non-Applicable

Requirement in the associated Deviation or Waiver. Relief from non-applicable requirements can be approved by the program or project level Technical Authority.

3.6.2 Change Request—A change to a prescribed requirement in an Agency or Center document that is recommended for all programs and projects for all time are submitted to the office responsible for the document for disposition unless formally delegated elsewhere.

3.6.3 Requests for Requirement Relief—To assist in the expeditious processing of requests for relief from a prescribed requirement and to support requirement tracking, the attributes that follow in tables 3-2 and 3-3 are to be included in requests for requirement relief. The specific format or form in which the attributes are submitted is the responsibility of the requesting activity, but must be useable by the receiving organization. All requirement relief requests (deviations or waivers) are also copied to the SMA TA at the program/project level for risk review.

3.6.3.1 Minimum Required Attributes are listed in Table 3-2.

Table 3-2 Minimum Attributes for Requests for Requirement Relief

Unique identifier which identifies the source of requirements relief request:	Descriptive Title:	Date:	
Name of center, program, project, and contractor involved in request, as applicable:	Activity responsible for request including contact information:		
Complete identification of requirement for which relief is being requested:	Description of the requirement(s), specification(s), drawing(s), and other baselined configuration, documentation, or product impacted due to this request:		
Description of the scope, nature, and duration of this request (this could include identification of the system, parts, heat, or lot, serial numbers):	Identify other organizations, systems, components, that may be affected:		
Justification for acceptance and reference to all supporting material used to support acceptance:	Risk (if acceptance increases risk, identify the names with signatures of the technical authority(ies) who has(have) agreed that the risk has been properly characterized and is acceptable, and the names with signatures of the programmatic authority(ies) who has(have) agreed to accept the additional risk:		
Description of, or reference to, the corrective action taken or planned to be taken to prevent future recurrence (as appropriate):			
Required Signatures	Signature	Date	Approved (Yes/No)

3.6.3.2 Tracking Data is listed in Table 3-3.

Table 3-3 Tracking Data

Requirement originates from: ☐ NPR, NPD, NID, CPR, CPD, CPC, CWI ☐ Mandatory Technical Standard ☐ Non-Mandatory Technical Standard ☐ Other/don't know (specify)	Rating (to be defined by the program/project/activity and properly documented): ☐ Critical ☐ Major ☐ Minor ☐ Additional information is attached
Type: ☐ Non-applicable (not relevant or not capable of being applied) ☐ Technically equal or better ☐ Requires acceptance of additional risk ☐ Involves non-conforming product ☐ Involves non-compliant requirement	Other: ☐ Permanent requirement relief ☐ Temporary requirement relief ☐ Recurring request for relief ☐ There is a need for corrective action to prevent recurrence
Notes: All characteristics that apply are to be checked Center, program, project may break the specified categories into additional logical sub-categories while preserving the standard check boxes Center, program, project may recommend to the NASA Chief Engineer additional standard check boxes at any time	

3.6.4 Waivers or deviations from NPR 7120.5 requirements may be granted by the officials shown in Table 3-4 unless formally delegated elsewhere.

Table 3-4 Waiver or Deviation Approval for NPR 7120.5 Requirements

	Project Manager	Program Manager	Center Director	MDAA	Chief Engineer	NASA AA	Approval Authority for Waivers or Deviations with Dissent
Programs (except tightly coupled programs)		R	A	A	A	I	NASA AA
Program (tightly coupled programs)		R		A	A	I	NASA AA
Category 1 Project	R	A	A	A	A	I	NASA AA
Category 2 and 3 Projects	R	A	A	A	A	I	NASA AA
Reimbursable Space Flight Projects	R		A	A*	A	I	NASA AA

R = Recommends; A = Approves; I = Informed

* As applicable

3.6.4.1 Prior to the KDP I for programs (KDP II for single-project programs) and KDP C for projects, requests for waivers or deviations may be documented and submitted individually or in batches. Batches should be submitted under a single waiver or deviation to ensure proper routing and control. Waivers or deviations impacting formulation or requiring long lead time may be submitted individually early in formulation. Batches of deviations and waivers may also be submitted in existing program or project plans or equivalent documentation as part of the normal approval process provided the required signatures are obtained and minimum attributes are included or referenced to easily retrievable data sources. (See Section 3.6.) Following KDP I for programs (KDP II for single-project programs) and KDP C for projects, waivers or deviation must be submitted individually to the appropriate authority.

Chapter 4. Program and Project Requirements by Phase

4.1 Programs—Formulation Phase

4.1.1 Purpose: The purpose of program formulation activities is to establish a cost-effective program that is demonstrably capable of meeting Agency and Mission Directorate goals and objectives. The program Formulation Authorization Document (FAD) authorizes a program manager to initiate the planning of a new program and to perform the analyses required to formulate a sound Program Plan. Major reviews leading to approval at KDP I are the Acquisition Strategy Meeting (ASM), the Program/System Requirements Review (P/SRR), the Program/System Definition Review (P/SDR)/ Program Approval Review (PAR), and the governing PMC review. In addition, at the discretion of the DA, a Preliminary Program Approval Review (PPAR) leading up to a KDP 0 may be required to ensure major issues are understood and resolved prior to KDP I. A summary of the required gate products is provided in Table 4-1.

4.1.2 Requirements: During program formulation, the program manager and the program team shall:

a. For all programs—

(1) Plan, prepare for, and support the Acquisition Strategy Meeting (ASM) prior to partnership commitments and obtain the ASM minutes.

(2) Support the MDAA in developing and obtaining approval of the FAD, PCA, and appropriate annual budget submissions.

(3) Prepare and obtain approval of the Program Plan that follows the template in Appendix E. (See Table 4-2 for a list of required Program Plan Control Plans and their required maturity.)

(4) Support the MDAA and the NASA HQ Office of External Relations in obtaining approved inter-agency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation in reviews, integration and test, and risk management).

(5) Document the traceability of program requirements on individual projects to Agency needs, goals, and objectives, as described in the NASA Strategic Plan.

(6) Initiate the development of technologies that cut across multiple projects within the program.

(7) Prior to the program life cycle formulation reviews shown in Figure 2-3, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(8) Plan, prepare for, and support the program life cycle formulation reviews shown in Figure 2-3 in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(9) If required by the DA, obtain KDP 0 readiness products as shown in Table 4-1.

(10) If required by the DA, plan, prepare for, and support the governing PMC review prior to KDP 0.

(11) Obtain KDP I readiness products as shown in Table 4-1.

(12) Plan, prepare for, and support the governing PMC review prior to KDP I.

b. For *single-project* and *tightly coupled programs*, implement the requirements in paragraphs 4.3.2 and 4.4.2 (Pre-Phase A and Phase A) with the following stipulations:

(1) In *single-project programs*, the Project Plan may serve as the Program Plan and KDP 0 (if required by the DA) and KDP I serve in lieu of KDP A and KDP B, respectively. In keeping with this, single-project programs are approved for implementation at KDP II. (At the discretion of the MDAA, there may also be a Project Plan separate from the Program Plan. In either case, all content required in Program and Project Plan templates must be included.)

(2) In *tightly coupled programs*, separate Project Plans are prepared for projects during their formulation. The program manager may allocate portions of the Program Plan to these individual Project Plans.

Table 4-1 Program Gate Products Maturity Matrix

Products	Formulation		Implementation			
	KDP 0 (if required by the DA)	KDP I	KDP II	KDP III	KDP IV	KDP n
Program Products						
1. FAD	Baseline	Baseline				
2. PCA		Baseline	Update	Update	Update	Update
3. Program Plan	Preliminary	Baseline	Update	Update	Update	Update
4. Inter-agency & International Agreements		Baseline	Update	Update	Update	Update
5. Traceability of Program Requirements on Projects to the Agency Strategic Plan	Preliminary	Baseline	Update	Update	Update	Update
6. ASM minutes		Final				
KDP Readiness Products						
1. Standing Review Board Report	Final	Final	Final	Final	Final	Final
2. CMC Recommendation	Final	Final	Final	Final	Final	Final
3. Program Manager Recommendation (includes response to SRB Report)	Final	Final	Final	Final	Final	Final
4. MDPMC Recommendation	Final	Final	Final	Final	Final	Final
5. Governing PMC Recommendation	Final	Final	Final	Final	Final	Final

Table 4-2 Program Plan Control Plan Maturity Matrix

NPR 7120.5 Program Plan – Control Plans	Formulation		Implementation			
	KDP 0 (if required by the DA)	KDP I	KDP II	KDP III	KDP IV	KDP n
1. Technical, Schedule, and Cost Control Plan		Preliminary	Baseline	Update	Update	Update
2. Safety and Mission Assurance Plan		Preliminary	Baseline	Update	Update	Update
3. Risk Management Plan		Preliminary	Baseline	Update	Update	Update
4. Acquisition Plan		Preliminary	Baseline	Update	Update	Update
5. Technology Development Plan		Preliminary	Baseline	Update	Update	Update
6. Systems Engineering Management Plan		Preliminary	Baseline	Update	Update	Update
7. Review Plan		Preliminary	Baseline	Update	Update	Update
8. Missions Operations Plan		Preliminary	Baseline	Update	Update	Update

NPR 7120.5 Program Plan – Control Plans	Formulation		Implementation			
	KDP 0 (if required by the DA)	KDP I	KDP II	KDP III	KDP IV	KDP n
9. Environmental Management Plan		Preliminary	Baseline	Update	Update	Update
10. Logistics Plan		Preliminary	Baseline	Update	Update	Update
11. Science Data Management Plan		Preliminary	Baseline	Update	Update	Update
12. Information and Configuration Management Plan		Preliminary	Baseline	Update	Update	Update
13. Security Plan		Preliminary	Baseline	Update	Update	Update
14. Export Control Plan		Preliminary	Baseline	Update	Update	Update
15. Education and Public Outreach Plan		Preliminary	Baseline	Update	Update	Update

4.2 Programs—Implementation Phase

4.2.1 **Purpose:** During implementation, the program manager works with the MDAA and the constituent projects to execute the Program Plan in a cost-effective manner. Program reviews ensure that the program continues to contribute to Agency and Mission Directorate goals and objectives within funding constraints. A summary of the required gate products is provided in Table 4-1.

4.2.2 **Requirements:** During program implementation, the program manager and the program team shall:

a. *For all programs—*

(1) Execute the Program Plan.

(2) Support the MDAA in updating the PCA, as appropriate.

(3) Update the Program Plan at KDP II and other KDPs, as appropriate. See Table 4-2 for a list of required Program Plan Control Plans and their required maturity.

(4) Support the MDAA and the NASA HQ Office of External Relations in obtaining updated inter-agency and international agreements (including the planning and negotiation of updated agreements and recommendations on joint participation in reviews, integration and test, and risk management).

(5) Conduct planning, program-level systems engineering, and integration, as appropriate, to support the MDAA in initiating the project selection process.

(6) Support the MDAA in the selection of projects, either assigned or through a competitive process.

(7) Approve project FADs and Project Plans.

(8) Prior to the program life cycle implementation reviews shown in Figure 2-3, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(9) Plan, prepare for, and support the program life cycle implementation reviews shown in Figure 2-3 in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(10) Maintain programmatic and technical oversight of the projects within the program and report their status periodically.

(11) Review and approve annual project budget submission inputs and prepare annual program budget submissions.

(12) Continue to develop technologies that cut across multiple projects within the program.

(13) Obtain KDP readiness products as shown in Table 4-1.

(14) Conduct program-level completion activities for each project in accordance with the project life cycle for Phase F (see paragraph 4.9.2).

b. For *single-project programs*—

(1) For KDP II, implement the requirements in paragraph 4.5.2 (Phase B).

(2) For KDP III, implement the requirements of paragraph 4.6.2 (Phase C).

(3) For KDP IV, implement the requirements of paragraph 4.7.2 (Phase D).

(4) For KDP V, implement the requirements of paragraph 4.8.2 (Phase E).

c. For *tightly coupled programs*—

(1) For KDP II, implement the requirements in paragraph 4.5.2 (Phase B) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

(2) For KDP III, implement the requirements in paragraph 4.6.2 (Phase C) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

(3) For KDP IV, implement the requirements of paragraph 4.7.2 (Phase D) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

(4) For KDP V, implement the requirements of paragraph 4.8.2 (Phase E) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

4.3 Projects—Pre-Phase A

4.3.1 **Purpose:** During Pre-Phase A, a pre-project team studies a broad range of mission concepts that contribute to program and Mission Directorate goals and objectives. These advanced studies, along with interactions with customers and other potential stakeholders, help the team to identify promising mission concept(s) and draft project-level requirements. The team also identifies potential technology needs (based on the best mission concepts) and assesses the gaps between such needs and current and planned technology readiness levels. These activities are focused toward a Mission Concept Review and KDP A. A summary of the required gate products for this phase is provided in Table 4-3.

4.3.2 **Requirements:** During Pre-Phase A, the pre-project manager and team shall:

a. Support Headquarters and program activities, in particular —

(1) Obtain an approved project FAD.

(2) Support the program manager and the MDAA in the development of the draft program requirements on the project.

b. Perform technical activities—

(1) Develop and document preliminary mission concept(s).

(2) Prior to the project independent life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(3) Plan, prepare for, and support the project independent life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

c. Perform project planning, costing, and scheduling activities—

(1) Develop and document a *draft* Management Baseline for all work to be performed by the project that includes the following:

(i) A high-level Work Breakdown Structure (WBS) consistent with the NASA standard space flight project WBS (Appendix G), a schedule, and a rough-order-of-magnitude cost estimate and cost range. Document the basis for the cost estimate and range.

(ii) An assessment of potential technology needs versus current and planned technology readiness levels, as well as potential opportunities to use

commercial, academic, and other Government agency sources of technology.

(iii) An assessment of potential infrastructure and workforce needs versus current plans, as well as opportunities to use infrastructure and workforce in other government agencies, industry, academia, and international organizations.

(iv) Identification of potential partnerships.

(v) Identification of conceptual acquisition strategies for proposed major procurements.

d. Conduct KDP readiness activities—

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP A.

Table 4-3 Project Gate Products Maturity Matrix

Products	Pre-Phase A	Phase A[§]	Phase B	Phase C	Phase D	Phase E
	KDP A	KDP B	KDP C	KDP D	KDP E	KDP F
Headquarters and Program Products						
1. FAD	Approved					
2. Program Requirements on the Project (from the Program Plan)	Draft	Baseline	Update			
3. ASM minutes		Baseline				
4. NEPA Compliance Documentation			Environmental Assessment or Environmental Impact Statement (if required)*			
5. Inter-agency & International Agreements			Baseline			
6. Mishap Control Plan					Baseline	
Project Technical Products						
1. Mission Concept Report	Preliminary	Baseline				
2. System Level Requirements		Preliminary	Baseline			
3. Preliminary Design Report			Baseline			
4. Missions Operations Concept		Preliminary	Baseline			
5. Technology Readiness Assessment Report			Baseline			
6. Missile System Pre-Launch Safety Package			Preliminary	Baseline	Update	
7. Detailed Design Report				Baseline		
8. As-built Hardware and Software Documentation					Baseline	
9. Verification and Validation Report					Baseline	
10. Operations Handbook				Preliminary	Baseline	
11. Orbital Debris Assessment		Initial	Preliminary	Baseline		
12. End of Mission Plan		Initial	Preliminary	Update	Baseline	Final
13. Mission Report						Final

Products	Pre-Phase A	Phase A§	Phase B	Phase C	Phase D	Phase E
	KDP A	KDP B	KDP C	KDP D	KDP E	KDP F
Project Planning, Cost, and Schedule Products						
1. Work Agreements for Next Phase		Baseline**	Baseline	Baseline	Baseline	Baseline
2. Management Baseline	Draft	Preliminary	Baseline			
3. Project Plan		Preliminary	Baseline			
4. CADRe		Preliminary	Baseline	Update	Update	Update
5. Planetary Protection Plan		Planetary Protection Certification	Baseline			
6. Nuclear Safety Launch Approval Plan		Baseline (mission has nuclear materials)				
7. Business Case Analysis for Infrastructure		Preliminary	Baseline			
8. Range Safety Risk Management Plan			Preliminary	Baseline		
9. Systems Decommissioning/Disposal Plan				Preliminary		Baseline
KDP Readiness Products						
1. Standing Review Board Report (SRB)	Final	Final	Final	Final	Final	Final
2. Project Manager Recommendation (includes response to SRB Report, as applicable)	Final	Final	Final	Final	Final	Final
3. CMC Recommendation	Final	Final	Final	Final	Final	Final
4. Program Manager Recommendation	Final	Final	Final	Final	Final	Final
5. MD-PMC Recommendation (for Category I projects only)	Final	Final	Final	Final	Final	Final
6. Governing PMC Recommendation	Final	Final	Final	Final	Final	Final

* See Section 4.5.2a (2) for exceptions.

