NM 7120-97
NPR 7120.5D
SRB Handbook

NASA Procedural Requirements

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COMPLIANCE IS MANDATORY

Responsible Office: Office of the Chief Engineer

NASA SPACE FLIGHT PROGRAM AND PROJECT MANAGEMENT REQUIREMENTS

NASA Interim Directive (NID) for NPR 7120.5D

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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) to 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 NASA Interim Directive (NID) to NPR 7120.5D 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, highly specialized IT acquired as a part of space flight programs and projects (non-highly specialized IT is subject to NPR 7120.7), and ground systems that are in direct support of space flight operations). This NID to NPR 7120.5D also applies to reimbursable space flight programs/projects performed for non-NASA sponsors and to NASA contributions to space flight programs and projects performed with international partners. For existing programs and projects, the requirements of this NID to NPR 7120.5D are applicable to the program/project's extant phase and to phases yet to be completed as determined by the responsible Mission Directorate and approved by the Decision Authority.

c. This NID to NPR 7120.5D 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 8010.3, Notification of Intent to Decommission or Terminate Operating Space Systems and Terminate Missions

d. NPR 7120.6, Lessons Learned Process

e. NPR 7120.9, NASA Product Data and Life-Cycle Management (PDLM) for Flight Programs and Projects

f. NPR 7120.10, Technical Standards for NASA Programs and Projects

g. NPR 7123.1, NASA Systems Engineering Processes and Requirements

h. NPR 8000.4, Agency Risk Management Procedural Requirements

i. NPR 8705.4, Risk Classification for NASA Payloads

j. NPR 8715.3, NASA General Safety Program Requirements

k. NPR 8900.1, Health and Medical Requirements for Human Space Exploration

l. ANSI/EIA-748, Standard for Earned Value Management Systems Intent Guide

m. NASA Federal Acquisition Regulation (FAR) Supplement

n. NASA Standing Review Board Handbook

o. NASA Program and Project Management Handbook

P.5 MEASUREMENT/VERIFICATION

a. Compliance with this document is verified by submission to responsible NASA officials of the gate products identified in this document at Key Decision Points (KDPs) and milestone products and control plans due at life cycle reviews and by internal and external controls. Internal controls are consistent with processes defined in NPD 1200.1, *NASA Internal Control*. Internal controls include surveys, audits, and reviews conducted in accordance with NPD 1210.2, *NASA Surveys, Audits, and Reviews Policy*. External controls may include external surveys, audits, and reporting requirements.

b. Compliance is also documented by appending a completed Compliance Matrix for this NID to NPR 7120.5D to the Formulation Agreement (preliminary with updated version in the Program or Project Plan) for projects in Formulation and the Program Plan or Project Plan for programs or projects entering or in Implementation. A copy should be forwarded to the Office of the Chief Engineer.

P.6 CANCELLATION

NID (NM 7120-81) for NPR 7120.5D, NASA Space Flight Program and Project Management Requirements, dated September 22, 2009.

Mike Ryschkewitsch
NASA Chief Engineer

Chapter 1. Introduction

1.1 Key Policy Changes in this NID to NPR 7120.5D

1.1.1 This NID to NPR 7120.5D has been substantially restructured to streamline the requirements and place guidance and contextual information into a companion handbook. This Handbook describes how programs and projects are managed in NASA and contains explanatory material to help understand the requirements of this NID to NPR 7120.5D. Both documents can be found in NODIS. The requirements of this NID to NPR 7120.5D may be tailored in accordance with section 3.5 of this NID.

1.1.2 NASA Centers shall develop Center documentation to implement the requirements of this NID.

1.1.3 For existing programs and projects, Mission Directorates shall determine the extent to which the requirements of this document are to be applicable to the program/project's extant phase and to phases yet to be completed and obtain approval for any differences to this policy from the Decision Authority.

1.2 Background

1.2.1 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.

1.2.2 NASA approaches the formulation and implementation of programs and projects through a governance model that balances different perspectives from different elements of the organization. The cornerstone of program and project governance is the organizational separation of the Mission Directorates and their respective programs and projects (Programmatic Authorities) from the Headquarters Mission Support Offices, the Center organizations that are aligned with these Mission Support Offices, and the Center Directors (Institutional Authorities). (See NPD 1000.0, *NASA Governance and Strategic Management Handbook*.)

1.2.3 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. Programmatic requirements 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 programmatic requirements flow down from the Agency's strategic planning process. Table 1-1 shows this flow down from Agency strategic planning through Agency, directorate, program, and project requirement levels to the systems that will be implemented to achieve the Agency goals.

[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 NID to NPR 7120.5D.

Table 1-1 Programmatic Requirements Hierarchy

Requirements Level	Content	Governing Document	Approver	Originator
Strategic Goals	Agency strategic 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 strategic goals and outcomes	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

1.2.3.1 Institutional requirements other than Technical Authority requirements (see section 3.3 for details of these 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 requirements may respond to Federal statute, regulation, treaty, or executive order. They are normally documented in NASA Policy Directives (NPDs), NASA Procedural Requirements (NPRs), NASA Standards, Center Policy Directives (CPDs), Center Procedural Requirements (CPRs), and Mission Directorate Requirements.

1.2.4 This NID to NPR 7120.5D is focused on improving program and project performance against internal and external commitments. Figure 1-1 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.