** Phase A work agreements are prepared and finalized as early as practical in Phase A.

§ See footnote 17 in Section 4.4 for competed Announcement of Opportunity (AO) mission exceptions.

4.4 Projects—Phase A

4.4.1 **Purpose:** During Phase A, a project team is formed to fully develop a baseline mission concept and begin or assume responsibility for the development of needed technologies. This work, along with interactions with customers and other potential stakeholders, helps with the baselining of a mission concept and the program requirements on the project. These activities are focused toward System Requirements Review (SRR) and System Definition Review (SDR/PNAR) (or Mission Definition Review (MDR/PNAR)). The SRR and SDR/PNAR (or MDR/PNAR) process culminates in KDP B. A summary of the required gate products for this phase is provided in Table 4-3.

4.4.2 **Requirements:** During Phase A, the project manager and project team shall:[16]

a. Support Headquarters- and program-related activities—

(1) Support the program manager and the MDAA in the development of the baseline program requirements on the project.[17]

(2) Plan, prepare for, and support the Acquisition Strategy Meeting (ASM) prior to partnership agreements and obtain the ASM minutes.

(3) Support the program manager, the MDAA, and the NASA HQ Office of External Relations in initiating inter-agency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation in reviews, integration and test, and risk management).

b. Perform technical activities—

(1) Develop preliminary system-level (and lower level, as needed) requirements.

(2) Develop and document a baseline mission concept (including key risk drivers and mitigation options and mission descope options).

(3) Develop a preliminary mission operations concept.

(4) Initiate technology developments, as required.

---

[16] For projects that are initiated through a competitive Announcement of Opportunity (AO) or similar instrument, the Phase A timeframe involves a great deal of project concept development, technology development, and independent assessment of PI-led teams that prepare detailed proposals aimed at meeting program-level requirements, all of which culminate in a rigorous selection process. As a result, the normal requirements for gate products and independent life cycle reviews are waived, and the emphasis shifts to the gate products and independent life cycle reviews at the end of Phase B.

[17] Program requirements on the project are contained in the Program Plan.

(5) Develop an initial orbital debris assessment in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA-STD-8719.14, *Process for Limiting Orbital Debris*.

(6) Prior to the project independent life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(7) Plan, prepare for, and support the project independent life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

c. Perform project planning, costing, and scheduling activities—

(1) As early as practical, prepare and finalize Phase A work agreements.

(2) Prepare a *preliminary* Project Plan that follows the template in Appendix F. See Table 4-4 for a list of the Control Plans and their required maturity by phase.

Table 4-4 Project Plan Control Plan Maturity Matrix

NPR 7120.5 Project Plan – Control Plans	Pre-Phase A	Phase A	Phase B	Phase C	Phase D	Phase E
	KDP A	KDP B	KDP C	KDP D	KDP E	KDP F
1. Technical, Schedule, and Cost Control Plan		Preliminary	Baseline			
2. Safety and Mission Assurance Plan		Preliminary	Baseline			
3. Risk Management Plan		Preliminary	Baseline			
4. Acquisition Plan		Preliminary	Baseline			
5. Technology Development Plan		Baseline				
6. Systems Engineering Management Plan		Baseline				
7. Software Management Plan		Preliminary	Baseline	Updated		
8. Review Plan		Preliminary	Baseline			
9. Missions Operations Plan			Preliminary	Baseline		
10. Environmental Management Plan		Baseline				
11. Logistics Plan		Preliminary		Baseline		
12. Science Data Management Plan			Preliminary	Baseline		
13. Information and Configuration Management Plan		Preliminary	Baseline			
14. Security Plan		Preliminary	Baseline			
15. Export Control Plan		Preliminary	Baseline			

(3) For contracts requiring Earned Value Management (EVM) (refer to the NASA FAR Supplement), conduct required Integrated Baseline Reviews (IBRs).

(4) For all flight projects, provide a draft Cost Analysis Data Requirement (CADRe) (Parts A, B, C) consistent with the NASA Cost Estimating Handbook (CEH) 60 days prior to the KDP B milestone with a final version 30 days after the KDP event to reflect any decisions from the KDP. This CADRe is based on the SDR/PNAR Management Baseline. (Note: For competed projects, a copy of the winning proposal and concept study report is acceptable.)

(5) Develop and document a *preliminary* Management Baseline for all work to be performed by the project, noting the following:

(i) The project's preliminary Management Baseline is consistent with the NASA standard space flight project WBS (see Appendix G) and has an associated WBS dictionary.

(ii) The project's preliminary Management Baseline includes a preliminary integrated master schedule, preliminary life cycle cost estimate, workforce estimates, and the project's technical baseline/mission concept, all consistent with the program requirements levied on the project.

(iii) The preliminary life cycle cost estimate is based on the project's technical baseline/mission concept and preliminary integrated master schedule.

(iv) The preliminary life cycle cost estimate uses the latest accounting guidance and practices.

(v) The preliminary life cycle cost estimate including UFE, along with confidence level and a cost and risk analysis.

(vi) The preliminary life cycle cost estimate is time-phased by Government Fiscal Year (GFY) to WBS Level 2.

(6) Complete a *preliminary* business case analysis for infrastructure for each proposed project real property infrastructure investment consistent with NPD 8820.2, *Design and Construction of Facilities* and NPR 8820.2, *Facility Project Requirements,* and for the acquisition of new aircraft consistent with NPR 7900.3, *NASA Aircraft Operations Management.*[18]

---

[18] See the *NASA Business Case Guide for Facilities Projects* at http://*www.hq.nasa.gov/office/codej/codejx/Assets/Docs/Case_Guide_4-20-06.pdf*

(7) Work with the appropriate NASA Headquarters offices to initiate the development of MOUs/MOAs with external partners, as needed.

(8) Obtain a planetary protection certification for the mission (if required) in accordance with NPD 8020.7, *Biological Contamination Control for Outbound and Inbound Planetary Spacecraft*, and NPR 8020.12, *Planetary Protection Provisions for Robotic Extraterrestrial Missions.*

(9) Develop a Nuclear Safety Launch Approval Plan (for missions with nuclear materials) in accordance with NPR 8715.3, *NASA General Safety Program Requirements.*

(10) Prepare and finalize work agreements for Phase B.

(11) Prepare for approval by the program manager a list of long-lead procurements that need to be procured in Phase B.

(12) In accordance with NPR 2190.1, *NASA Export Control Program*, support the appropriate NASA export control officials to identify and assess export-controlled technical data that potentially will be provided to foreign partners and the approval requirements for release of that data, all as a part of developing the project's Export Control Plan.

(13) In coordination with the OCFO and in accordance with NPR 9250.1, *Property, Plant, and Equipment and Operating Materials and Supplies* complete the Alternative Future Use Questionnaire (Form NF 1739), Section A, to determine the appropriate accounting treatment of capital assets. Once completed, forward the questionnaire to the OCFO, Property Branch. (Note: The questionnaire can be found in NASA's Electronics Forms Database.)

d. Conduct KDP readiness activities—

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP B. (Note: This does not apply to competed missions.)

4.5 Projects—Phase B

4.5.1 **Purpose:** During Phase B, the project team completes its preliminary design and technology development. These activities are focused toward completing the Project Plan and Preliminary Design Review (PDR)/Non-Advocate Review (NAR). The PDR/NAR process culminates in KDP C. A summary of the required gate products for this phase is provided in Table 4-3.

4.5.2 **Requirements:** During Phase B, the project manager and the project team shall:

a. Support Headquarters- and program-related activities:

(1) Obtain an update to the baseline program requirements on the project.

(2) Complete the environmental planning process as explained in NPR 8580.1, *Implementing the National Environmental Policy Act*, and *Executive Order 12114*. (Note: For certain projects utilizing nuclear power sources, completion of the environmental planning process can be extended, with the approval of the DA, into Phase C, but must be completed by the project CDR.)

(3) In coordination with the program manager, the MDAA, and the NASA HQ Office of External Relations, support the development of external agreements, such as inter-agency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation in reviews, integration and test, and risk management).

(4) Coordinate with the Space Operations Mission Directorate (SOMD) if the project involves space transportation services, space communication and navigation capabilities, or launch services, in compliance with NPD 8610.7, *Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions*, and NPD 8610.12, *Office of Space Operations (OSO) Space Transportation Services for NASA and NASA-Sponsored Payloads*.

b. Perform technical activities:

(1) Implement the *preliminary* Project Plan.

(2) Baseline the system-level requirements and develop the subsystem and lower-level technical requirements leading to the PDR baseline.

(3) Develop a set of system and associated subsystem preliminary designs, including interface definitions, and document this work in a preliminary design report.

(4) As part of baselining the interface control documents, document compliance with NPD *7120.4, NASA Engineering and Program/Project Management Policy*, and/or obtain any necessary waivers or deviations.

(5) Develop and document a baseline mission operations concept.

(6) Complete development of mission-critical or enabling technology, as needed, with demonstrated evidence of required technology qualification (i.e., component and/or breadboard validation in the relevant environment) or execute off-ramps (i.e., substitution of more mature or proven technologies) and document this work in a technology readiness assessment report.

(7) Plan and execute long-lead procurements in accordance with the Acquisition Plan. (Note: Long-lead procurements can be initiated in Phase B only when specifically approved by the MDAA.)

(8) Identify any risk drivers (and proposed mitigation plans for each risk).

(9) Develop a list of descope options.

(10) Develop a *preliminary* orbital debris assessment in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA–STD-8719.14, *Process for Limiting Orbital Debris*.

(11) Develop and document a *preliminary* Missile System Pre-Launch Safety Package (MSPSP) in accordance with NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program* and Air Force Space Command Manual 91-710, *Range Safety User Requirements Manual Volume 3 - Launch Vehicles, Payloads, and Ground Support Systems Requirements.*

(12) Prior to the project life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this NID.

(13) Plan, prepare for, and support the project life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

c. Perform project planning, costing, and scheduling activities—

(1) Complete and obtain approval of the Project Plan that follows the template in Appendix F. See Table 4-4 for a list of the Control Plans and their required maturity by phase.

(2) For contracts requiring EVM (refer to the NASA FAR Supplement), conduct required IBRs.

(3) For all flight projects, provide a draft CADRe (Parts A, B, and C) consistent with the NASA Cost Estimating Handbook 60 days prior to KDP C with a final version 30 days after the event to reflect any changes from the KDP. This CADRe is based on the PDR baseline.)

(4) Prepare and finalize Phase C and D work agreements. (Note: Prior to approval to proceed, Phase C and D contracts' work scope and cost/price can be negotiated but not executed. Once the project has been approved and funding is available, the negotiated contracts can be executed, assuming nothing material has changed.)

(5) Develop, document, and maintain a project Management Baseline for all work performed by the project noting the following:

(i) The project's Management Baseline is consistent with the NASA standard space flight project WBS (see Appendix G) and has an associated WBS dictionary.

(ii) The project's Management Baseline includes the integrated master schedule, baseline life cycle cost estimate, workforce estimates, and the PDR-technical baseline, all consistent with the program requirements levied on the project. For KDP C project baselines are to be based on a joint cost and schedule confidence level consistent with the program confidence level approved by the decision authority.

(iii) The baseline life cycle cost estimate is based on the PDR-technical baseline and integrated master schedule and is expected to include a review of the entire scope of work with a series of in-depth assessments of selected critical work elements of the WBS prior to and following the project's PDR/NAR preceding KDP C. (Note: The CADRe is updated to reflect changes.)

(iv) The baseline life cycle cost estimate uses the latest accounting guidance and practices.

(v) The baseline life cycle cost estimate including UFE, along with the level of confidence estimate provided by a joint cost and schedule confidence level.

(vi) The baseline life cycle cost estimate is time-phased by Government Fiscal Year (GFY) to WBS Level 2.

(6) When an Independent Cost Estimate is required or performed, explain any significant differences with the project's baseline life cycle independent cost estimate (ICE).

(7) Complete a business case analysis for infrastructure for each of the project's proposed real property infrastructure investments consistent with NPD 8820.2, *Design and Construction of Facilities*, and NPR 8820.2, *Facility Project Requirements*, and for the acquisition of new aircraft consistent with NPR 7900.3, *Aircraft Operations Management*.[19] (Note: Business case analyses require the approval of the MDAA and the Assistant Administrator for Infrastructure and Administration, or designee.)

(8) Develop a baseline planetary protection plan (if required) in accordance with NPD 8020.7, *Biological Contamination Control for Outbound and Inbound Planetary Spacecraft*, and NPR 8020.12, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*.

---

[19] See the *NASA Business Case Guide for Facilities Projects* at http://*www.hq.nasa.gov/office/codej/codejx/Assets/Docs/Case_Guide_4-20-06.pdf*

(9) Develop a *preliminary* Range Safety Risk Management Plan in accordance with NPR 8715.5, *Range Safety Program*.

(10) In coordination with the OCFO, complete the Alternative Future Use Questionnaire (Form NF 1739), Section B, to identify the acquisition components of the project and to determine the appropriate accounting treatment of the capital acquisitions within the project. Once completed, forward the questionnaire to the OCFO, Property Branch. (Note: The questionnaire can be found in NASA's Electronics Forms Database.)

d. Conduct KDP readiness activities:

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP C.

4.6 Projects—Phase C

4.6.1 **Purpose:** During Phase C, the project completes the design that meets the detailed requirements and begins fabrication of test and flight article components, assemblies, and subsystems. These activities focus on preparing for the Critical Design Review (CDR) and the System Integration Review (SIR). This phase culminates in KDP D. A summary of the required gate products for this phase is provided in Table 4-3.

4.6.2 **Requirements:** During Phase C, the project manager and the project team shall:

a. Perform technical activities:

(1) Implement the *baseline* Project Plan.

(2) Complete all requisite flight and ground designs/analyses through their respective CDRs in accordance with NPR 7123.1 and document this work in detailed design report(s).

(3) Develop and test all requisite engineering models (brass boards, breadboards, full-up models) sufficiently prior to lower level CDRs to enable test results to affect detailed designs.

(4) Develop requisite system and subsystem test beds needed for qualification and acceptance testing of flight articles.

(5) Following the appropriate lower level CDR, initiate fabrication/procurement of flight article components, assemblies, and/or subsystems.

(6) Initiate the qualification and acceptance testing of flight article components, assemblies, and/or subsystems.

(7) Hold peer reviews, as appropriate, prior to major project reviews in accordance with the Project Review Plan.

(8) Develop a *baseline* orbital debris assessment a minimum of 45 days prior to the project CDR in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA–STD-8719.14, *Process for Limiting Orbital Debris*.

(9) Develop a *preliminary* Operations Handbook that will be used to support the operations team.

(10) Develop and document a *baseline* Missile System Pre-Launch Safety Package (MSPSP) by the project-level CDR in accordance with NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*, and Air Force Space Command Manual 91-710, *Range Safety User Requirements Manual Volume 3 - Launch Vehicles, Payloads, and Ground Support Systems Requirements*.

(11) Prior to the project independent life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(12) Plan, prepare for, and support the project independent life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(13) Following the SIR and/or PRR (unless otherwise directed by the program manager), initiate system assembly and integration and test activities even if KDP D has not occurred.

b. Perform project planning, costing, and scheduling activities:

(1) Provide a draft CADRe (Parts A, B, and C) consistent with the NASA Cost Estimating Handbook 60 days prior to KDP D with a final version 30 days after the event to reflect any changes from the KDP. This CADRe is based on the CDR baseline.

(2) Update work agreements for Phase D.

(3) Maintain the Management Baseline under configuration management with traceability to the KDP C-approved baseline.

(4) Mature preliminary Project Plan Control Plans, as required by Table 4-4.

(5) Develop a *baseline* Range Safety Risk Management Plan in accordance with NPR 8715.5, *Range Safety Program*.

(6) Develop a *preliminary* End of Mission Plan per NPR 8715.6.

c. Implement project cost and schedule control activities:

(1) Implement Earned Value Management (EVM) as documented in the Project Plan.

(2) For contracts requiring EVM (refer to the NASA FAR Supplement), conduct required IBRs.

(3) Provide immediate written notice and a recovery plan to the program manager and the MDAA if the latest Phase C through D Estimate at Completion (EAC) of the project exceeds by 15 percent or more the KDP C-approved Management Baseline cost for Phases C through D. (Note: Since the Management Baseline cost contains project UFE, an EAC exceeding the Management Baseline cost presumes that these UFE will be exhausted.)