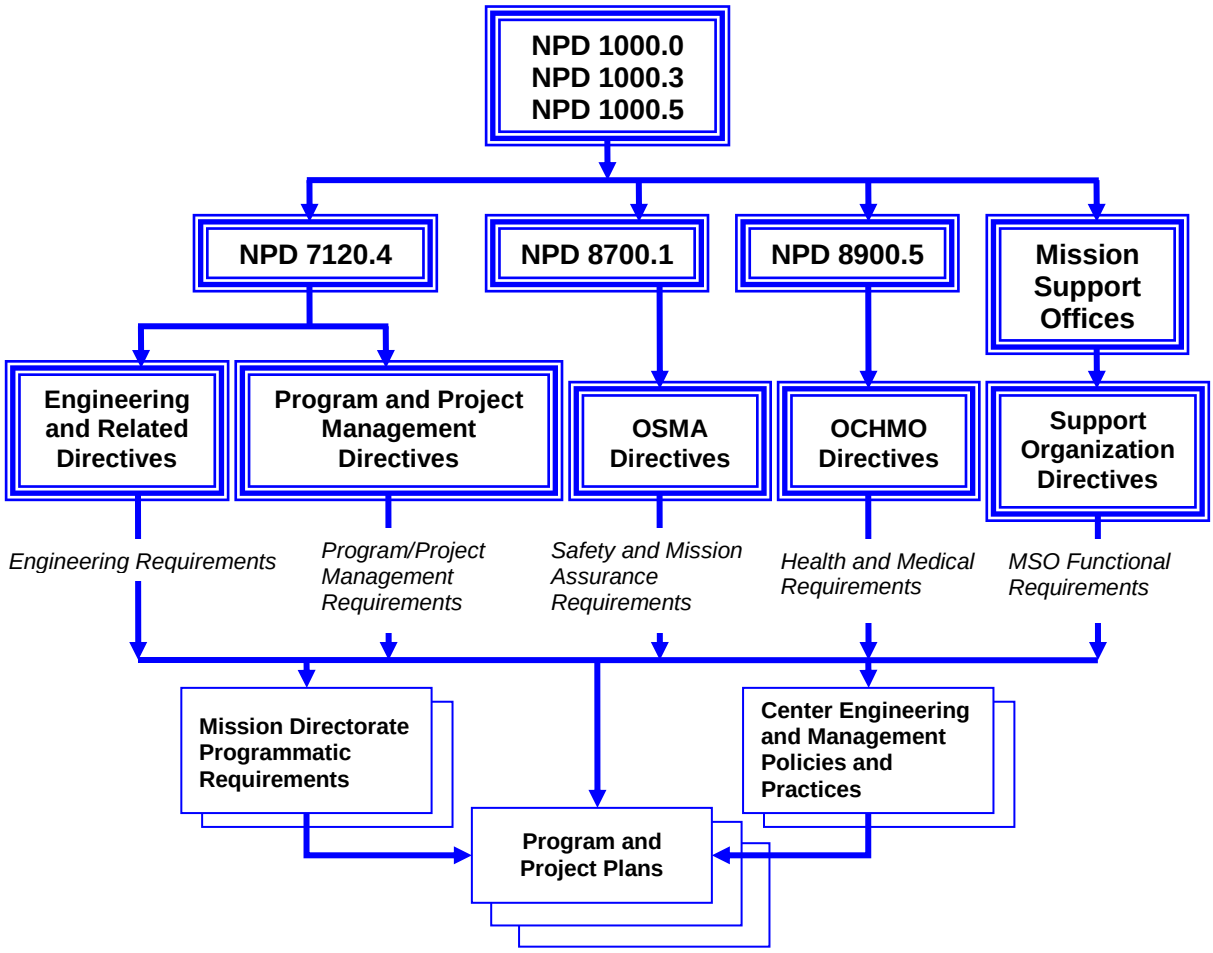


Figure 1-1 Institutional Requirements Flow Down

1.3 Overview of Management Process

1.5.1. Although this document emphasizes program and project management based on life cycles, Key Decision Points (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—identifying how the program or project supports the Agency's strategic goals; assessing feasibility, technology, concepts, and performance of trade studies; risk assessment and possible risk mitigations based on risk-informed decision making (RIDM) and continuous risk management (CRM) processes; team building; and development of operations concepts and acquisition strategies; establishing high-level requirements, requirements flow down, and success criteria; assessing the relevant industrial base/supply chain to ensure program or project success; preparing plans, budgets, and schedules essential to the success of a program or project; and

establishing control systems to ensure performance of those plans and alignment with current Agency strategies.

b. Approval (for Implementation)—acknowledgment by the Decision Authority (see Appendix A for definition of "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—execution of approved plans for the development and operation of the program/project, and use of control systems to ensure performance to approved plans and requirements and continued alignment with the Agency's strategic goals.

d. Evaluation—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.

1.4 Strategic Acquisition and Partnering Process

1.4.1 NASA's program and project support of its overall mission is long term in nature, but the environments in which these programs and projects are conducted are dynamic. In recognition of this, NPD 1000.0 has put in place a framework for ensuring that NASA's strategic vision, programs and projects, and resources remain properly aligned. The strategic acquisition and partnering process and annual strategic resource planning form a continuous process to oversee this alignment. At the program and project level, the Acquisition Strategy Meeting (ASM) and the Procurement Strategy Meeting (PSM) support the Agency's acquisition process.

1.5 Document Structure

1.5.1. In this document, a specific requirement is identified by "*shall*," a good practice by "*should*," permission by "*may*" or "*can*," and expectation by "*will*."

Chapter 2 NASA Life Cycles for Space Flight Programs and Projects

2.1 Programs and Projects

2.1.1 Space flight 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.

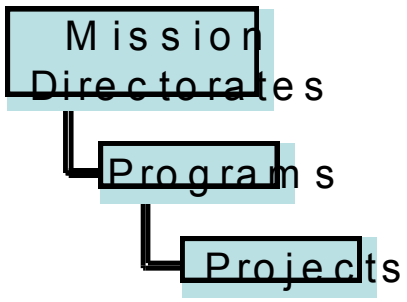


Figure 2-1 Programmatic Authority Organizational Hierarchy

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 that directly address NASA's strategic goals.

c. Regardless of the structure of a program or project meeting the criteria of Section P.2, this NID to NPR 7120.5D shall apply to the full scope of the program or project and all the activities under it. Specific NPR7120.5 requirements are flowed down to these activities by the program or project to the extent necessary for the program or project to ensure compliance and mission success.

2.1.2 NASA Programs

2.1.2.1 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 process. 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 (defined in Appendix A) that may be employed: single-project programs, uncoupled programs, loosely coupled programs, and tightly coupled programs

2.1.3 NASA Projects

2.1.3.1 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 *Category 1, 2, or 3* and shall be assigned to a category based initially on: (1) the project life cycle cost (LCC) estimate, the inclusion of significant radioactive material[2], and whether or not the system being developed is for human space flight; and (2) the 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 Mission Directorate Associate Administrator (MDAA) that consider additional risk factors facing the project. The NASA Associate Administrator (AA) will approve the final project categorization. The Office of the Chief Engineer (OCE) is responsible for the official listing and categorization of NASA programs and projects.[3] For purposes of project categorization, the project life cycle cost estimate includes phases A through F and all Work Breakdown Structure (WBS) Level 2 elements and is measured in real year (nominal) dollars.

[2] Nuclear safety launch approval is required by the Administrator or Executive Office of the President when significant radioactive materials are included onboard the spacecraft and/or launch vehicle. (Levels are defined in NPR 8715.3, *NASA General Safety Program Requirements*.)

[3] 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 breakdown and forms the structure for program and project status reporting across all Mission Directorates and Mission Support Offices.

Table 2-1 Project Categorization Guidelines

Priority Level	LCC < $250M	$250M ≤ LCC ≤ $1B	LCC > $1B, significant radioactive material, 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

2.1.3.2 When projects are initiated, they are assigned to a NASA Center or implementing organization by the MDAA consistent with direction/guidance from the strategic 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).[4] For Category 1 projects, the assignment shall be with the concurrence of the NASA AA.

2.2 Program and Project Life Cycles

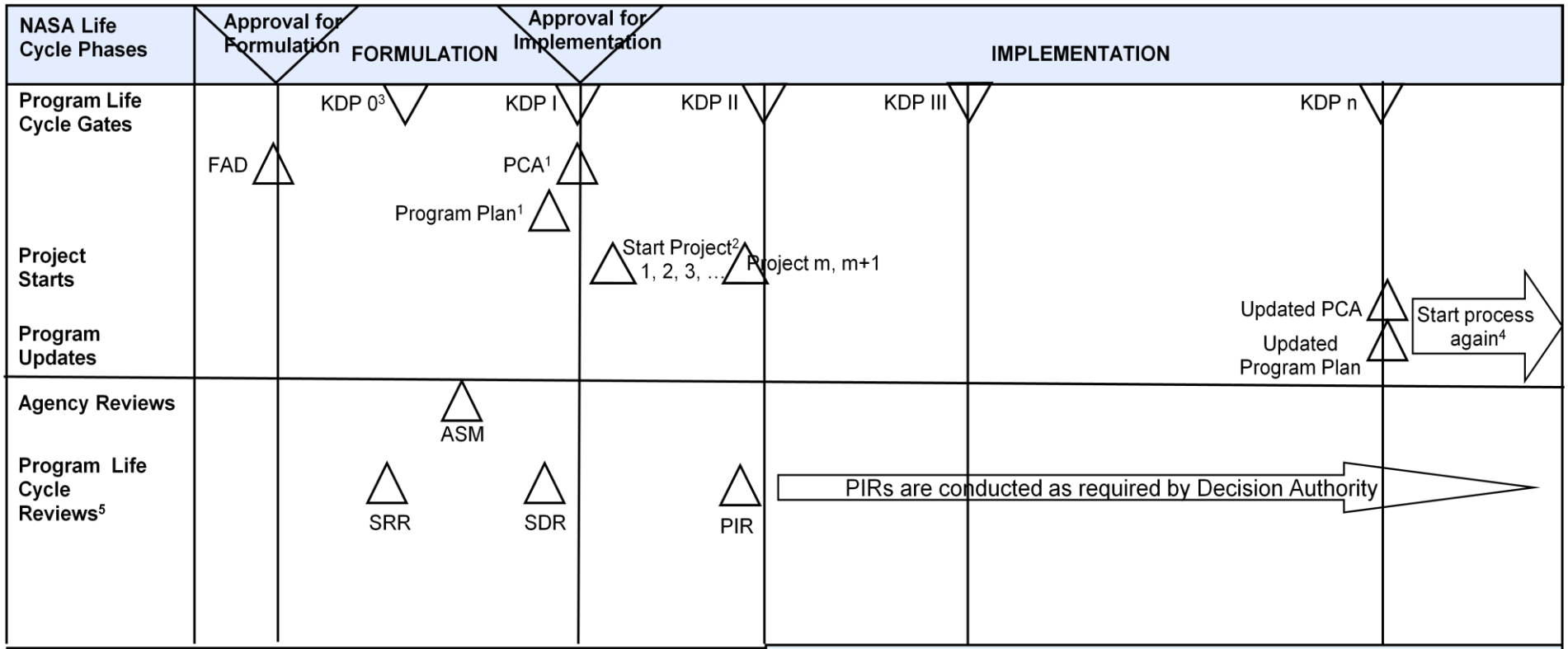
2.2.1 Programs and projects shall follow the appropriate life cycle to formalize their life cycle phases; life cycle gates and major events, including KDPs; major life cycle reviews; principal documents that govern the conduct of each phase; and the process of recycling through Formulation when program changes warrant such action. Uncoupled and loosely coupled programs follow the life cycle depicted in Figure 2-2. Tightly coupled programs follow the life cycle shown in Figure 2-3. Projects follow the life cycle shown in Figure 2-4. Single-project programs follow the project life cycle, Figure 2-4, and associated project requirements, but must include the draft Program Commitment Agreement (PCA) and Program Plan due at KDP B, with final versions approved by KDP C.