(4) Provide immediate written notice and a recovery plan to the program manager and the MDAA if a milestone listed for Phases C and D on the project life cycle chart (Figure 2-4) is estimated to be delayed in excess of six months from the date scheduled in the KDP C-approved Management Baseline.

(5) If the trigger points in (2) or (3) above are breached and upon written notice from the program manager, update the Project Plan per direction received from the program manager.

d. Conduct KDP readiness activities:

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP D.

4.7 Projects—Phase D

4.7.1 **Purpose:** During Phase D, the project performs system assembly, integration, and test. These activities focus on preparing for the Flight Readiness Review (FRR). This phase culminates in KDP E. A summary of the required gate products for this phase is provided in Table 4-3.

4.7.2 **Requirements:** During Phase D, the project manager and the project team shall:

a. Support Headquarters- and program-related activities:

(1) Develop a Mishap Contingency Plan in accordance with NPR 8621.1, *Mishap and Close Call Reporting, Investigating, and Recordkeeping*.

b. Perform technical activities:

(1) Implement the Project Plan.

(2) Initiate system assembly, integration, and test.

(3) As required by NPR 7123.1, execute and document the results of the project's multi-tiered Verification and Validation (V&V) Plan.

(4) Resolve all test, analysis, and inspection discrepancies.

(5) Integrate payload/launch vehicle and test.

(6) Prepare "as-built" and "as-deployed" hardware and software documentation, including "close-out" photographs.

(7) Complete all operational support and other enabling developments (e.g., facilities, equipment, and updated databases), including a *baseline* Operations Handbook to support the operations team.

(8) Conduct operational tests and training, including normal and anomalous scenarios.

(9) Prior to the project independent life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(10) Plan, prepare for, and support the project independent life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(11) Establish and maintain an integrated logistics support (ILS) capability, including spares, ground support equipment, and system maintenance and operating procedures, in accordance with the project's Logistics Plan.

(12) Forty-five (45) days prior to delivery of the spacecraft to the launch facility, update the Missile System Pre-Launch Safety Package (MSPSP) in accordance with NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*, and Air Force Space Command Manual 91-710, *Range Safety User Requirements Manual Volume 3 - Launch Vehicles, Payloads, and Ground Support Systems Requirements*. Launch and perform system checkout. (Note: The checkout period is specified in the Project Plan.)

(13) Develop a final orbital debris assessment and a pre-launch End-of-Mission Plan a minimum of 30 days prior to the project Safety and Mission Success (SMSR) review in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA–STD-8719.14, *Process for Limiting Orbital Debris.*

c. Perform project planning, costing, and scheduling activities:

(1) Implement Earned Value Management (EVM) as documented in the Project Plan.

(2) For contracts requiring EVM (refer to the NASA FAR Supplement), conduct required IBRs.

(3) Prepare and finalize work agreements for Phase E.

d. Implement project cost and schedule control activities:

(1) Provide immediate written notice and a recovery plan to the program manager and the MDAA if the latest Phase C through D Estimate at Completion (EAC) of the project exceeds by 15 percent or more the KDP C-approved Management Baseline cost for Phases C through D. (Note: Since the Management Baseline cost contains project UFE, an EAC exceeding the Management Baseline cost presumes that these UFE will be exhausted.)

(2) Provide immediate written notice and a recovery plan to the program manager and the MDAA if a milestone listed for Phases C and D on the project life cycle chart (Figure 2-4) is estimated to be delayed in excess of 6 months from the date scheduled in the KDP C-approved Management Baseline.

(3) If the trigger points in (1) or (2) above are breached and upon written notice from the program manager, update the Project Plan per direction received from the program manager.

e. Conduct KDP readiness activities:

(1) Obtain approved launch approval documents.

(2) Obtain KDP readiness products as shown in Table 4-3.

(3) Plan, prepare for, and support the governing PMC review prior to KDP E.

4.8 Projects—Phase E

4.8.1 **Purpose:** During Phase E, the project implements the Missions Operations Plan developed in previous phases. This phase culminates in KDP F. A summary of the required gate products for this phase is provided in Table 4-3.

4.8.2 **Requirements:** During Phase E, the project manager and the project team shall:

a. Perform technical activities:

(1) Implement the Project Plan.

(2) Execute the mission in accordance with the Mission Operations Plan and document this work in a Mission Report.

(3) Prior to the project life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(4) Plan, prepare for, and support the project life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(5) Monitor system incidents, problems, and anomalies, as well as system margins to ensure that deployed project systems function as intended, and investigate system behavior that is observed to exceed established operational boundaries or expected trends, and implement corrective actions, as necessary.

(6) Provide sustaining engineering, as appropriate, to the mission to enhance efficiency, safety, and accommodate obsolescence.

(7) Monitor for potential conjunctions with other space objects in accordance with paragraph 3.4 of NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris*.

(8) Develop a final End-of-Mission Plan a minimum of 6 months prior to the system decommissioning/disposal in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA–STD-8719.14, *Process for Limiting Orbital Debris*.

(9) Capture and archive mission results, including engineering data on system and subsystem performance, in an MDAA-approved data depository.

b. Perform project planning, costing, and scheduling activities:

(1) For all flight projects, provide an *updated* CADRe (Parts A, B, and C) consistent with the NASA Cost Estimating Handbook within 60 days after the completion of spacecraft post-launch checkout. This CADRe is based on the "as built" launched baseline.

(2) As directed by the program manager, support the development of Project Plan revisions to continue the mission into extended operations beyond the primary mission phase or beyond any extension previously included in the plan.

(3) Prepare and document a *baseline* Systems Decommissioning/Disposal Plan.

(4) Prepare or update work agreements for Phase F.

c. Conduct KDP readiness activities:

(1) Obtain KDP readiness products as shown in Table 4-3.

(2) Plan, prepare for, and support the governing PMC review prior to KDP F.

4.9 Projects—Phase F

4.9.1 **Purpose:** During Phase F, the project implements the Systems Decommissioning/ Disposal Plan developed in Phase E, and performs analyses of the returned data and any returned samples.

4.9.2 **Requirements:** During Phase F, the project manager and the project team shall:

a. Perform technical activities:

(1) Complete analysis and archiving of mission and science data and curation of any returned samples, as well as archiving of project engineering and technical management data and documentation, and lessons learned in accordance with agreements, the Project Plan and Program Plan, and Center and Agency policies.

(2) Prior to the project life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(3) Plan, prepare for, and support the project life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

(4) Implement the Systems Decommissioning/Disposal Plan and safely dispose of project systems.

b. Provide a final CADRe (Parts A, B, and C) consistent with the NASA Cost Estimating Handbook within 60 days after End of Planned Mission.

APPENDIX A Definitions

Acceptable Risk. The risk that is understood and agreed to by the program/project, governing PMC, Mission Directorate, and other customer(s) such that no further specific mitigating action is required. (Some mitigating actions might have already occurred.)

Acquisition. The process for obtaining the systems, research, services, construction, and supplies that NASA needs to fulfill its missions. Acquisition--which may include procurement (contracting for products and services)--begins with an idea or proposal that aligns with the NASA Strategic Plan and fulfills an identified need and ends with the completion of the program or project or the final disposition of the product or service.

Acquisition Strategy Meeting. A forum where senior Agency management reviews major acquisitions in programs, projects, or activities before authorizing budget expenditures. The ASM is held at the Mission Directorate/Mission Support Office level, implementing the decisions that flow out of the ASP meeting and recommending implementation plans for approval.

Acquisition Strategy Planning Meeting. A forum that provides an early view of potential major acquisitions so that senior leaders can consider issues such as the appropriate application of new Agency and Administration initiatives, current portfolio risk and implications to the future portfolio, high-level make-or-buy strategy, and the placement of development or operations work in-house versus out-of-house. It also provides the strategic framework for addressing challenges associated with fully utilizing NASA Centers' capabilities, including workforce and infrastructure, and shaping the Agency over time.

Agency Program Management Council (Agency PMC). The senior management group, chaired by the NASA Associate Administrator or designee, responsible for reviewing formulation performance, recommending approval, and overseeing implementation of programs and Category 1 projects according to Agency commitments, priorities, and policies.

Agreement. The statement (oral or written) of an exchange of promises. Parties to a binding agreement can be held accountable for its proper execution and a change to the agreement requires a mutual modification or amendment to the agreement or a new agreement.

Aircraft Operations. A mission support organization function that provides both manned and unmanned aircraft, whether U.S. Government owned or chartered, leased, or rented to accomplish work for NASA.

Analysis of Alternatives. A formal analysis method that compares alternative approaches by estimating their ability to satisfy mission requirements through an effectiveness analysis and by estimating their life cycle costs through a cost analysis. The results of these two analyses are used together to produce a cost-effectiveness comparison that allows decision-makers to assess the relative value or potential programmatic returns of the alternatives. An AoA broadly examines multiple elements of program/ project alternatives (including technical performance, risk, LCC, and programmatic aspects).

Approval (for Implementation). The acknowledgment by the decision authority that the program/project has met stakeholder expectations and formulation requirements, and is ready to proceed to implementation. By approving a program/project, the decision authority commits the budget resources necessary to continue into implementation. Approval (for Implementation) must be documented.

Approval. Authorization by a required management official to proceed with a proposed course of action. Approvals must be documented.

Architectural Control Document. A configuration-controlled document or series of documents that embodies an Agency mission architecture(s), including the structure, relationships, principles, assumptions, and results of the analysis of alternatives that govern the design of the enabling mission systems.

Baseline (general context). An agreed-to set of requirements, cost, schedule, designs, documents, etc. that will have changes controlled through a formal approval and monitoring process.

Baseline (document context). Implies the expectation of a finished product, though updates may be needed as circumstances warrant. All approvals required by Center policies and procedures have been obtained.

Baseline Science Requirements. The mission performance requirements necessary to achieve the full science objectives of the mission. (Also see Threshold Science Requirements.)

Budget. A detailed statement of anticipated revenues and expenditures for a specified period of time with information on the purposes for which the funds will be used.

Center Management Council. The council at a Center that performs oversight of programs and projects by evaluating all program and project work executed at that Center.

Change Request. A change to a prescribed requirement in an Agency or Center document that is recommended for all programs and projects for all time.

Component Facilities. Complexes that are geographically separated from the NASA Center or institution to which they are assigned.

Commitment Baseline. Establishes and documents an integrated set of project requirements, cost, schedule, technical content, and an agreed-to JCL that forms the basis for NASA's commitment with the external entities of OMB and Congress. Only one official baseline exists for a NASA program or project and it is the Commitment Baseline.

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

Configuration Management. A management discipline applied over the product's life cycle to provide visibility into and to control changes to performance, functional, and physical characteristics.

Conflict of Interest. A conflict of interest involves the abuse—actual, apparent, or potential—of the trust that NASA has in its personnel. A conflict of interest is a situation in which financial or other personal considerations have the potential to compromise or bias professional judgment and objectivity. An apparent conflict of interest is one in which a reasonable person would think that the individual's judgment is likely to be compromised. A potential conflict of interest involves a situation that may develop into an actual conflict of interest. A conflict of interest exists whether or not decisions are affected by a personal interest; a conflict of interest implies only the potential for bias, not likelihood.

Continuous Risk Management. A systematic and iterative process that efficiently identifies, analyzes, plans, tracks, controls, communicates, and documents risks associated with implementation of designs, plans, and processes.

Contract. A mutually binding legal relationship obligating the seller to furnish the supplies or services (including construction) and the buyer to pay for them. It includes all types of commitments that obligate the Government to an expenditure of appropriated funds and that, except as otherwise authorized, are in writing. In addition to bilateral instruments, contracts include (but are not limited to) awards and notices of awards; job orders or task letters issued under basic ordering agreements; letter contracts; orders, such as purchase orders, under which the contract becomes effective by written acceptance or performance; and bilateral contract modifications. Contracts do not include grants and cooperative agreements.

Convening Authority. The management official(s) responsible for convening a program/project review, establishing the Terms of Reference, including review objectives and success criteria, appointing the SRB chair, concurring in SRB membership, and receiving documented results of the review.

Cost Analysis Data Requirement. A formal document designed to help managers understand the cost and cost risk of space flight projects. The CADRe consists of a Part A "Narrative" and a Part B "Technical Data" in tabular form, both provided by the program/project to the ICE team. A "Project Life Cycle Cost Estimate," produced by the project team, is appended as Part C, but the ICE team does not see Part C until it has produced its own independent estimate.

Decision Authority. The Agency's responsible individual who authorizes the transition of a program/project to the next life cycle phase.

Decommissioning Review. 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.

Derived Requirements. Arise from constraints, consideration of issues implied but not explicitly stated in the high-level direction provided by NASA Headquarters and Center institutional requirements, factors introduced by the selected architecture, and the design. These requirements are finalized through requirements analysis as part of the overall systems engineering process and become part of the program/project requirements baseline. They are established by and are the responsibility of the Programmatic Authority

Design Report. A document or series of documents that captures and communicates to others specific technical aspects of a design. It may include images, tabular data, graphs, and other

descriptive material. A design report is different from the CADRe, though parts of a design report may be repeated in the latter.

Development Costs. The total of all costs, from the period beginning with the approval to proceed to implementation through the achievement of operational readiness

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

Dissenting Opinion. A Dissenting Opinion is a disagreement with a decision or action that is based on a sound rationale (not on unyielding opposition) that an individual judges is of sufficient importance that it warrants a specific review and decision by higher level management, and the individual specifically requests that the dissent be recorded and resolved by the Dissenting Opinion process.

Earned Value Management. A tool for measuring and assessing project performance through the integration of technical scope with schedule and cost objectives during the execution of the project. EVM provides quantification of technical progress, enabling management to gain insight into project status and project completion costs and schedules. Two essential characteristics of successful EVM are EVM system data integrity and carefully targeted monthly EVM data analyses (i.e., risky WBS elements).

Engineering Requirements. Requirements defined to achieve programmatic requirements and relating to the application of engineering principles, applied science, or industrial techniques.

Environmental Impact. The direct, indirect, or cumulative beneficial or adverse effect of an action on the environment.

Environmental Management. The activity of ensuring that program and project actions and decisions that potentially impact or damage the environment are assessed/evaluated during the formulation/planning phase and reevaluated throughout implementation. This activity must be performed according to all NASA policy and Federal, state, and local environmental laws and regulations.

Evaluation. The continual self evaluation and independent assessment of the performance of a program or project and incorporation of the evaluation findings to ensure adequacy of planning and execution according to plans.

Final (Document Context). Implies the expectation of a finished product. All approvals required by Center policies and procedures have been obtained.

Formulation. The identification of how the program or project supports the Agency's strategic needs, goals, and objectives; the assessment of feasibility, technology and concepts; risk assessment, team building, development of operations concepts and acquisition strategies; establishment of high-level requirements and success criteria; the preparation of plans, budgets, and schedules essential to the success of a program or project; and the establishment of control systems to ensure performance to those plans and alignment with current Agency strategies.

Formulation Authorization Document. The document issued by the MDAA (or MSOD) to authorize the formulation of a program whose goals will fulfill part of the Agency's Strategic Plan, Mission Directorate Strategies, or Mission Support Office Functional Leadership Plans. In addition, a FAD or equivalent is used to authorize the formulation of a project.

Funding (Budget Authority). The authority to incur financial obligations that will result in outlays. Authority is delegated through the formal funds distribution process.

Health and Medical Requirements. Requirements defined by the Office of the Chief Health and Medical Officer.

Implementation. The execution of approved plans for the development and operation of the program/project, and the use of control systems to ensure performance to approved plans and continued alignment with the Agency's strategic needs, goals, and objectives.

Independent Assessment(s) (includes reviews, evaluations, audits, analysis oversight, investigations). Assessments are independent to the extent the involved personnel apply their expertise impartially, without any conflict of interest or inappropriate interference or influence, particularly from the organization(s) being assessed.

Independent Cost Analysis. An independent analysis of program/project resources (including budget) and financial management associated with the program/project content over the program's budget horizon, conducted by an impartial body independent from the management or advocacy chain of the program/project. ICA includes, but is not limited to, the assessment of cost estimates, budgets, and schedules in relation to a program/project and a program's constituent projects' technical content, performance, and risk. ICAs may include Independent Cost Estimates (ICE), assessment of resource management, distribution and planning, and verification of cost-estimating methodologies. (ICAs are not life cycle cost estimates but are assessments of the adequacy of the budget and management practices to accomplish the work scope through the budget horizon; as such, ICAs can be performed for programs/projects when a life cycle ICE is not warranted.)

Independent Cost Estimate. An independent program/project cost estimate prepared by an office or other entity that is not under the supervision, direction, advocacy, or control of the program/project (or its chain of command) that is responsible for carrying out the development or acquisition of the program/project. An ICE is bounded by the program/project scope (total life cycle through all phases), schedule, technical content, risk, ground rules, and assumptions and is conducted with objectivity and the preservation of integrity of the cost estimate. ICEs are generally developed using parametric approaches that are tailored to reflect the design, development state, difficulty, and expertise of team members.

Information Technology. Any equipment, or interconnected system(s) of subsystem(s) of equipment, that is used in the automatic acquisition, storage, analysis, evaluation, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the Agency.

Infrastructure Requirements. The facilities, environmental, aircraft, personal property, equipment, and information technology resources that are needed to support programs and

projects. Utilization of the capability afforded by the infrastructure includes consideration of the maintenance and other liabilities it presents.

In-House Project. One that is conducted onsite or in the immediate vicinity of a NASA Center in which most major technical, business, and management tasks are performed primarily by the Center's civil service workforce.

Institutional Authority. Institutional Authority includes the Headquarters and Center organizations, including the Technical Authorities (Engineering, Safety and Mission Assurance, and Health and Medical), and the Mission Support Authorities (made up of all of the remaining Mission Support Offices, including the Chief Financial Officer and associated Center Chief Financial Officers). Individuals in these organizations are the official voices for their respective areas of responsibility. Institutional Authority sets, oversees, and ensures conformance to applicable institutional requirements.

Institutional Requirements. Requirements that focus on how NASA does business that are independent of the particular program or project. There are five types: engineering, program/project management, safety and mission assurance, health and medical and Mission Support Office functional requirements.

Integrated Baseline Review. A joint assessment by the offeror/contractor and the Government to verify the technical content and the realism of the related performance budgets, resources, and schedules. It should provide a mutual understanding of the inherent risks in offerors'/contractors' performance plans and the underlying management control systems, and it should formulate a plan to handle these risks.

Integrated Master Schedule. An integrated set of schedule data that reflects the total project scope of work as discrete and measurable tasks/milestones that are time-phased through the use of task durations, interdependencies, and date constraints and is traceable to the WBS.

Joint Cost and Schedule Confidence Level. (1) The probability that cost will be equal to or less than the targeted cost AND schedule will be equal to or less than the targeted schedule date. (2) A process and product that helps inform management of the likelihood of a project's programmatic success. (3) A process that combines a project's cost, schedule, and risk into a complete picture. JCL is not a specific methodology (e.g., resource-loaded schedule) or a product from a specific tool (e.g., @RISK).

Key Decision Point. The event at which the decision authority determines the readiness of a program/project to progress to the next phase of the life cycle (or to the next KDP).

Life Cycle Cost. The total of the direct, indirect, recurring, nonrecurring, and other related expenses incurred, or estimated to be incurred, in the design, development, verification, production, operation, maintenance, support, and disposal of a project. The LCC of a project or system can also be defined as the total cost of ownership over the project or system's life cycle from formulation through implementation. It includes all design, development, deployment, operation and maintenance, and disposal costs.

Logistics. The management, engineering activities, and analysis associated with design requirements definition, material procurement and distribution, maintenance, supply replacement, transportation, and disposal that are identified by space flight and ground systems supportability objectives.

Management Baseline. The integrated set of requirements, cost, schedule, technical content, and associated JCL that forms the foundation for program/project execution and reporting done as part of NASA's performance assessment and governance process.

Margin. The allowances carried in budget, projected schedules, and technical performance parameters (e.g., weight, power, or memory) to account for uncertainties and risks. Margins are allocated in the formulation process, based on assessments of risks, and are typically consumed as the program/project proceeds through the life cycle.

Metric. A measurement taken over a period of time that communicates vital information about the status or performance of a system, process, or activity. A metric should drive appropriate action.

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

Mission Directorate Program Management Council. The senior management group, chaired by an MDAA or designee, responsible for reviewing project formulation performance, recommending approval, and overseeing implementation of Category 2 and 3 projects according to Agency commitments, priorities, and policies.

Mission Support Office Requirements. Requirements defined by Mission Support Offices (e.g., procurement and medical).

Non-Advocate Review. The analysis of a proposed program or project by a (non-advocate) team composed of management, technical, and resources experts (personnel) from outside the advocacy chain of the proposed program or project. It provides Agency management with an independent assessment of the readiness of the program/project to proceed into implementation.

Non-Applicable Requirement. Not relevant, not capable of being applied

Preliminary (document context). Implies that the product has received initial review in accordance with Center best practices. The content is considered correct, though some TBDs may remain. All approvals required by Center policies and procedures have been obtained. Major changes are expected.

Prescribed Requirement. A requirement levied on a lower organizational level by a higher organizational level.

Principal Investigator. A person who conceives an investigation and is responsible for carrying it out and reporting its results. In some cases, PIs from industry and academia act as project managers for smaller development efforts with NASA personnel providing oversight.

Primary Risks. Those undesirable events having both high probability and high impact/severity.

Procurement Strategy Meeting. A forum where management reviews and approves the approach for the Agency's major and other selected procurements. Chaired by the Assistant Administrator for Procurement (or designee), the PSM addresses and documents information, activities, and decisions required by the FAR and NFS and incorporates NASA strategic guidance and decisions from the ASP and ASM strategic procurement meetings to insure the alignment of the individual procurement action with NASA's portfolio and mission.

Program. A strategic investment by a Mission Directorate or Mission Support Office that has a defined architecture and/or technical approach, requirements, funding level, and a management structure that initiates and directs one or more projects. A program defines a strategic direction that the Agency has identified as critical.

Program Commitment Agreement. The contract between the Associate Administrator and the responsible MDAA that authorizes transition from formulation to implementation of a program.

Program Plan. The document that establishes the program's baseline for implementation, signed by the MDAA, Center Director(s), and program manager.

Program (Project) Team. All participants in program (project) formulation and implementation. This includes all direct reports and others that support meeting program (project) responsibilities.

Programmatic Authority. Programmatic Authority includes of the Mission Directorates and their respective program and project managers. Individuals in these organizations are the official voices for their respective areas. Programmatic Authority sets, oversees, and ensures conformance to applicable programmatic requirements.

Programmatic Requirements. Requirements set by the Mission Directorate, program, project, and PI, if applicable. These include strategic scientific and exploration requirements, system performance requirements, and schedule, cost, and similar non-technical constraints.

Program/Project Management Requirements. Requirements that focus on how NASA and Centers perform program and project management activities.

Project. A specific investment identified in a Program Plan having defined requirements, a life cycle cost, a beginning, and an end. A project yields new or revised products and services that directly address NASA's strategic needs. A project also has a management structure and may have interfaces to other projects, agencies, and international partners. (See Section 2.1.2.)

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

Rebaselining. The process by which a program/project updates or modifies the Commitment Baseline. Rebaselining occurs as a result of drivers which are either internal or external to the Agency.

Reimbursable Program/Project. A program/project executed at a NASA Center for a sponsor other than NASA.

Replanning. The process by which a program or project updates or modifies the Management Baseline.

Reserves. Obsolete term. See Unallocated Future Expenses.

Restricted Information. Information that is not available to the public, such as information developed at private expense embodying trade secrets or comprising commercial or financial information that is privileged or confidential; information determined by NASA to be restricted, such as U.S. Government Sensitive But Unclassified (SBU) information as defined in NPR 1600.1; and "contractor bid or proposal information" or "source selection information" as defined in the FAR.

Risk. The combination of the probability that a program or project will experience an undesired event and the consequences, impact, or severity of the undesired event, were it to occur. The undesired event may come from technical or programmatic sources (e.g., a cost overrun, schedule slippage, safety mishap, health problem, malicious activities, environmental impact, failure to achieve a needed scientific or technological objective, or success criterion). Both the probability and consequences may have associated uncertainties.

Risk Assessment. An evaluation of a risk item that determines (1) what can go wrong, (2) how likely is it to occur, (3) what the consequences are, and (4) what are the uncertainties associated with the likelihood and consequences.

Risk-Based Acquisition Management. The integration of risk management into the NASA acquisition process.

Risk-Informed Decision Making. A risk-informed decision-making process uses a diverse set of performance measures (some of which are model-based risk metrics) along with other considerations within a deliberative process to inform decision making.

Risk Management. Risk management includes risk-informed decision making and continuous risk management in an integrated framework. This is done in order to foster proactive risk management, to better inform decision making through better use of risk information, and then to more effectively manage implementation risks by focusing the CRM process on the baseline performance requirements emerging from the RIDM process. (See NPR 8000.4, *Agency Risk Management Procedural Requirements*).

Safety. Freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment.

Safety and Mission Assurance Requirements. Requirements defined by the SMA organization related to safety and mission assurance.

Security. Protection of people, property, and information assets owned by NASA, which covers physical assets, personnel, IT, communications, and operations.

Segment (of a Program)**.** A major program segment represents a part of a program that may build on earlier parts but when accomplished could be considered a completed mission (e.g., Constellation—establishing full ISS capability, lunar exploration, etc.)

Signature. A distinctive mark, characteristic, or thing that indicates identity; one's name as written by oneself.**Stakeholder.** An individual or organization outside a specific program or project having an interest (or stake) in the outcome or deliverable of a program or project.

Standards. NASA Standards are formal documents that establish a norm, requirement, or basis for comparison, a reference point to measure or evaluate against. A technical standard, for example, establishes uniform engineering or technical criteria, methods, processes, and practices.

Standing Review Board. The board responsible for conducting independent reviews (life cycle and special) of a program/project and providing objective, expert judgments to the convening authorities. The reviews are conducted in accordance with approved Terms of Reference (ToR) and life cycle requirements per NPR 7120.5 and NPR 7123.1.

Success Criteria. That portion of the top-level requirements that defines what must be achieved to successfully satisfy NASA Strategic Plan objectives addressed by the program or project.

System. The combination of elements that function together to produce the capability required to meet a need. The elements include all hardware, software, equipment, facilities, personnel, processes, and procedures needed for this purpose.

Systems Engineering. A disciplined approach for the definition, implementation, integration, and operation of a system (product or service). The emphasis is on achieving stakeholder functional, physical, and operational performance requirements in the intended use environments over its planned life within cost and schedule constraints. Systems engineering includes the engineering processes and technical management processes that consider the interface relationships across all elements of the system, other systems, or as a part of a larger system.

Tailoring. The process used to adjust or seek relief from a prescribed requirement to accommodate the needs of a specific task or activity (e.g., program or project). The tailoring process results in the generation of deviations and waivers depending on the timing of the request.

Technical Authority. Technical Authorities are part of NASA's system of checks and balances and provide independent oversight of programs and projects in support of safety and mission success through the selection of individuals at delegated levels of authority. These individuals are the Technical Authorities. Technical Authority delegations are formal and traceable to the Administrator. Individuals with Technical Authority are funded independently of a program or project.

Technical Authority Requirements. Requirements invoked by OCE, OSMA, and OCHMO documents (e.g., NPRs or standards specified as NASA core or mandatory standards) or contained in Center institutional documents. These requirements are the responsibility of the office or organization that established the requirement unless delegated elsewhere.

Technical Standards. NASA documents that contain common and repeated use of rules, conditions, guidelines, or characteristics for products or related processes and production methods and related management systems practices.

Termination Review. A review initiated by the decision authority for the purpose of securing a recommendation as to whether to continue or terminate a program or project. Failing to stay within the parameters or levels specified in controlling documents will result in consideration of a termination review.

Terms of Reference. A document specifying the nature, scope, schedule, and ground rules for an independent review or independent assessment.

Threshold Science Requirements. The mission performance requirements necessary to achieve the minimum science acceptable for the investment. In some AOs used for competed missions, threshold science requirements may be called the "science floor" for the mission. (Also see Baseline Science Requirements.)

Unallocated Future Expenses. The portion of estimated cost required to meet specified JCL that cannot yet be allocated to the specific project WBS sub-elements because the estimate includes probabilistic risks and specific needs that are not known until these risks are realized.

Validation. Proof that the product accomplishes the intended purpose based on stakeholder expectations. May be determined by a combination of test, analysis, demonstration, and inspection.

Verification. Proof of compliance with design solution specifications and descriptive documents. May be determined by a combination of test, analysis, demonstration, and inspection.

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

Work Agreement. The Center form (or equivalent), prepared for each program/project cost account and used to document agreements and commitments for the work to be performed, including scope of work, receivables/deliverables, schedule, budget, and assumptions.

Work Breakdown Structure. A product-oriented hierarchical division of the hardware, software, services, and data required to produce the program/project's end product(s), structured according to the way the work will be performed, and reflective of the way in which program/project costs, schedule, technical and risk data are to be accumulated, summarized, and reported.

APPENDIX B Acronyms

AA	Associate Administrator
ACD	Architectural Control Document
AO	Announcement of Opportunity
AoA	Analysis of Alternatives
ASM	Acquisition Strategy Meeting
ASP	Acquisition Strategy Planning
ATD	Advanced Technology Development
B&AR	Basic and Applied Research
CADRe	Cost Analysis Data Requirement
CAIB	Columbia Accident Investigation Board
CD	Center Director
CDR	Critical Design Review
CE	Chief Engineer
CERR	Critical Events Readiness Review
CFO	Chief Financial Officer
CHMO	Chief Health and Medical Officer
CM	Configuration Management
CMC	Center Management Council
CPD	Center Policy Directive
CPR	Center Procedural Requirements (also Contract Performance Report)
CRM	Continuous Risk Management
CSMA	Chief Safety and Mission Assurance
DA	Decision authority (also Deputy Administrator)
DR	Decommissioning Review
EAC	Estimate at Completion
EMO	Environmental Management Office
EPO	Education and Public Outreach
EVM	Earned Value Management
EVMS	Earned Value Management System
FAD	Formulation Authorization Document
FAR	Federal Acquisition Regulation
FRR	Flight Readiness Review
FTE	Full-Time Equivalent
GDS	Ground Data System
GFE	Government Furnished Equipment
GFY	Government Fiscal Year
GSE	Ground Support Equipment
HMA	Health and Medical Authority
IBPD	Integrated Budget and Performance Document
IBR	Integrated Baseline Review
ICA	Independent Cost Analysis

ICE	Independent Cost Estimate
ILS	Integrated Logistics Support
IMS	Integrated Master Schedule
IPAO	Independent Program Assessment Office
ISS	International Space Station
IT	Information Technology
JCL	Joint Cost and Schedule Confidence Level
JPL	Jet Propulsion Laboratory
KDP	Key Decision Point
LCC	Life Cycle Cost
LDE	Lead Discipline Engineer
LRR	Launch Readiness Review
MCR	Mission Concept Review
MD	Mission Directorate
MDAA	Mission Directorate Associate Administrator
MDM	Meta-Data Manager
MDPMC	Mission Directorate Program Management Council
MDR	Mission Definition Review
MMT	Mission Management Team
MO&DA	Mission Operations and Data Analysis
MOA	Memorandum of Agreement
MOS	Mission Operations System
MOU	Memorandum of Understanding
MSO	Mission Support Office
MSOD	Mission Support Office Director
MSPSP	Missile System Pre-Launch Safety Package
NAR	Non-Advocate Review
NEPA	National Environmental Policy Act
NESC	NASA Engineering and Safety Center
NFS	NASA Federal Acquisition Regulation (FAR) Supplement
NGO	Needs, Goals, and Objectives
NID	NASA Interim Directive
NOA	New Obligational Authority
NODIS	NASA On-Line Directives Information System
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
OCE	Office of the Chief Engineer
OCFO	Office of the Chief Financial Officer
OCHMO	Office of the Chief Health and Medical Officer
OER	Office of External Relations
OMB	Office of Management and Budget (Executive Office of the White House)
ORR	Operational Readiness Review
OSMA	Office of Safety and Mission Assurance

OSTP	Office of Science and Technology Policy (Executive Office of the White House)
PA&E	Program Analysis and Evaluation
PA&R	Programmatic Audit and Review
PAO	Public Affairs Office
PAR	Program Approval Review
PCA	Program Commitment Agreement
PCE	Program (or Project) Chief Engineer
PDR	Preliminary Design Review
PFAR	Post-Flight Assessment Review
PI	Principal Investigator
PIR	Program Implementation Review
PLAR	Post-Launch Assessment Review
PMC	Program Management Council
PNAR	Preliminary Non-Advocate Review
POP	Program Operating Plan
PPAR	Preliminary Program Approval Review
PP&E	Property, Plant, and Equipment
P/SDR	Program/System Definition Review
PRR	Production Readiness Review
PSM	Procurement Strategy Meeting
PSR	Program Status Review
P/SRR	Program/System Requirements Review
QSR	Quarterly Status Report
RFA	Request for Action
RFP	Request for Proposal
RID	Review Item Discrepancy
RIDM	Risk-Informed Decision Making
ROM	Rough Order-of-Magnitude
RM	Review Manager
SAR	System Acceptance Review
SDR	System Definition Review
SEMP	Systems Engineering Management Plan
SIR	System Integration Review
SMA	Safety and Mission Assurance
SMO	Systems Management Office
SMSR	Safety and Mission Success Review
SOMD	Space Operations Mission Directorate
SRB	Standing Review Board
SRR	System Requirements Review
STEM	Science, Technology, Engineering, and Mathematics
TA	Technical Authority
TBD	To Be Determined
ToR	Terms of Reference

UFE	Unallocated Future Expense
V&V	Verification and Validation
WBS	Work Breakdown Structure

APPENDIX C Formulation Authorization Document Template

C.1 Program FAD Title Page

Program
Formulation Authorization Document

(Provide a title for the candidate program and designate a short title or proposed acronym in parenthesis, if appropriate.)