2.2.2 Each program and project performs the work required for each phase. This work is described in the NASA Program and Project Management Handbook and in NPR 7123.1. The documents shown on the life cycle figures and described below shall be prepared in accordance with the templates in Appendices D through H.

2.2.2.1 The program Formulation Authorization Document (FAD) authorizes a program manager to initiate the planning of a new program and to perform the analysis of alternatives required to formulate a sound Program Plan that contains project elements, requirements, schedules, risk assessments, and budgets.

2.2.2.2 The PCA is an agreement between the MDAA and the NASA AA (the Decision Authority) that authorizes program transition from Formulation to Implementation. It documents Agency requirements that flow down to the Mission Directorate Program, Mission Directorate requirements, program objectives, management and technical approach and associated

[4] As part of the process of assigning projects to NASA Centers, the affected program manager may recommend project assignments to the MDAA.



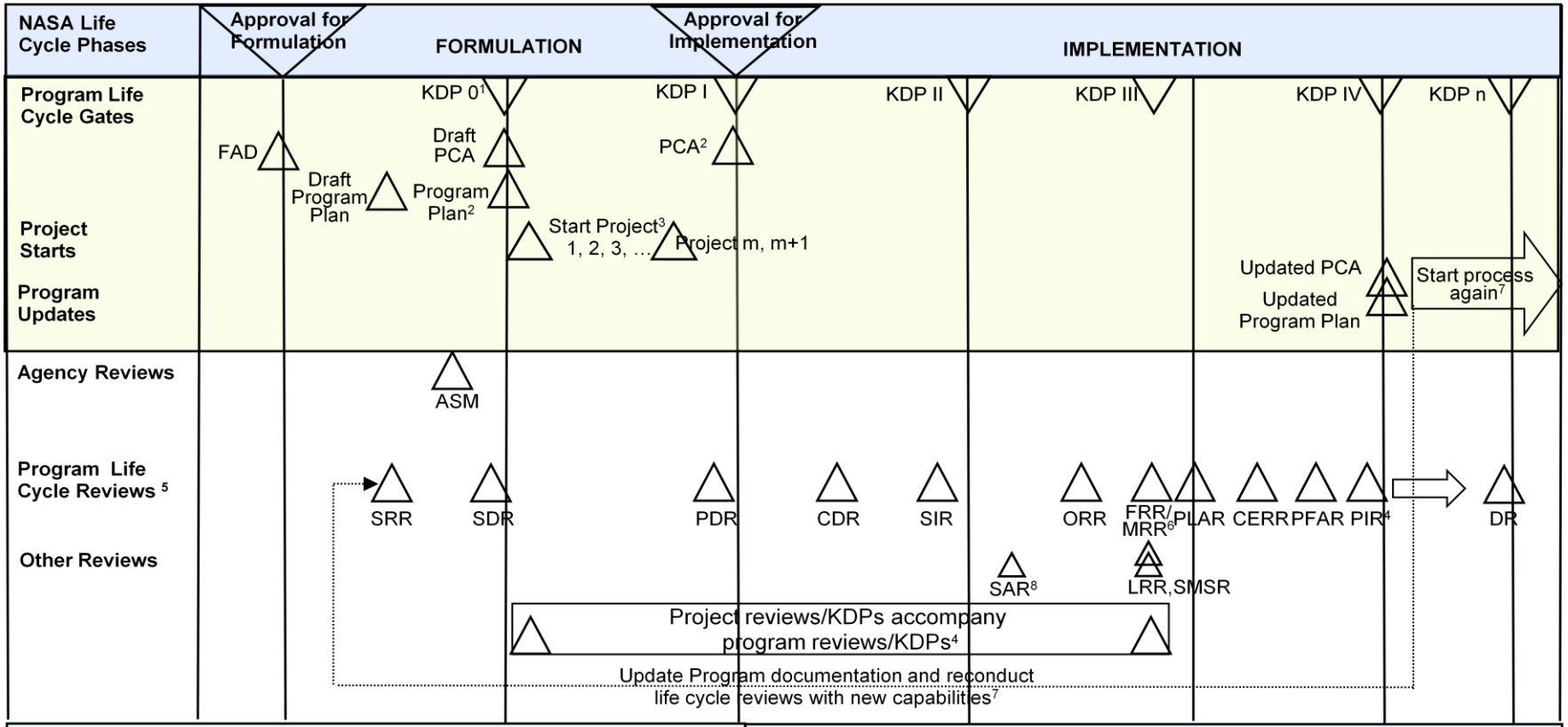
FOOTNOTES

1. Program Plans are baselined at SDR, and PCAs are baselined at KDP I. These are 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 I. Initial project pre-Formulation generally occurs during program Formulation.
3. KDP 0 may be required by the Decision Authority to ensure major issues are understood and resolved prior to formal program approval at KDP I.
4. When programs evolve and/or require upgrades (e.g., new program capabilities), the life cycle process will be restarted when warranted, i.e., the program's upgrade will go through Formulation and Implementation steps.
5. Life cycle review objectives and expected maturity states for these reviews and the attendant KDPs are contained in Table 2-2.