_____ _____
Mission Directorate Associate Administrator Date

Figure C-1 Program Formulation Authorization Document Title Page

C.2 Project FAD Title Page

Project
Formulation Authorization Document

(Provide a title for the candidate project and designate a short title or proposed acronym in parenthesis, if appropriate.)

_____ _____
Mission Directorate Associate Administrator Date

_____ _____
Program Manager Date

Figure C-2 Project Formulation Authorization Document Title Page

C.3 Program/Project FAD Template

PROGRAM/PROJECT
FORMULATION AUTHORIZATION DOCUMENT
(PROGRAM/PROJECT TITLE)

1.0 PURPOSE

Describe the purpose of the program/project. The program/project purpose must have clear traceability from the goals and objectives in the Mission Directorate Strategies or Program Plan (as applicable). This need is independent of any particular technological solution and is stated in terms of functional capabilities.

2.0 AUTHORITY

Describe the NASA organizational structure for managing the formulation process from the MDAA to the NASA Center program/project managers, as applicable. Include lines of authority, coordination, and reporting.

3.0 PROGRAM / PROJECT GOALS AND OBJECTIVES

Describe the level or scope of work, goals, and objectives to be accomplished in the formulation phase, formulation cost targets and constraints, the time available, and any other constraints.

4.0 INTERNAL PARTICIPANTS

Identify Mission Directorates, Mission Support Offices, and Centers to be involved in the activity, their scope of work, and any known constraints related to their efforts (e.g., the program/project must be co-funded by a different Mission Directorate).

5.0 EXTERNAL PARTICIPANTS

Identify participation external to NASA to be involved in the activity, their scope of work, and any known constraints related to their efforts (e.g., the program/project must be co-funded by the external participant).

6.0 FUNDING

Identify, by fiscal year, the funding that will be committed for formulation.

7.0 REVIEWS

Describe the reviews according to the space flight program and project reviews tables in Chapter 2, required during the formulation phase.

APPENDIX D Program Commitment Agreement Template

D.1 PCA Title Page

Program Commitment Agreement

(Provide a title for the candidate program and designate a short title or proposed acronym in parenthesis, if appropriate.)
It is the responsibility of each of the signing parties to notify the other in the event that a commitment cannot be met and to initiate the timely renegotiations of the terms of this agreement.

_____ _____
Mission Directorate Associate Administrator Date

_____ _____
Associate Administrator Date

Figure D-1 Program Commitment Agreement Title Page

D.2 PCA Template

PROGRAM COMMITMENT AGREEMENT
(PROGRAM TITLE)

1.0 PROGRAM OBJECTIVES

Identify the broad program objectives. Describe the program's relationship to Mission Directorate goals, and objectives as documented in the Directorate's plan. Convey the public good of the program to the taxpayer, stated in a way that can be understood by the average citizen.

2.0 PROGRAM OVERVIEW

Describe the strategy to achieve the above-mentioned objectives. Relationships with external organizations, other agencies, or international partners should be addressed if achievement of the program objectives is dependent on their performance. Identify the associated projects to be included in the program as of the writing date. Specify the type of program (i.e., single-project, uncoupled, loosely coupled, or tightly coupled) and the basis for that classification.

3.0 PROGRAM AUTHORITY

Describe the NASA organizational structure for managing the program and projects from the MDAA to the NASA Center project managers. Include lines of authority and reporting, Center(s) responsibilities, the governing PMC(s) for the oversight of the program and its known projects, and the approving official for new projects. Identify any delegated decision authority, per Section 2.4 of this NID.

4.0 TECHNICAL PERFORMANCE COMMITMENT

Summarize the technical performance requirements, identifying baselines and thresholds needed to achieve the program objectives, as applicable. If the objectives include a technical performance target (goal) in addition to a threshold requirement, the commitment could be stated as a range. Demonstrate traceability to Agency needs, goals, and objectives and Agency requirements.

5.0 SCHEDULE COMMITMENT

Identify the following key target milestones for each project in the program, such as:

1. Start of formulation.
2. Target date or timeframe for the SDR or MDR/PNAR.
3. Target date or timeframe for the PDR/NAR or the start of implementation.
4. Start of operations.
5. End of prime operations and/or disposal, if applicable.

6. Other milestones or time periods as appropriate for a specific program/project.

6.0 COST COMMITMENT

Provide the estimated cost range for the program for the ten-year period beginning in the current fiscal year at a level of detail that identifies the approved individual projects. Identify the constraints and assumptions used to develop this estimated cost range and specifically identify those assumptions that drive the range. This cost range should contain all costs necessary to perform the program, including, but not limited to, customary project activities, required technology developments, facilities costs, launch vehicles, tracking, operations and sustainment, data analysis, and disposal. Reference the annual budget contained in the Integrated Budget and Performance Document (IBPD) for cost phasing. The cost range should be updated when program content changes, such as the addition of new projects entering implementation.

7.0 ACQUISITION STRATEGY

Provide a high level summary of the Acquisition Plan (described in Appendix E.3, Section 3.4) to reflect the results of the ASP and ASM.

8.0 HIGH RISK AREAS

Identify the areas of highest risk for the program (covering safety, technical, institutional, cost, or schedule issues) in which failure may result in changes to the program/project baseline cost, schedule, or technical performance requirements. This section should identify, where possible, the specific risk drivers, such as high-risk technologies upon which the program is dependent, and mitigation options.

9.0 INTERNAL AGREEMENTS

If the program is dependent on other NASA activities outside of the MDAA's control to meet program objectives, identify the required support and list any formal agreements required.

10.0 EXTERNAL AGREEMENTS

Explain the involvement of external organizations, other agencies, or international support necessary to meet the program objectives. Include a brief overview of the program/project relationships with such external organizations. Include an identification of the commitments being made by the external organizations, other agencies, or international partners and a listing of the specific agreements to be concluded. Any unique considerations affecting implementation of required NASA policies and processes necessitated by the external involvement should be clearly identified.

11.0 REVIEWS

Specify the type of reviews that will be performed during the life cycle of the program/project.

12.0 OUTCOMES

Identify the discrete set of expected deliverables (outcomes) that flow from the Agency goals and objectives, as defined in the Agency Strategic Plan.

13.0 WAIVERS AND DEVIATIONS

Identify known waivers or deviations that will be sought for the program. Provide rationale consistent with program characteristics such as scope, complexity, visibility, cost, safety, and acceptable risk.

14.0 PCA ACTIVITIES LOG

Provide and maintain a log of all PCA activities, including revisions that reflect all waivers to the original PCA. This log includes the information shown in Table D-1 and may be supplemented with an attached addendum for each change, describing the change. The PCA should be updated to add approved projects or whenever substantial change makes it necessary.

Table D-1 Sample Program Commitment Agreement Activities Log

				Termination	MDAA	Associate Administrator
Date	Event	Change	Addendum	Review Req'd	Signature	Signature
dd/mm/yy	Revalidation	None	N/A	No		
dd/mm/yy	Revalidation	None	N/A	No		
dd/mm/yy	Approval of new project	Addition of Project N	Ref. #1	No		

APPENDIX E Program Plan Template

E.1 Template Instructions

The Program Plan is an agreement among the program manager, Center Director, and Mission Directorate Associate Administrator (MDAA). Other Center Directors providing a significant contribution to the program also concur with the Program Plan to document their commitment to provide required Center resources. The Program Plan defines the goals and objectives of the program, the environment within which the program operates, and the Management Baseline commitments of the program, including identifying the high-level requirements on both the program and each constituent project. Project requirements may be in the body of the Plan or added as appendices. The Program Plan is to be updated and approved during the program life cycle if warranted by changes in the stated Management Baseline commitments.

In this Program Plan template, all subordinate plans, collectively called Control Plans, are required. They are based on requirements in NASA Policy Directives (NPDs) and NASA Procedural Requirements (NPRs) that affect program/project planning. For tightly coupled programs, the SMA Plan, Risk Management Plan, and SEMP are required to be stand-alone plans with summaries and references provided in the Program Plan. The remaining Control Plans can either be part of the Program Plan or separate stand-alone documents referenced in the appropriate part of the Program Plan. In the case of the latter, the Program Plan contains a summary of and reference to the stand-alone document; the approval authority for the stand-alone Control Plan is the program manager.

Each section of the Program Plan template is required. If a section is not applicable to a particular program, indicate by stating that in the appropriate section and provide a rationale. If a section is applicable but the program desires to omit the section or parts of a section, then a waiver or deviation must be obtained in accordance with the requirement tailoring process for NPR 7120.5. Approvals are documented in Part 4.0, Waivers or Deviations Log, of the Program Plan.

E.2 Program Plan Title Page

Program Plan

(Provide a title for the candidate program and designate a short title or proposed acronym in parenthesis, if appropriate.)

_____ _____

Mission Directorate Associate Administrator Date

_____ _____

Center Director (as many signature lines as needed) Date

_____ _____

Program Manager Date

Figure E-1 Program Plan Title Page

E.3 Program Plan Template

PROGRAM PLAN
(PROGRAM TITLE)

1.0 PROGRAM OVERVIEW

1.1 Introduction

Briefly describe the background of the program and its current status, including results of formulation activities, decisions, and documentation.

1.2 Goals and Objectives

State program goals and specific objectives, and provide clear traceability to the Agency's Needs, Goals, and Objectives and to Mission Directorate strategic goals and objectives. Program performance goals and their relationship to NASA program goals and objectives set forth in NPD 1001.1, *NASA Strategic Plan*, should be expressed in an objective, quantifiable, and measurable form. Goals and objectives should include specific commitments to safety and mission success.

1.3 Program Architecture

Briefly describe the architecture of the program, its major components, and the way they will be integrated. Describe how the major program components are intended to operate together, and with legacy systems, as applicable, to achieve program goals and objectives. Specify the type of program (i.e., single-project, uncoupled, loosely coupled, or tightly coupled) and the basis for that classification.

Provide a summary-level technical description of the program, including constituent projects and operations concepts. The description should also include mission description, program interfaces, facilities, logistics concepts, planned mission results, and data analysis, archiving, and reporting. Identify major constraints affecting program systems development (e.g., cost, launch window, required launch vehicle, mission planetary environment, fuel/engine design, and foreign partners).

Describe how the program will relate to other organizations within NASA and outside NASA. Reference Section 3.4, the Acquisition Plan of this document, or provide the following information here:

a. For organizations within NASA, describe the roles of each in the program, including technology efforts, space communications, and launch services.

b. For organizations outside NASA, describe the role of each in the program, including other government agencies, academia, industry, and international partners as they are known at the start of the program.

1.4 Stakeholder Definition

Identify the main stakeholders of the program (e.g., PI, science community, technology community, public, education community, Mission Directorate sponsor(s)) and the process to be used within the program to ensure stakeholder advocacy.

1.5 Program Authority, Management Approach and Governance Structure

Describe the program management structure, including each participating organization's responsibilities. Identify:

a. The Center where the program manager resides.

b. Each Center's responsibilities, as they relate to their respective requirement allocations referenced in Section 2.1, Requirements Baseline, below.

Describe the chain of accountability and decision path outlining the roles and responsibilities of the MD sponsor(s), program manager, Center Director, and other authorities (including the Technical Authorities), as required. Provide a high-level description of the project's organization within the program, showing the chain of accountability. Describe clear lines of authority from projects and Centers to the program, and to the MD, and frequency of reporting for each. Illustrate the organization graphically. Describe the process by which projects are formulated, approved, and terminated.

1.6 Implementation Approach

Describe briefly the implementation approach of the program, including any guidance or direction from the applicable ASP and ASM reviews, the acquisition strategy (e.g., in-house, NASA Centers, and contractor primes), partners, and partner contributions, if appropriate. Include make-or-buy decision plans and trade studies.

Describe how lessons learned and participating NASA Centers' implementation policies and practices will be utilized in the execution of the program. (Note: For tightly coupled programs, the program manager, the NASA Chief Engineer, and the Center Chief Engineers (or designees) participating in the program establish the engineering best practices for the program. These decisions are documented here.) Document the agreements on the use of implementation policies and practices between the program manager and participating NASA Centers in this section (or in appendices to the document), along with the program's approach to ensuring that interfaces do not increase risk to mission success.

2.0 PROGRAM BASELINE

2.1 Requirements Baseline

a. Program Requirements. Document the high-level program requirements, including performance, safety, and programmatic requirements and correlate them to Agency and Mission Directorate strategic objectives and requirements. Describe the process by which program requirements are verified for compliance. Describe the process for controlling changes to program requirements. Document the traceability of requirements that flow down from Agency- and Center-level policy to the program and from the program to projects.

b. Requirements Documentation. For tightly coupled programs and single-project programs, decompose these high-level requirements into requirements on constituent projects or systems, specified herein or in a separate, configuration-controlled, program requirements document to be prepared by the program manager and approved by the MDAA. Additional concurrences may be required at the option of the NASA AA. There may also be subordinate project requirements documents controlled at lower levels.

   For uncoupled or loosely coupled programs, apply these high-level requirements to generate the program's requirements on each constituent project. This documentation is controlled by the Mission Directorate and may be located in the body of the Program Plan or in a subsequent appendix. Requirements thus documented, and any subsequent changes, require approval of the program manager, MDAA, and participating Center Director(s).

c. Program Requirements on Projects. For each project, provide a top-level description, including the mission's science or exploration objectives. Document the project's category, governing PMC, and risk classification. Describe the project's mission, performance, and safety requirements. For science missions, include both baseline science requirements and threshold science requirements. (See Appendix A for definitions.) Identify the mission success criteria for each project based on the baseline science requirements. State each requirement in objective, quantifiable, and verifiable terms. Identify the project's principal schedule milestones, including PDR, CDR, launch, mission operational-critical milestones, and the planned decommissioning date. State the development and/or total life cycle cost constraints on the project. Set forth any budget constraints by fiscal year. State the specific conditions under which a project Termination Review would be triggered. Describe any additional requirements on the project (e.g., international partners). If the mission characteristics indicate a greater emphasis is necessary on maintaining either technical, cost, or schedule, then identify which is most important (e.g., state if the mission is cost capped, or if schedule is paramount as for a planetary mission, or if it is critical to accomplish all of the technical objectives as for a technology demonstration mission).

2.2 WBS Baseline

Provide the program's WBS and WBS dictionary to the second level.

2.3 Schedule Baseline

Present a summary of the program's integrated master schedule (IMS), including all critical milestones, major events, and Agency and program-level reviews throughout the program life cycle. The summary schedule should include the logical relationships (interdependencies) for the critical milestones, major events, program reviews, and critical paths, as appropriate.

2.4 Resource Baseline

Present the program's funding requirements by fiscal year. State the NOA in real-year dollars for all years - prior, current, and remaining. The funding requirements are to be consistent with the program's WBS and include funding for all cost elements required by the Agency's full-cost accounting procedures. Funding requirements are to be consistent with the budget. Provide a

breakdown of the program's funding requirements to the WBS Level 2 elements. Present the program-specific (i.e., not individual project) workforce requirements by fiscal year, consistent with the program's funding requirements and WBS. Throughout the Implementation Phase baselines are to be based on the joint cost and schedule confidence level and the approved confidence level in accordance with NPD 1000.5 and NPR 7120.5.

Describe the program infrastructure requirements (acquisition, renovations, and/or use of real property/facilities, aircraft, personal property, and information technology). Identify means of meeting infrastructure requirements through synergy with other existing and planned programs and projects to avoid duplication of facilities and capabilities. Identify necessary upgrades or new developments, including those needed for environmental compliance.

Document the project Commitment Baselines.

2.5 Joint Cost and Schedule Confidence Level

For implementation and beyond, document the joint cost and schedule confidence level approved by the decision authority.