ACRONYMS

ASM—Acquisition Strategy Meeting
FAD—Formulation Authorization Document
KDP—Key Decision Point
PCA—Program Commitment Agreement
PIR—Program Implementation Review
SDR—System Definition Review
SRR—System Requirements Review

Figure 2-2 The NASA Program Life Cycle (Uncoupled and Loosely Coupled)



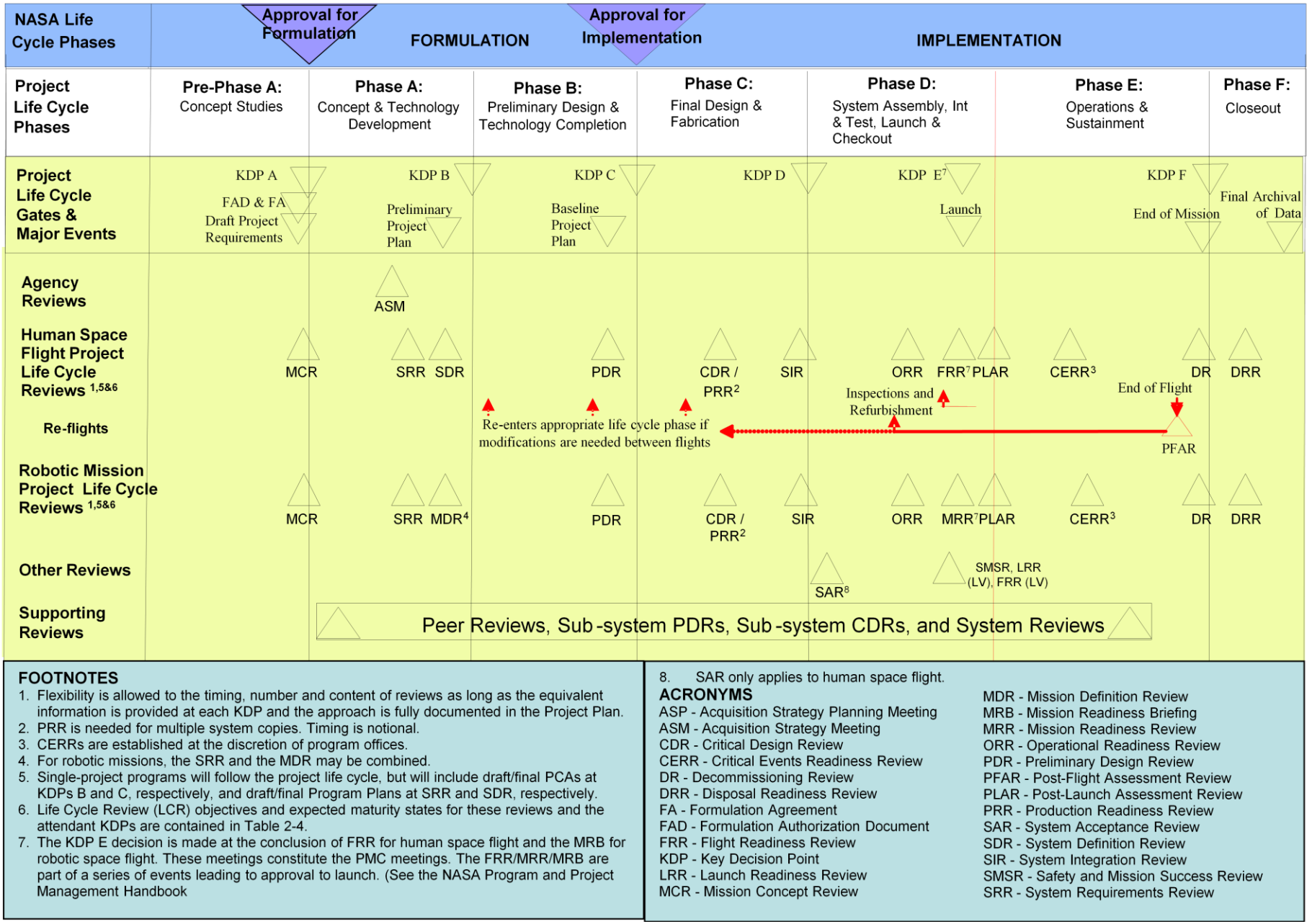
FOOTNOTES

1. KDP 0 may be required by the Decision Authority to ensure major issues are understood and resolved prior to formal program approval at KDP I.
2. Program Plans are baselined at SDR, and PCAs are baselined at KDP I. These are reviewed and updated, as required, to ensure program content, cost, and budget remain consistent.
3. Projects are usually approved for Formulation prior to KDP I.
4. Tightly coupled program reviews generally differ from the reviews of other program types because they are conducted to ensure the overall integration of all program elements (i.e., projects). Once the program is in operations, PIRs are conducted as required by the Decision Authority.
5. Life cycle review objectives, expected maturity states for these reviews, and the attendant KDPs are contained in Table 2-3.
6. The KDP III decision is made at the conclusion of FRR for human space flight and the MRB for robotic space flight. These meetings constitute the PMC meetings. The FRR/MRR/MRB are part of a series of events shown in the NASA Program and Project. Management Handbook leading to approval to launch
7. When programs evolve and/or require upgrades (e.g., new program capabilities), the life cycle process will be restarted when warranted, i.e., the program's upgrade will go through Formulation and Implementation steps.
8. SAR only applies to human space flight.