3.0 PROGRAM CONTROL PLANS

3.1 Technical, Schedule, and Cost Control Plan

Document how the program plans to control program requirements, technical design, schedule, and cost to achieve its high-level requirements. This control plan will include the following:

a. Describe the plan to monitor and control the requirements, technical design, schedule, and cost of the program.

b. Describe the program's performance measures in objective, quantifiable, and measurable terms and document how the measures are traced from the program high-level requirements. Establish goal and threshold values for the performance metrics to be achieved at each KDP, as appropriate. In addition, document the minimum mission success criteria associated with the high-level program requirements that, if not met, trigger consideration of a Termination Review.

c. Describe the project's implementation of Technical Authority (Engineering, Safety and Mission Assurance, and Health and Medical).

d. Describe the program's Earned Value Management System (EVMS), if EVM requirements are to be levied at the program level.

e. Describe any additional specific tools the program will use to implement the program control processes, e.g., the requirements management system, the program scheduling system, the program information management systems.

f. Describe how the program will monitor and control the integrated master schedule (IMS).

g. Describe how the program will utilize its technical and schedule margins and UFE to control the Management Baseline.

h. Describe how the program plans to report technical, schedule, and cost status to the MDAA, including frequency and the level of detail.

i. Describe how the program will address technical waivers and deviations and how dissenting opinions will be handled.

3.2 Safety and Mission Assurance Plan

Develop a program SMA Plan. The SMA Plan addresses life cycle SMA functions and activities. The plan identifies and documents program-specific SMA roles, responsibilities, and relationships. This is accomplished through a program-unique mission assurance process map and matrix developed and maintained by the program with appropriate support and guidance of the Headquarters and/or Center SMA organization.

The Plan reflects a program life cycle SMA process perspective, addressing areas including: procurement, management, design and engineering, design verification and test, software design, software verification and test, manufacturing, manufacturing verification and test, operations, and pre-flight verification and test.

The plan also addresses specific critical SMA disciplines including (as a minimum): safety per NPR 8715.3, *NASA General Safety Program Requirements* and NPR 8705.2, *Human-Rating Requirements for Space Systems*; quality assurance per NPD 8730.5, *NASA Quality Assurance Program Policy*; compliance verification, audit, safety and mission assurance reviews, and safety and mission assurance process maps per NPR 8705.6, *Safety and Mission Assurance Audits, Reviews, and Assessments*; reliability and maintainability per NPD 8720.1B, *NASA Reliability and Maintainability (R&M) Program Policy*; software safety and assurance per NASA-STD-8719.13, *NASA Software Safety Standard*; and NASA-STD-8739.8, *NASA Software Assurance Standard*; quality assurance functions per NPR 8735.2, *Management of Government Quality Assurance Functions for NASA Contracts*; and other applicable NASA procedural safety and mission success requirements.

Describe how the program will develop and manage a Closed Loop Problem Reporting and Resolution System. Describe how the program develops, tracks, and resolves problems. The process should include a well-defined data collection system and process for hardware and software problem and anomaly reports, problem analysis, and corrective action.

3.3 Risk Management Plan

Summarize how the program will implement the NASA risk management process (including risk-informed decision making (RIDM) and continuous risk management (CRM) in accordance with NPR 8000.4, *Agency Risk Management Procedural Requirements*. Include the initial Significant Risk List and appropriate actions to mitigate each risk. Programs with international or other U.S. Government agency contributions must plan for, assess, and report on risks due to international or other government partners and plan for contingencies.

For tightly coupled programs, develop a stand-alone Risk Management Plan and reference the stand-alone plan here.

3.4 Acquisition Plan

The program Acquisition Plan is developed by the program manager, supported by the Office of Procurement, and must be consistent with the results of the ASP meeting and the ASM. The elements of the program Acquisition Plan should be reflected in any resulting PSM for individual procurement activity supporting the program Acquisition Plan. It documents an integrated acquisition strategy that enables the program to meet its mission objectives and provides the best value to NASA. In addition, the Acquisition Plan should:

a. Identify all major proposed acquisitions (such as engineering design study, hardware and software development, and mission and data operations support) in relation to the program WBS. Provide summary information on each such proposed acquisition, including a Contract WBS; major deliverable items; type of procurement (competitive, AO for instruments); type of contract (cost-reimbursable, fixed-price); source (institutional, contractor, other U.S. Government agency, or international organization); procuring activity; and surveillance approach. Identify those major procurements that require a Procurement Strategy Meeting (PSM).

b. Describe completed or planned studies supporting make-or-buy decisions, considering NASA's in-house capabilities and the maintenance of NASA's core competencies, as well as cost and best overall value to NASA.

c. Identify the program's approach to creating contractor incentives that strengthen safety and mission assurance.

d. Describe how the program will establish and implement a risk management process per NPR 8000.4.

e. Describe all agreements, memoranda of understanding, barters, in-kind contributions, and other arrangements for collaborative and/or cooperative relationships. Include partnerships created through mechanisms other than those prescribed in the FAR and NFS. List all such agreements (the configuration control numbers, the date signed or projected dates of approval, and associated record requirements) necessary for program success. Include or reference all agreements concluded with the authority of the program manager and reference agreements concluded with the authority of the MDAA and above. Include the following:

    (1) NASA agreements, e.g., space communications, launch services, inter-Center memoranda of agreement.

    (2) Non-NASA agreements:

        (i) Domestic, e.g., U.S. Government agencies.

        (ii) International, e.g., memoranda of understanding.

3.5 Technology Development Plan

Describe the technology assessment, development, management, and acquisition strategies needed to achieve the program's mission objectives.

a. Describe how the program will assess its technology development requirements, including how the program will evaluate the feasibility, availability, readiness, cost, risk, and benefit of the new technologies.

b. Describe how the program will identify opportunities for leveraging ongoing technology efforts.

c. Describe the program's strategy for assuring that there are alternative development paths available if/when technologies do not mature as expected.

d. Describe how the program will remove technology gaps, including maturation, validation, and insertion plans, performance measurement at quantifiable milestones, decision gates, and resources required.

e. Describe briefly how the program will ensure that all planned technology exchanges, contracts, and partnership agreements comply with all laws and regulations regarding export control and the transfer of sensitive and proprietary information.

f. Describe the program's technology utilization plan that meets the requirements of NPD 7500.2, *NASA Technology Commercialization Policy*, and NPR 7500.1, *NASA Technology Commercialization Process*.

3.6 Systems Engineering Management Plan

Summarize the key elements of the program Systems Engineering Management Plan (SEMP). Include descriptions of the program's overall approach for systems engineering, to include system design and product realization processes (implementation and/or integration, verification and validation, and transition), as well as the technical management processes.

For tightly coupled programs, develop a stand-alone SEMP that includes the content required by NPR 7123.1, *NASA Systems Engineering Processes and Requirements*. Reference the stand-alone Plan here.

3.7 Review Plan

Summarize the program's approach for conducting a continuum of reviews for the program life cycle, including peer reviews. In accordance with Center best practices, MD review requirements, and the requirements in NPR 7123.1, *NASA Systems Engineering Processes and Requirements*, provide the names, purposes, content, and timing of the critical milestone reviews.

Explain the reporting requirements for program reviews. Provide the technical, scientific, schedule, cost, and other criteria that will be utilized in the consideration of a Termination Review.

For tightly coupled programs that involve multiple Centers, document the program review requirements on the supporting projects that represent an integrated review process for the various projects and take into consideration the participating Centers' review process best practices.

3.8 Mission Operations Plan

This section is required only for tightly coupled and single-project programs. For those programs, describe the activities required to perform the mission. Describe how the program will implement the associated facilities, hardware, software, and procedures required to complete the mission. Describe mission operations plans, rules, and constraints. Describe the Mission Operations System (MOS) and Ground Data System (GDS) in the following terms:

a. MOS and GDS human resources and training requirements.

b. Procedures to ensure that operations are conducted in a reliable, consistent, and controlled manner using lessons learned during the program and from previous programs.

c. Facilities requirements (offices, conference rooms, operations areas, simulators, and test beds).

d. Hardware (ground-based communications and computing hardware and associated documentation).

e. Software (ground-based software and associated documentation).

3.9 Environmental Management Plan

Describe the activities to be conducted to comply with NPR 8580.1, *Implementing the National Environmental Policy Act and Executive Order 12114*. After consultation with the NASA Headquarters NEPA Coordinator, describe the program's NEPA strategy, including decisions regarding programmatic NEPA documents. Insert into the program schedule the critical milestones associated with complying with these regulations.

3.10 Logistics Plan

Describe how the program will implement NPD 7500.1B, *Program and Project Logistics Policy*, including integrated logistics infrastructure for supply support, maintenance, test and support equipment, training, technical documentation, packaging, handling and transportation, and logistics information systems for the life of the program.

3.11 Science Data Management Plan

Describe how the program will manage the scientific data generated and captured by the operational mission(s) and any samples collected and returned for analysis. Include descriptions of how data will be generated, processed, distributed, analyzed, and archived, as well as how any samples will be collected, stored during the mission, and managed when returned to Earth. The Plan should include definition of data rights and services and access to samples, as appropriate. Explain how the program will accomplish the knowledge capture and information management and disposition requirements in NPD 2200.1, *Management of NASA Scientific and Technical*

Information, NPR 2200.2, *Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information*, NPR 1441.1, *NASA Records Retention Schedules*, as applicable to program science data.

State futher that the program will adhere to all NASA sample handling, curation, and planetary protection directives and rules, including NPR 8020.12, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*.

3.12 Information and Configuration Management Plan

Describe the configuration management (CM) approach that the program team will implement, consistent with NPR 7123.1. Describe the structure of the CM organization and tools to be used. Describe the methods and procedures to be used for configuration identification, configuration control, interface management, configuration traceability, and configuration status accounting and communications. Describe how CM will be audited and how contractor CM processes will be integrated with the program. Reference the stand-alone program Configuration Management Plan, if applicable.

Describe how the program will manage information throughout its life cycle, including the development and maintenance of an electronic program library. Explain how the program will ensure identification, control, and disposition of program records in accordance with NPD 1440.6, *NASA Records Management*, and NPR 1441.1, *NASA Records Retention Schedules.*

Describe the program's approach to knowledge capture, as well as the methods for contributing knowledge to other entities and systems, including compliance with NPD 2200.1, *Management of NASA Scientific and Technical Information*, and NPR 2200.2, *Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information*.

Describe the program's approach to capturing lessons learned in accordance with appropriate directives, standards, requirements, design principles, or other requirements documentation in accordance with NPD 7120.4, *NASA Engineering and Program/Project Management Policy* and as described in NPR 7120.6, *Lessons Learned Process*.

3.13 Security Plan

Describe the program's plans for ensuring security and technology protection, including:

a. Security Requirements: Describe the program's approach for planning and implementing the requirements for information, physical, personnel, industrial, and counterintelligence/counterterrorism security, and for security awareness/education requirements in accordance with NPR 1600.1, *NASA Security Program Procedural Requirements*, and NPD 1600.2, *NASA Security Policy*. Include in the plan provisions to protect personnel, facilities, mission-essential infrastructure, and critical program information from potential threats and other vulnerabilities that may be identified during the threat and vulnerability assessment process.

b. Information Technology (IT) Security Requirements: Document the program's approach to implementing IT security requirements in accordance with NPR 2810.1, *Security of Information Technology*.

c. Emergency Response Requirements: Describe the program's emergency response plan in accordance with NPR 1040.1, *NASA Continuity of Operations (COOP) Planning Procedural Requirements*, and define the range and scope of potential crises and specific response actions, timing of notifications and actions, and responsibilities of key individuals.

3.14 Export Control Plan

Describe how the program will implement the export control requirements specified in NPR 2190.1, *NASA Export Control Program*.

3.15 Education and Public Outreach Plan

Describe planned efforts and activities to improve science literacy by engaging the public in understanding the program, its objectives, and benefits. Summarize plans to develop education activities, services, and products that contribute to our Nation's efforts in achieving excellence in science, technology, engineering, and mathematics (STEM) education or to stimulate interest in STEM through program-related public outreach activities. Specifically, address how planned efforts will:

a. Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals.

b. Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty.

c. Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

Summarize the plan to flow the Education and Public Outreach (EPO) requirements to projects within the program.

4.0 WAIVERS OR DEVIATIONS LOG

Identify NPR 7120.5 requirements for which a waiver or deviation has been requested and approved consistent with program characteristics such as scope, complexity, visibility, cost, safety, and acceptable risk, and provide rationale and approvals. Waivers and deviations from other prescribed requirements will be documented in retrievable program records.

5.0 CHANGE LOG

Record changes in the Program Plan.

6.0 APPENDICES

Appendix A Acronyms

Appendix B Definitions

APPENDIX F Project Plan Template

F.1 Template Instructions

The Project Plan is an agreement among the project manager, program manager, Center Director, and as required, the Mission Directorate Associate Administrator (MDAA). Other Center Directors providing a significant contribution to the project also concur with the Project Plan to document their commitment to provide required Center resources. It defines, at a high level, the scope of the project, the implementation approach, the environment within which the project operates, and the baseline commitments of the program and project. The Project Plan is consistent with the Program Plan. The Project Plan is updated and approved during the project life cycle in response to changes in program requirements on the project or the baseline commitments.

In this Project Plan template, all subordinate plans, collectively called Control Plans, are required. They are based on requirements in NASA Policy Directives (NPDs) and NASA Procedural Requirements (NPRs) that affect program/project planning. Certain Control Plans (the SMA Plan, Risk Management Plan, SEMP, and Software Management Plan) are required to be stand-alone plans with summaries and references provided in the Project Plan. The remaining Control Plans can either be part of the Project Plan or separate stand-alone documents referenced in the appropriate part of the Project Plan. In the case of the latter, the Project Plan contains a summary of and reference to the stand-alone document; the approval authority for the stand-alone Control Plan is the project manager.

Each section of the Project Plan template is required. If a section is not applicable to a particular project, indicate by stating that in the appropriate section and provide a rationale. If a section is applicable but the project desires to omit the section or parts of a section, then a waiver or deviation must be obtained in accordance with the requirement tailoring process for NPR 7120.5. approvals are documented in Part 4.0, Waivers or Deviations Log, of the Project Plan.

F.2 Project Plan Title Page

[*Project Name*] Project Plan

(*short title or acronym)*

(Provide a title for the candidate project and designate a short title or proposed acronym in parenthesis, if appropriate.)

_____ _____
Mission Directorate Associate Administrator Date

_____ _____
Center Director (as many signature lines as needed) Date

_____ _____
Program Manager Date

_____ _____
Project Manager Date

Figure F-1 Project Plan Title Page

F.3 Project Plan Template

[*PROJECT NAME*] PROJECT PLAN

1.0 PROJECT OVERVIEW

1.1 Introduction

Briefly describe the background of the project and its current status, including results of formulation activities, decisions, and documentation. Document the project's category and NASA payload development risk classification (see NPR 8705.4, *Risk Classification for NASA Payloads*) as stated in the program requirements on the project.

1.2 Objectives

State the specific project objectives and high-level performance goals levied on the project by the program. Include performance, schedule, cost, and technology development objectives, as applicable.

1.3 Mission Description and Technical Approach

Describe briefly the mission and the mission design. Include key characteristics of the mission, such as launch date(s), flight plans, and the key phases and events on the mission timeline, including end of mission. Use drawings, figures, charts, etc., for clarification. Describe planned mission results, data archiving, and reporting.

Provide a brief description of the technical approach, including constituent launch, flight, and ground systems, operations concepts, and logistics concepts. Describe the systems to be developed (hardware and software), legacy systems, system interfaces, and facilities. Identify major constraints affecting system development (e.g., cost, launch window, required launch vehicle, mission planetary environment, fuel/engine design, and international partners.)

1.4 Project Authority, Governance Structure, Management Structure and Implementation Approach

Identify the Center where the project manager resides. Describe the governance structure based on the project category. Identify the governing PMC responsible for oversight of the project. Describe other Centers' responsibilities, if any. Describe the chain of accountability and decision path that outlines the roles and responsibilities of the project manager, program manager, Center Director, Principal Investigator, and Project Scientist (as appropriate), and other authorities as required per the project's categorization.

Define the relationships among various elements and organizations within the project structure, including all stakeholders, team members, and supporting organizations (This includes Technical Authorities). Describe the project's approach for fostering effective upward and downward communication of critical management, technical, risk, and safety information (This includes the Dissenting Opinion process). Describe the process that the project will follow to communicate with the CMC, Center Director, program manager, and governing PMC. Describe briefly the process for problem reporting and subsequent decision-making, clearly describing the roles and responsibilities of all organizations. Describe any use of special boards and committees.