ACRONYMS

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
MRB—Mission Readiness Briefing
MRR—Mission Readiness Review
ORR—Operational Readiness Review
PCA—Program Commitment Agreement
PDR—Preliminary Design Review
PFAR—Post-Flight Assessment Review
PIR—Program Implementation Review
PLAR—Post-Launch Assessment Review
SAR—System Acceptance Review
SDR—Program/System Definition Review
SIR—System Integration Review
SMSR—Safety and Mission Success Review
SRB—Standing Review Board
SRR—Program/System Requirements Review

Figure 2-3 The NASA Program Life Cycle (Tightly Coupled)



FOOTNOTES

1. Flexibility is allowed to 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.
2. PRR is needed for multiple 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. Single-project programs will follow the project life cycle, but will include draft/final PCAs at KDPs B and C, respectively, and draft/final Program Plans at SRR and SDR, respectively.
6. Life Cycle Review (LCR) objectives and expected maturity states for these reviews and the attendant KDPs are contained in Table 2-4.
7. The KDP E decision is made at the conclusion of FRR for human space flight and the MRB for robotic space flight. These meetings constitute the PMC meetings. The FRR/MRR/MRB are part of a series of events leading to approval to launch. (See the NASA Program and Project Management Handbook
8. SAR only applies to human space flight.

ACRONYMS

ASP - Acquisition Strategy Planning Meeting
ASM - Acquisition Strategy Meeting
CDR - Critical Design Review
CERR - Critical Events Readiness Review
DR - Decommissioning Review
DRR - Disposal Readiness Review
FA - Formulation Agreement
FAD - Formulation Authorization Document
FRR - Flight Readiness Review
KDP - Key Decision Point
LRR - Launch Readiness Review
MCR - Mission Concept Review
MDR - Mission Definition Review
MRB - Mission Readiness Briefing
MRR - Mission Readiness Review
ORR - Operational Readiness Review
PDR - Preliminary Design Review
PFAR - Post-Flight Assessment Review
PLAR - Post-Launch Assessment 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

architecture, technical performance, schedule, cost, safety and risk factors, internal and external agreements, life cycle reviews, and all attendant top-level program requirements.

2.2.2.3 The Program Plan is an agreement between the MDAA (who has final 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, environment within which the program operates, funding by fiscal year consistent with the approved PCA, and commitments of the program.

2.2.2.4 The project FAD authorizes a project manager to initiate the planning of a new project and to perform the analysis of alternatives required to formulate a sound Formulation Agreement and subsequent Project Plan and contains requirements, schedules, risk assessments, and budgets.

2.2.2.5 The Formulation Agreement is prepared by the project as a response to the FAD to establish the technical and acquisition work that must be conducted during Formulation and defines the schedule and funding requirements during Phase A and Phase B for that work.

2.2.2.6 The Project Plan is an agreement among the MDAA, the program manager, participating Center Director(s), the project manager, and for AO-driven missions, the principal investigator[5]. The Project Plan is prepared by the project manager with the support of the project team and defines at a high level the project's objectives, technical and management approach, environment within which the project operates, and commitments of the project to the program.

2.2.3 Each program and project shall perform the Life Cycle Reviews (LCRs) identified in its respective figure in accordance with NPR 7123.1, applicable Center practices, and the requirements of this document. These reviews provide a periodic assessment of the program's or project's technical and programmatic status and health at a key point in the life cycle.

2.2.4 The program or project and an independent Standing Review Board (SRB) shall conduct the LCRs in figures 2-2, 2-3 and 2-4 (except for the Mission Concept Review (MCR), Flight Readiness Review (FRR), Mission Readiness Review (MRR), and all post-launch reviews unless requested by the Decision Authority)[6]. The *NASA Standing Review Board Handbook* further expands on the review processes conducted by the SRB.

2.2.4.1 NASA accords special importance to the policies and procedures established to ensure the integrity of the SRB's independent review process and to comply with Federal law. The Conflict of Interest (COI) procedures detailed in the *NASA Standing Review Board Handbook* shall be strictly adhered to.

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[5] A principal investigator is a person who conceives an investigation and is responsible for carrying it out and reporting its results. In some cases, principal investigators from industry and academia act as project managers for smaller development efforts with NASA personnel providing oversight.

[6] Other reviews in Figures 2-2, 2-3 and 2-4, e.g., the ASM, SMSR, SAR, and LRR, are generally not conducted by the SRB unless requested by the Decision Authority.

2.2.4.2 The Independent Program Assessment Office (IPAO), or equivalent, shall document the requirements for the portion of the LCR conducted by the SRB in the Terms of Reference (ToR), for which there is a template in the *NASA Standing Review Board Handbook.*

2.2.4.3 The program or project manager, the SRB chair, and the Center Director (or designated Technical Authority representative) shall mutually assess the program's or project's expected readiness for the LCR and report any disagreements to the Decision Authority for final decision. The assessment occurs approximately 30 to 90 days prior to the LCR.

2.2.5 In preparation for these LCRs, the program or project shall document the results of its Formulation or Implementation activities (described in the *NASA Program and Project Management Handbook*) prior to the LCR and generate the appropriate documentation per Appendix C tables C-1 through C-4 of this document, NPR 7123.1, and Center practices as necessary to demonstrate that the program's or project's definition and associated plans are sufficiently mature to execute the follow-on phase(s) with acceptable technical, safety, and programmatic risk. Paragraph 3.5.2.2 provides the process for tailoring these product deliverables.

2.2.6 Each program and project proceeds through the KDPs identified in its respective figure in the NID to NPR 7120.5D. A KDP is the event where the Decision Authority determines the readiness of a program or project to progress to the next phase of the life cycle. Transition to the following phase occurs immediately following KDP approval except for transition from Phase D to E where transition occurs following on orbit checkout and initial operations. KDPs associated with programs are designated with Roman numerals. The first KDP is KDP 0; the second is KDP I. KDPs for projects are labeled with capital letters, e.g., KDP A.

2.2.6.1 For missions selected as a result of an AO, KDP A is the selection of a Step 1 proposal for concept development. In a one-step AO process, projects enter Phase A after selection (KDP A) and the process becomes conventional. In a two-step AO process, projects are down-selected following evaluation of concept study reports and the down-selection serves as KDP B. Following this selection, the process becomes conventional with the exception that KDP B products requiring Mission Directorate input will be finished as early in Phase B as feasible.

2.2.7 Programs, at the discretion of the MDAA, and projects in phases C and D (and project modifications, enhancements, or upgrades during Phase E) with a life cycle cost estimated to be greater than $20 million shall perform earned value management (EVM) with an EVM system that complies with the guidelines in ANSI/EIA-748, *Standard for Earned Value Management Systems*. This includes flowing down EVM system requirements to applicable suppliers.

2.2.8 Projects will conduct an integrated review of project baselines as part of their preparations for KDP C to ensure that the project's work is properly linked with its cost, schedule, and risk and that the systems are in place to conduct EVM.

2.2.9 The Office of the Administrator, MDAA, or the Technical Authority may convene special reviews of programs/projects as they determine the need. 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 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.

2.2.10 Each program and project shall complete a Compliance Matrix for this NID to NPR 7120.5D and attach it to the Formulation Agreement, Program Plan, or Project Plan. The program or project will use the Compliance Matrix to demonstrate how it is complying with the requirements of this document and verify the compliance of other responsible parties. The Compliance Matrix template is available on the Other Policy Documents tab in the OCE section in the NODIS library and in the program and project Communities of Practice on the NASA Engineering Network (NEN).

2.3 Program and Project Oversight and Approval

2.3.1 Each program and project shall have a Decision Authority who is the Agency's responsible individual who determines whether and how the program or project proceeds through the life cycle and the key program or project cost, schedule, and content parameters that govern the remaining life cycle activities. For programs and Category 1 projects, the Decision Authority is the NASA Associate Administrator. This authority may be delegated to the MDAA for Category 1 projects. For Category 2 and 3 projects, the Decision Authority is the MDAA. These project authorities may be delegated to a Center Director. All delegations are documented and approved in the applicable authority document (PCA or Project Plan) depending on which Decision Authority is delegating.

2.3.1.1 For Category 2 projects with a life cycle cost greater than $250 million, the NASA AA will approve all external agency baseline commitments. For programs with life cycle cost greater than $1 billion and all Category 1 projects, the NASA Administrator will approve all agency baseline commitments. (See paragraph 2.4.1.5 for more information on agency baseline commitments.)

2.3.2 To ensure the appropriate level of management oversight, NASA has established two levels of Program Management Councils (PMCs)—the Agency PMC (APMC) and Mission Directorate PMCs (MDPMC). The PMCs have the responsibility for periodically evaluating the technical, safety, and programmatic performance (including cost, schedule, and risk) and content of a program or project under their purview. These evaluations focus on whether the program or project is meeting its commitments to the Agency. Each program and project shall have a governing PMC. For all programs and Category 1 projects, the governing PMC is the Agency PMC; for Category 2 and 3 projects, the governing PMC is the Mission Directorate PMC.

2.3.3 The Center Director (or designee) shall oversee programs and projects usually through the Center Management Council (CMC), which monitors and evaluates all program and project work (regardless of category) executed at that Center. The CMC evaluation focuses on whether Center engineering, Safety and Mission Assurance (SMA), health and medical, and management best practices (e.g., program and project management, resource management, procurement, institutional best practices) are being followed by the program/project under review and whether Center resources support program/project requirements. The CMC also assesses program and project risk and evaluates the status and progress of activities to identify and report trends and provide 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 performance and technical and management viability of the program/project prior to KDPs.

2.3.4 Following each LCR, the independent SRB and the program or project shall brief the applicable management councils on the results of the LCR to support the councils' assessments. The final LCR in a given life cycle phase provides essential information for the KDP, which marks the end of that life cycle phase. To support the Decision Authority's determination of the readiness of a program or project to progress to the next phase of the life cycle, the program manager (for projects in their program), the Center Director, the MDAA (for programs and Category 1 projects), and the governing PMC provide their assessments and recommendations with supporting data as necessary. Tables 2-2 through 2-5 define for each LCR and each KDP the LCR objectives and the expected maturity state at the subsequent KDP. (The *NASA Program and Project Management Handbook* provides further details.)

Table 2-2 Expected Maturity State Through the Uncoupled and Loosely Coupled Program Life Cycle

NOTE: LCR entrance and success criteria in Appendix G of NPR 7123.1 and the life cycle phase and KDP requirement in the NASA Program and Project Management Handbook provide specifics for addressing the expected maturity state.

KDP Review	Associated Lifecycle Review	LCR Objectives	Overall Expected Maturity State at KDP
KDP 0	**SRR**	To evaluate whether the program functional and performance requirements are properly formulated and correlated with the Agency and Mission Directorate strategic objectives; to assess the credibility of the program's estimated budget and schedule.	Overall KDP 0: Program addresses critical NASA needs and can likely be achieved as conceived.
KDP I	**SDR**	To evaluate the proposed program requirements/ architecture and allocation of requirements to initial projects; to assess the adequacy of project pre-Formulation efforts; to determine whether the maturity of the program's definition and associated plans are sufficient to begin implementation.	Overall KDP I: Program is in place and stable; addresses critical NASA needs; has adequately completed Formulation activities; has an acceptable plan for Implementation that leads to mission success; proposed projects are feasible within available resources; and the program's risks are commensurate with the Agency's expectations.
KDP II to KDP n	**PIR**	To evaluate the program's continuing relevance to the Agency's Strategic Plan; to assess performance with respect to expectations; to determine the program's ability to execute the implementation plan with acceptable risk within cost and schedule constraints.	Overall KDP II to KDP n: Program still meets Agency needs and is continuing to meet Agency commitments as planned.