Describe the project management structure consistent with the project WBS, including organization and responsibilities, its integration with the parent program management structure, and NASA Center(s) participation. Describe clear lines of authority within the project team and between the project, the program office, the primary Center, the MD, other participating Centers, and other participating organizations. Illustrate the organization graphically.

Describe briefly the implementation approach of the project, including any guidance or direction from the applicable ASP and ASM reviews, the acquisition strategy (e.g., in-house, NASA Centers, and contractor primes), partners and partner contributions, if appropriate. Describe briefly other program/project dependencies with NASA, other U.S. Government agencies, and international activities, studies, and agreements. Include make-or-buy decision plans and trade studies.

Describe how lessons learned and participating NASA Centers' implementation policies and practices will be utilized in the execution of the project. Document the agreements on the use of implementation policies and practices between the project manager and contributing NASA Centers in this section (or in appendices to the document), along with the project's approach to ensuring that interfaces do not increase risk to mission success.

1.5 Stakeholder Definition

Describe the stakeholders of the project (e.g., PI, science community, technology community, public, education community, parent program, and Mission Directorate sponsor) and the process to be used within the project to ensure stakeholder advocacy.

2.0 PROJECT BASELINE

2.1 Requirements Baseline

List or reference the requirements levied on the project by the program in the Program Plan and discuss how these are flowed down to lower levels by summarizing the requirements allocation process. Reference requirements documents used by the project.

2.2 WBS Baseline

Provide the project's WBS and WBS dictionary to the Level 2 elements. (See Appendix G of this NID.)

2.3 Schedule Baseline

Present a summary of the project's integrated master schedule (IMS), including all critical milestones, major events, and Agency and project-level reviews throughout the project life cycle. The summary schedule should include the logical relationships (interdependencies) for the critical milestones, major events, project reviews, and critical paths, as appropriate.

2.4 Resource

Present the project funding requirements by fiscal year. State the NOA in real-year dollars for all years - prior, current, and remaining. The funding requirements are to be consistent with the project WBS and include funding for all cost elements required by the Agency's full-cost accounting procedures. Provide a breakdown of the project's funding requirements to the WBS

Level 2 elements. (See Appendix G of this NID.) Throughout the Implementation Phase, cost and schedule baselines are to be based on and maintained consistent with the approved joint cost and schedule confidence level in accordance with the NPD 1000.5 and NPR 7120.5.

Present the project's workforce requirements by fiscal year, consistent with the project funding requirements and WBS. The workforce estimate is to encompass all work required to achieve project objectives. Include the actual full-cost civil service and support contractor workforce by providing organization for any prior fiscal years. Include full-cost civil service and support contractor workforce requirements by providing organization for the current fiscal year and remaining fiscal years.

Describe the project's infrastructure requirements (acquisition, renovations, and/or use of real property/facilities, aircraft, personal property, and information technology). Identify means of meeting infrastructure requirements through synergy with other existing and planned programs and projects to avoid duplication of facilities and capabilities. Identify necessary upgrades or new developments, including those needed for environmental compliance.

2.5 Joint Cost and Schedule Confidence Level

For implementation and beyond, document the project's joint cost and schedule confidence level approved by the decision authority and the basis for its consistency with the program's JCL.

3.0 PROJECT CONTROL PLANS

3.1 Technical, Schedule, and Cost Control Plan

Document how the project plans to control project requirements, technical design, schedule, and cost to achieve the program requirements on the project. (If this information is best documented in other control plans, e.g., the Systems Engineering Management Plan, then reference those control plans.) This control plan documents the following:

a. Describe the plan to monitor and control the project requirements, technical design, schedule, and cost of the project to ensure the high-level requirements levied on the project are met.

b. Describe the project's performance measures in objective, quantifiable, and measurable terms and document how the measures are traced from the program requirements on the project. In addition, document the minimum mission success criteria associated with the program requirements on the project that, if not met, trigger consideration of a Termination Review.

c. Describe the project's implementation of Technical Authority (Engineering, Health and Medical, and Safety and Mission Assurance).

d. Describe the project's implementation of Earned Value Management (EVM). The following requirements apply:

    (1) The project's EVM approach is consistent with the participating Center's best practices.

(2) The project's EVM approach is in-place by KDP C and implemented in Phase C through KDP E.

(3) Project EVM reporting begins within 60 days after the start of Phase C.

(4) As a minimum, EVM principles, as defined by ANSI/EIA-748-B , *Earned Value Management Systems*, apply from KDP C through KDP E, if the project's life cycle cost is at or greater than $20M.

(5) If the project's primary NASA Center has a fully validated Earned Value Management System (EVMS), the project uses that system rather than EVM principles.

(6) For contracts and subcontracts, refer to the NASA FAR Supplement. In addition:

(i) A Contract Performance Report (CPR), Integrated Master Schedule (IMS), WBS, and WBS Dictionary are required whenever EVMS is required for contracts and subcontracts.

(ii) EVM and IBRs will be implemented on contracts and subcontracts in accordance with the requirements in the NASA FAR Supplement on Implementation of EVM.

e. Describe any additional specific tools necessary to implement the project's control processes (e.g., the requirements management system, project scheduling system, project information management systems, budgeting, and cost accounting system).

f. Describe the process for monitoring and controlling the IMS.

g. Describe the process for utilizing the project's technical and schedule margins and UFE to meet the Management and Commitment Baselines.

h. Describe how the project plans to report technical, schedule, and cost status to the program manager, including the frequency and level of detail of reporting.

i. Describe the project's internal processes for addressing technical waivers and deviations and handling dissenting opinions.

j. Describe the project's descope plans, including key decision dates and savings in cost and schedule and show how the descopes are related to the project's threshold performance requirements.

k. Include a description of the systems engineering organization and structure and how the Project Chief Engineer (PCE) executes the overall systems engineering functions.

3.2 Safety and Mission Assurance Plan

Develop a project SMA Plan. The SMA Plan addresses life cycle SMA functions and activities. The plan identifies and documents project-specific SMA roles, responsibilities, and relationships. This is accomplished through a project-unique mission assurance process map and matrix developed and maintained by the project with appropriate support and guidance of the Headquarters and/or Center- SMA organization.

The plan reflects a project life cycle SMA process perspective, addressing areas including: procurement, management, design and engineering, design verification and test, software design, software verification and test, manufacturing, manufacturing verification and test, operations, and pre-flight verification and test.

The plan also addresses specific critical SMA disciplines, including (as a minimum): safety per NPR 8715.3, *NASA General Safety Program Requirements*, and NPR 8705.2, *NASA Human-Rating Requirements for Space Systems*; quality assurance per NPD 8730.5, *NASA Quality Assurance Program Policy*; compliance verification, audit, safety and mission assurance reviews, and safety and mission assurance process maps per NPR 8705.6, *Safety and Mission Assurance Audits, Reviews, and Assessments*; reliability and maintainability per NPD 8720.1, *NASA Reliability and Maintainability (R&M) Program Policy*; software safety and assurance per NASA-STD-8719.13, *NASA Software Safety Standard*, and NASA-STD-8739.8, *NASA Software Assurance Standard*; quality assurance functions per NPR 8735.2, *Management of Government Quality Assurance Functions for NASA Contracts*; and other applicable NASA procedural safety and mission success requirements.

Describe how the project will develop and manage a Closed Loop Problem Reporting and Resolution System. Describe how the project develops, tracks, and resolves problems. The process should include a well-defined data collection system and process for hardware and software problem and anomaly reports, problem analysis, and corrective action.

Reference the stand-alone SMA Plan here.

3.3 Risk Management Plan

Summarize how the project will implement a risk management process (including risk-informed decision-making (RIDM) and continuous risk management (CRM) in accordance with NPR 8000.4, *Agency Risk Management Procedural Requirements*. Include the initial Significant Risk List and appropriate actions to mitigate each risk. Projects with international or other U.S. Government agency contributions must plan for, assess, and report on risks due to international or other government partners and plan for contingencies.

Develop a stand-alone Risk Management Plan that includes the content required by NPR 8000.4. Reference the stand-alone plan here.

3.4 Acquisition Plan

The Project Acquisition Plan is developed by the project manager, supported by the host Center's Procurement Officer, and must be consistent with the results of the ASP meeting and

ASM. It documents an integrated acquisition strategy that enables the project to meet its mission objectives and provides the best value to NASA. In addition, the Acquisition Plan should:

a. Identify all major proposed acquisitions (such as engineering design study, hardware and software development, and mission and data operations support) in relation to the project WBS. Provide summary information on each such proposed acquisition, including a Contract WBS; major deliverable items; type of procurement (competitive, AO for instruments); type of contract (cost-reimbursable, fixed-price); source (institutional, contractor, other U.S. Government organizations); procuring activity; and surveillance approach. Identify those major procurements that require a Procurement Strategy Meeting (PSM).

b. Describe completed or planned studies supporting make-or-buy decisions, considering NASA's in-house capabilities and the maintenance of NASA's core competencies, as well as cost and best overall value to NASA.

c. Identify the project's approach to creating contractor incentives that strengthen safety and mission assurance.

d. Describe how the project will establish and implement a risk management process per NPR 8000.4.

e. Describe all agreements, memoranda of understanding, barters, in-kind contributions, and other arrangements for collaborative and/or cooperative relationships. Include partnerships created through mechanisms other than those prescribed in the FAR. List all such agreements (the configuration control numbers, the date signed or projected dates of approval, and associated record requirements) necessary for project success. Include or reference all agreements concluded with the authority of the project manager and reference agreements concluded with the authority of the program manager and above. Include the following:

    (1) NASA agreements, e.g., space communications, launch services, inter-Center memoranda of agreement.

    (2) Non-NASA agreements:

        (i) Domestic, e.g., U.S. Government agencies.

        (ii) International, e.g., memoranda of understanding.

3.5 Technology Development Plan

Describe the technology assessment, development, management, and acquisition strategies needed to achieve the project's mission objectives.

a. Describe how the project will assess its technology development requirements, including how the project will evaluate the feasibility, availability, readiness, cost, risk, and benefit of the new technologies.

b. Describe how the project will identify opportunities for leveraging ongoing technology efforts.

c. Describe the project's strategy for assuring that there are alternative development paths available if/when technologies do not mature as expected.

d. Describe how the project will remove technology gaps, including maturation, validation, and insertion plans, performance measurement at quantifiable milestones, decision gates, and resources required.

e. Describe briefly how the project will ensure that all planned technology exchanges, contracts, and partnership agreements comply with all laws and regulations regarding export control and the transfer of sensitive and proprietary information.

f. Describe the program's technology utilization plan that meets the requirements of NPD 7500.2, *NASA Technology Commercialization Policy*, and NPR 7500.1, *NASA Technology Commercialization Process*.

3.6 Systems Engineering Management Plan

Summarize the key elements of the project Systems Engineering Management Plan (SEMP). Include descriptions of the project's overall approach for systems engineering to include system design and product realization processes (implementation and/or integration, verification and validation, and transition), as well as the technical management processes.

Develop a stand-alone SEMP that includes the content required by NPR 7123.1, *NASA Systems Engineering Processes and Requirements*. Reference the stand-alone Plan here.

3.7 Softw are Management Plan

Summarize how the project will develop and/or manage the acquisition of software required to achieve project and mission objectives.

Develop a stand-alone Software Management Plan that includes the content required by NPR 7150.2, *Software Engineering Requirements*, and NASA Standard 8739.8, *Software Assurance Standard.* The Plan should be coordinated with the Systems Engineering Management Plan. Reference the stand-alone Plan here.

3.8 Review Plan

Summarize the project's approach for conducting a continuum of reviews for the project life cycle, including peer reviews. In accordance with Center best practices, program review requirements, and the requirements in NPR 7123.1, *NASA Systems Engineering Processes and Requirements*, provide the names, purposes, content, and timing of the critical milestone reviews.

Explain the reporting requirements for project reviews. Provide the technical, scientific, schedule, cost, and other criteria that will be utilized in the consideration of a Termination Review.

3.9 Mission Operations Plan

Describe the activities required to perform the mission. Describe how the project will implement the associated facilities, hardware, software, and procedures required to complete the mission. Describe mission operations plans, rules, and constraints. Describe the Mission Operations System (MOS) and Ground Data System (GDS) in the following terms:

a. MOS and GDS human resources and training requirements.

b. Procedures to ensure that operations are conducted in a reliable, consistent, and controlled manner using lessons learned during the program and from previous programs.

c. Facilities requirements (offices, conference rooms, operations areas, simulators, and test beds).

d. Hardware (ground-based communications and computing hardware and associated documentation).

e. Software (ground-based software and associated documentation).

3.10 Environmental Management Plan

Describe the activities to be conducted with support from the responsible Environmental Management Office (EMO) to comply with NPR 8580.1, *Implementing the National Environmental Policy Act and Executive Order 12114*. Specifically:

a. Identify all required permits, waivers, documents, approvals, or concurrences required for compliance with applicable Federal, State, Tribal Government, and local environmental regulations.

b. Describe the documentation and schedule of events for complying with these regulations, including identifying any modifications to the Center's Environmental Management System (EMS) that would be required for compliance.

c. Insert into the project schedule the critical milestones associated with complying with these regulations.

3.11 Logistics Plan

Describe how the project will implement NPD 7500.1, *Program and Project Logistics Policy*, including integrated logistics infrastructure for supply support, maintenance, test and support equipment, training, technical documentation, packaging, handling and transportation, and logistics information systems for the life of the project.

3.12 Science Data Management Plan

Describe how the project will manage the scientific data generated and captured by the operational mission(s) and any samples collected and returned for analysis. Include descriptions of how data will be generated, processed, distributed, analyzed, and archived, as well as how any samples will be collected, stored during the mission, and managed when returned to Earth. The

Plan should include definition of data rights and services and access to samples, as appropriate. Explain how the project will accomplish the knowledge capture and information management and disposition requirements in NPD 2200.1, *Management of NASA Scientific and Technical Information,* NPR 2200.2, *Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information,* NPR 1441.1, *NASA Records Retention Schedules,* as applicable to project science data.

3.13 Information and Configuration Management Plan

Describe the configuration management (CM) approach that the project team will implement, consistent with NPR 7123.1. Describe the structure of the CM organization and tools to be used. Describe the methods and procedures to be used for configuration identification, configuration control, interface management, configuration traceability, and configuration status accounting and communications. Describe how CM will be audited and how contractor CM processes will be integrated with the project. Reference the stand-alone project Configuration Management Plan, if applicable.

Describe how the project will manage information throughout its life cycle, including the development and maintenance of an electronic program library. Explain how the project will ensure identification, control, and disposition of project records in accordance with NPD 1440.6, *NASA Records Management,* and NPR 1441.1, *NASA Records Retention Schedules*. Reference the stand-alone Records Management Plan, if applicable, to address all records described in NPR 7120.5.

Describe the project's approach to knowledge capture, as well as the methods for contributing knowledge to other entities and systems, including compliance with NPD 2200.1, *Management of NASA Scientific and Technical Information*, and NPR 2200.2, *Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information*.

Describe the project's approach to capturing lessons learned in appropriate directives, standards, requirements, design principles, or other requirements documentation in accordance with NPD 7120.4, *NASA Engineering and Program/Project Management Policy* and as described in NPR 7120.6, *Lessons Learned Process*.

3.14 Security Plan

Describe the project's plans for ensuring security and technology protection, including:

a. Security Requirements: Describe the project's approach for planning and implementing the requirements for information, physical, personnel, industrial, and counterintelligence/ counterterrorism security and for security awareness/education requirements in accordance with NPR 1600.1, *NASA Security Program Procedural Requirements* and NPD 1600.2, *NASA Security Policy.* Include in the plan provisions to protect personnel, facilities, mission-essential infrastructure, and critical project information from potential threats and other vulnerabilities that may be identified during the threat and vulnerability process.

b. Information Technology (IT) Security Requirements: Document the project's approach to implementing IT security requirements in accordance with NPR 2810.1, *Security of Information Technology*.

c. Emergency Response Requirements: Describe the project's emergency response plan in accordance with NPR 1040.1, *NASA Continuity of Operations (COOP) Planning Procedural Requirements*, and define the range and scope of potential crises and specific response actions, timing of notifications and actions, and responsibilities of key individuals.

3.15 Export Control Plan

Describe how the project will implement the export control requirements specified in NPR 2190.1, *NASA Export Control Program*.

4.0 WAIVERS OR DEVIATIONS LOG

Identify NPR 7120.5 requirements for which a waiver or deviation has been requested and approved consistent with project characteristics such as scope, complexity, visibility, cost, safety, and acceptable risk, and provide rationale and approvals. Waivers and deviations from other prescribed requirements will be documented in retrievable project records.

5.0 CHANGE LOG

Track and document changes to the Project Plan.

6.0 APPENDICES

Appendix A Acronyms

Appendix B Definitions

APPENDIX G Space Flight Project Work Breakdown Structure

G.1 Introduction

G.1.1 The Project Work Breakdown Structure (WBS) is a key element of project management. The purpose of a WBS is to divide the project into manageable pieces of work to facilitate planning and control of cost, schedule, and technical content.

G.2 Assumptions

G.2.1 The WBS standard elements defined in this appendix are only applicable to space flight projects.

G.2.2 The following list of assumptions is provided as background information to assist in the development of the project WBS:

a. The CADRe captures major assembly actuals (one level lower than subsystem (as defined in the *NASA* Systems Engineering Handbook (SP-2007-6105 Rev1) and NPR 7123.1)) at major milestones (PDR, CDR, etc.).

b. There are both political and technical requirement drivers to a WBS.

G.3 Project Business Rules

G.3.1 Purpose: The standardization of WBS elements for space flight projects is being driven by requirements for more effective cost estimating and consistency of project work packages across the Agency. The standard WBS is intended to apply to projects, not programs. There are no *program* WBS standard requirements due to the variance in structure of the Mission Directorates.

G.3.2 Business Rules:

a. The standard space flight project WBS applies to projects established on or after June 1, 2005. It is not intended to be applied retroactively to existing projects.

b. The standard space flight project WBS applies to the entire life cycle of the project, including disposal and decommissioning.

c. The standard space flight project WBS applies to both crewed and robotic projects.

d. Space flight projects will use the standard Level 1/2 WBS elements (See Section G.5.). Specifically:

(1) The Project Name will be WBS Level 1.

(2) The title of each WBS Level 2 element can be modified to facilitate project-unique titles, but the content of each must remain the same. If the linkage of

the project-unique title to the standard title is not intuitive, the project-unique title is cross-referenced to the standard.

(3) If the set of standard WBS Level 2 elements does not comprise an exhaustive set of WBS elements, additional WBS elements may be added horizontally (i.e., at Level 2) as long as their content does not fit into the content of any existing standard WBS elements.

(4) For each standard WBS Level 2 element, the subordinate (children) WBS elements at Level 3 and lower will be determined by the project.

(5) The Level 3 and lower elements can differ from project to project but will include only work that rolls up to the standard WBS Dictionary definition of the Level 2 element. (See Section G.5.)

(6) If there is no work to fit into a standard WBS element, then an inactive placeholder element (and an inactive placeholder financial code) will be established.

(7) A single WBS will be used for both technical/business management and reporting.

(8) The management assigned to each WBS element may differ from project to project.

e. Changes to the standard space flight project WBS will be governed by the requirement tailoring approval process in Chapter 3 of this document.

G.4 Space Flight Project WBS Standard Elements

Standard Level 2 WBS elements for space flight projects are shown in Figure G-1. The standard WBS template below assumes a typical spacecraft flight development project with relatively minor ground or mission operations elements. For major launch or mission operations ground development activities which are viewed as projects unto themselves, the WBS may be modified. For example, the spacecraft element may be changed to reflect the ground project major deliverable product (such as a facility). The elements such as payload, launch vehicle/services, ground system(s), and mission operations (system) that are not applicable may be deleted.

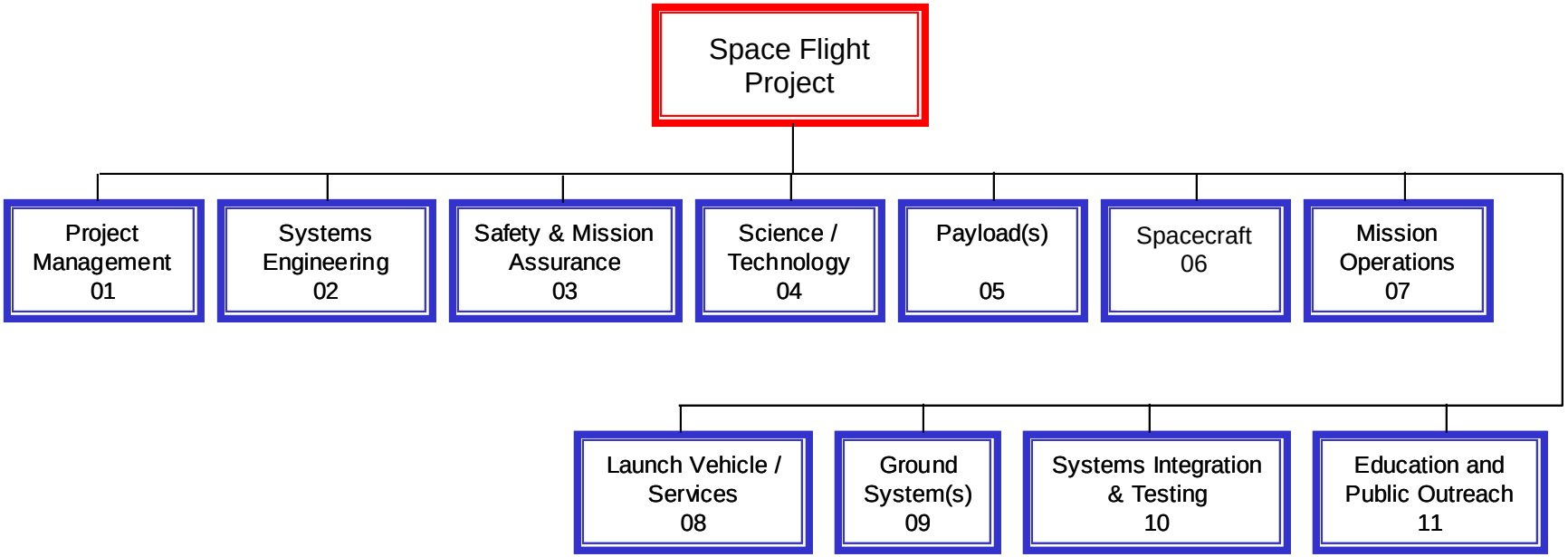


Figure G-1 Standard Level 2 WBS Elements for Space Flight Projects

G.5 Space Flight Project Standard WBS Dictionary

Element 1 – Project Management: The business and administrative planning, organizing, directing, coordinating, analyzing, controlling, and approval processes used to accomplish overall project objectives, which are not associated with specific hardware or software elements. This element includes project reviews and documentation, non-project owned facilities, and project UFE. It excludes costs associated with technical planning and management and costs associated with delivering specific engineering, hardware, and software products.

Element 2 – Systems Engineering: The technical and management efforts of directing and controlling an integrated engineering effort for the project. This element includes the efforts to define the project space flight vehicle(s) and ground system, conducting trade studies, the integrated planning and control of the technical program efforts of design engineering, software engineering, specialty engineering, system architecture development and integrated test planning, system requirements writing, configuration control, technical oversight, control and monitoring of the technical program, and risk management activities. Documentation products include requirements documents, interface control documents (ICDs), Risk Management Plan, and master verification and validation (V&V) plan. Excludes any design engineering costs.

Element 3 – Safety and Mission Assurance: The technical and management efforts of directing and controlling the safety and mission assurance elements of the project. This element includes design, development, review, and verification of practices and procedures and mission success criteria intended to ensure that the delivered spacecraft, ground systems, mission operations, and payload(s) meet performance requirements and function for their intended lifetimes. This element excludes mission and product assurance efforts directed at partners and subcontractors other than a review/oversight function, and the direct costs of environmental testing.

Element 4 – Science / Technology: This element includes the managing, directing, and controlling of the science investigation aspects, as well as leading, managing, and performing the technology demonstration elements of the Project. The costs incurred to cover the Principal Investigator, Project Scientist, science team members, and equivalent personnel for technology demonstrations are included. Specific responsibilities include defining the science or demonstration requirements; ensuring the integration of these requirements with the payloads, spacecraft, ground systems, and mission operations; providing the algorithms for data processing and analyses; and performing data analysis and archiving. This element excludes hardware and software for onboard science investigative instruments/payloads.

Element 5 – Payload: This element includes the equipment provided for special purposes in addition to the normal equipment (i.e., GSE) integral to the spacecraft. This includes leading, managing, and implementing the hardware and software payloads that perform the scientific experimental and data gathering functions placed on board the spacecraft, as well as the technology demonstration for the mission.

Element 6 – Spacecraft(s): The spacecraft that serves as the platform for carrying payload(s), instrument(s), humans, and other mission-oriented equipment in space to the mission destination(s) to achieve the mission objectives. The spacecraft may be a single spacecraft or multiple spacecraft/modules (i.e., cruise stage, orbiter, lander, or rover modules). Each spacecraft/module of the system includes the following subsystems, as appropriate: Crew,

Power, Command & Data Handling, Telecommunications, Mechanical, Thermal, Propulsion, Guidance Navigation and Control, Wiring Harness, and Flight Software. This element also includes all design, development, production, assembly, test efforts, and associated GSE to deliver the completed system for integration with the launch vehicle and payload. This element does not include integration and test with payloads and other project systems.

Element 7 - Mission Operations System: The management of the development and implementation of personnel, procedures, documentation, and training required to conduct mission operations. This element includes tracking, commanding, receiving/processing telemetry, analyses of system status, trajectory analysis, orbit determination, maneuver analysis, target body orbit/ephemeris updates, and disposal of remaining end-of-mission resources. The same WBS structure is used for Phase E Mission Operation Systems but with inactive elements defined as "not applicable." (See "Other Policy Documents" section of NODIS for WBS handbook.) However, different accounts must be used for Phase E due to NASA cost reporting requirements. This element does not include integration and test with the other project systems.

Element 8 – Launch Vehicle / Services: The management and implementation of activities required to place the spacecraft directly into its operational environment, or on a trajectory towards its intended target. This element includes launch vehicle, launch vehicle integration, launch operations, any other associated launch services (frequently includes an upper-stage propulsion system), and associated ground support equipment. This element does not include the integration and test with the other project systems.

Element 9 – Ground System(s): The complex of equipment, hardware, software, networks, and mission-unique facilities required to conduct mission operations of the spacecraft systems and payloads. This complex includes the computers, communications, operating systems, and networking equipment needed to interconnect and host the Mission Operations software. This element includes the design, development, implementation, integration, test, and the associated support equipment of the ground system, including the hardware and software needed for processing, archiving, and distributing telemetry and radiometric data and for commanding the spacecraft. Also includes the use and maintenance of the project testbeds and project-owned facilities. This element does not include integration and test with the other project systems and conducting mission operations.

Element 10 – Systems Integration and Testing: This element includes the hardware, software, procedures, and project-owned facilities required to perform the integration and testing of the project's systems, payloads, spacecraft, launch vehicle/services, and mission operations.

Element 11 – Education and Public Outreach: Provide for the education and public outreach (EPO) responsibilities of NASA's missions, projects, and programs in alignment with the Strategic Plan for Education. This includes management and coordinated activities, formal education, informal education, public outreach, media support, and Web site development.

APPENDIX H References

NASA programs/projects and Centers are required to comply with all applicable Agency directives, not limited to those listed in this Appendix. The directives listed in Section H.1 are those cited in this document. Applicable directives not cited in this document should be identified in Center policies and procedures.

Similarly, not all related references or other resources for program/project management teams are identified. The related references listed in Section H.2 are those cited in this document.

H.1 NASA Policy Directives and NASA Procedural Requirements

a. NPD 1000.0, NASA Governance and Strategic Management Handbook

b. NPD 1000.3, The NASA Organization

c. NPD 1000.5, Policy for NASA Acquisition

d. NPD 1001.0, 2006 NASA Strategic Plan

e. NPD 1200.1, NASA Internal Control

f. NPD 1440.6, NASA Records Management

g. NPD 1600.2, NASA Security Policy

h. NPD 2200.1, Management of NASA Scientific and Technical Information (STI)

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

j. NPD 7500.1, Program and Project Logistics Policy

k. NPD 7500.2, NASA Technology Commercialization Policy

l. NPD 8010.3, Notification of Intent to Decommission or Terminate Operating Space Missions and Terminate Missions

m. NPD 8020.7, Biological Contamination Control for Outbound and Inbound Planetary Spacecraft

n. NPD 8610.7, Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions

o. NPD 8610.12, Office of Space Operations (OSO) Space Transportation Services for NASA and NASA-Sponsored Payloads

p. NPD 8700.3, Safety and Mission Assurance Policy for NASA Spacecraft, Instruments, and Launch Services

q. NPD 8710.5, Policy for Pressure Vessels and Pressurized Systems

r. NPD 8720.1, NASA Reliability and Maintainability (R&M) Program Policy

s. NPD 8730.5, NASA Quality Assurance Program Policy

t. NPD 8820.2, Design and Construction of Facilities

u. NPD 8900.5, NASA Health and Medical Policy for Human Space Exploration

v. NPR 1040.1, NASA Continuity of Operations (COOP) Planning Procedural Requirements

w. NPR 1441.1, NASA Records Retention Schedules

x. NPR 1600.1, Security Program Procedural Requirements

y. NPR 2190.1, NASA Export Control Program

z. NPR 2200.2, Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information

aa. NPR 2810.1, Security of Information Technology

bb. NPR 7120.6, Lessons Learned Process

cc. NPR 7120.7, NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements

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

ee. NPR 7123.1, NASA Systems Engineering Processes and Requirements

ff. NPR 7150.2, NASA Software Engineering Requirements

gg. NPR 7500.1, NASA Technology Commercialization Process

hh. NPR 7900.3, NASA Aircraft Operations Management

ii. NPR 8000.4, Agency Risk Management Procedural Requirements

jj. NPR 8020.12, Planetary Protection Provisions for Robotic Extraterrestrial Missions

kk. NPR 8580.1, Implementing the National Environmental Policy Act and Executive Order 12114

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

mm. NPR 8705.2, Human-Rating Requirements for Space Systems

nn. NPR 8705.4, Risk Classification of NASA Payloads

oo. NPR 8705.6, Safety and Mission Assurance Audits, Reviews, and Assessments

pp. NPR 8715.1 NASA Occupational Safety and Health Programs

qq. NPR 8715.3, NASA General Safety Program Requirements

rr. NPR 8715.5, Range Safety Program

ss. NPR 8715.6, NASA Procedural Requirements for Limiting Orbital Debris

tt. NPR 8715.7, Expendable Launch Vehicle Payload Safety Program

uu. NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts

vv. NPR 8820.2, Facility Project Implementation Guide

ww. NPR 8900.1, Health and Medical Requirements for Human Space Exploration

xx. NPR 9250.1, Property, Plant, and Equipment and Operating Materials and Supplies

H.2 NASA Standards

a. NASA-STD-0005, NASA Configuration Management (CM) Standard

b. NASA-STD-8719.7, Facility System Safety Guidebook

c. NASA-STD-8719.9, Standard for Lifting Devices and Equipment

d. NASA-STD-8719.10, Standard for Underwater Facility and Non-Open Water Operations

e. NASA-STD-8719.11, NASA Safety Standard for Fire Protection

f. NASA-STD-8719.12, Safety Standard for Explosives, Propellants, and Pyrotechnics

g. NASA-STD-8719.13, NASA Software Safety Standard

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

i. NASA-STD-8719.17, NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems (PV/S)

j. NASA-STD-8739.8, Software Assurance Standard

H.3 Non-NASA Standards

a. Air Force Space Command Manual 91-710, Range Safety User Requirements Manual Volume 3 - Launch Vehicles, Payloads, and Ground Support Systems Requirements

b. ANSI/EIA-748-B , Earned Value Management Systems

H.2 Related References

Manuals and Reports

Columbia Accident Investigation Board Report, Volume 1, August 2003. (Available at http://www.nasa.gov/columbia/home/CAIB_Vol 1.html)

NASA Special Publications and Similar Documents

(1) Program and Project Management Handbook

(2) NASA Standing Review Board Handbook

(3) NASA Project Management Competency Model

(4) The Federal Acquisition Certification for Program/Project Managers- Center Implementation Guidelines.

Web Sites

(1) NASA Cost Estimating Handbook, http://www.nasa.gov/offices/pae/organization/cost_analysis_division.html

(2) NASA Technical Standards Program Web site, http://standards.nasa.gov

(3) NASA POLARIS Web site, https://polaris.nasa.gov

(4) NASA Business Case Guide for Facilities Projects, http://www.hq.nasa.gov/office/codej/codejx/codejx.html

(5) NASA Online Directives Information System (NODIS), http://nodis3.gsfc.nasa.gov

(6) NASA forms Web site, http://server-mpo.arc.nasa.gov/Services/NEFS/