Table 2-3 Expected Maturity State Through the Tightly Coupled Program Life Cycle

NOTE: LCR entrance and success criteria in Appendix G of NPR 7123.1 and the life cycle phase and KDP requirement in the NASA Program and Project Management Handbook provide specifics for addressing the expected maturity state.

KDP Review	Associated Lifecycle Review	LCR Objectives	Overall Expected Maturity State at KDP
KDP 0	SRR	KDP 0 may be required by the Decision Authority to ensure major issues are understood and resolved prior to formal program approval at KDP I.	Overall KDP 0 Expected State: Program addresses critical NASA needs and projects are feasible within available resources.
	SDR	To evaluate the credibility and responsiveness of the proposed program requirements/architecture to the Mission Directorate requirements and constraints, including available resources, and allocation of requirements to projects; to determine whether the maturity of the program's mission/system definition and associated plans are sufficient to begin preliminary design.	
KDP I	PDR	To evaluate the completeness/consistency of the program's preliminary design, including its projects, in meeting all requirements with appropriate margins, acceptable risk and within cost and schedule constraints; and to determine the program's readiness to proceed with the detailed design phase of the program.	Overall KDP I: Program is in place and stable; addresses critical NASA needs; has adequately completed Formulation activities; has an acceptable plan for Implementation that leads to mission success; proposed projects are feasible within available resources; and the program's risks are commensurate with the Agency's tolerances.
KDP II	CDR	To evaluate the integrity of the program integrated design, including its projects and ground systems, to meet mission requirements with appropriate margins and acceptable risk, within cost and schedule constraints; to determine if the integrated design is appropriately mature to continue with the final design and fabrication phase.	Overall KDP II Expected Maturity: Program is still on plan; the risk is commensurate with the projects' payload classifications; and the program is ready for AI&T with acceptable risk within Agency Baseline Commitment.
	SIR	To evaluate the readiness of the program, including its projects and supporting infrastructure, to begin system assembly, integration and test, with acceptable risk and within cost and schedule constraints.	
KDP III	ORR	To evaluate the readiness of the program, including its projects, ground systems, personnel, procedures and user documentation, to operate the flight system and associated ground systems in compliance with program requirements and constraints during the operations phase.	Overall KDP III Expected State: Program ready for launch and early operations with acceptable risk, within Agency commitments.
	FRR/MRR	To evaluate the readiness of the program and its projects, ground systems, personnel, and procedures, for a safe and successful launch and flight/mission.	
Non-KDP Mission Operations Reviews	PLAR	To evaluate the in-flight performance of the program and its projects; to determine the program's readiness to begin the operations phase of the life cycle and to transfer responsibility to the operations organization.	PLAR Expected State: Project ready to conduct mission operations with acceptable risk, within Agency Commitments.
	CERR	To evaluate the readiness of the program and its projects to execute a critical event during the flight operations phase of the life cycle.	Mission CERR Expected State: Project ready to conduct critical mission activity with acceptable risk.
	PFAR	To evaluate how well mission objectives were met during a human spaceflight mission; and to evaluate the status of the flight and ground systems, including the identification of any anomalies and their resolution.	PFAR Expected State: All anomalies that occurred in flight are identified; actions necessary to mitigate or resolve these anomalies are in place; and lessons learned identified and documented.

KDP IV to KDP n-1	**PIR**	To evaluate the program's continuing relevance to the Agency's Strategic Plan; to assess performance with respect to expectations; to determine the program's ability to execute the implementation plan with acceptable risk within cost and schedule constraints.	Overall KDP IV to KDP n-1: Program still meets Agency needs and is continuing to meet Agency commitments as planned.
KDP n	**DR**	To evaluate the readiness of the program and its projects to conduct closeout activities, including final delivery of all remaining program/project deliverables and safe decommissioning/disposal of spaceflight systems and other program/project assets.	Overall KDP n Expected State: Program decommissioning is consistent with program objectives, and program is ready for final analysis and archival of mission and science data and safe disposal of its assets.

Table 2-4 Expected Maturity State Through the Project Life Cycle

NOTE: LCR entrance and success criteria in Appendix G of NPR 7123.1 and the life cycle phase and KDP requirement in the NASA Program and Project Management Handbook provide specifics for addressing the expected maturity state.

KDP Review	Associated Lifecycle Review	LCR Objectives	Overall Expected Maturity State at KDP
KDP A	**MCR**	To evaluate the feasibility of the proposed mission concept(s) and its fulfillment of the program's needs and objectives; to determine whether the maturity of the concept and associated planning are sufficient to begin Phase A.	Overall KDP A Expected Maturity: Project addresses critical NASA need; proposed mission concept(s) is feasible; associated planning is sufficiently mature to begin Phase A, and the mission can likely be achieved as conceived.
KDP B	**SRR**	To evaluate whether the functional and performance requirements defined for the system are responsive to the program's requirements on the project and represent achievable capabilities.	Overall KDP B Expected State: Proposed mission/system architecture is credible and responsive to program requirements and constraints including resources; and the maturity of the project's mission/system definition and associated plans is sufficient to begin Phase B; and the mission can likely be achieved within available resources with acceptable risk.
	MDR	To evaluate the credibility and responsiveness of the proposed mission/system architecture to the program requirements and constraints, including available resources; to determine whether the maturity of the project's mission/system definition and associated plans are sufficient to begin Phase B.	
	SDR	To evaluate the credibility and responsiveness of the proposed mission/system architecture to the program requirements and constraints, including available resources; to determine whether the maturity of the project's mission/system definition and associated plans are sufficient to begin Phase B.	
KDP C	**PDR**	To evaluate the completeness/consistency of the planning, technical & cost/schedule baselines developed during Formulation; to assess compliance of the preliminary design with applicable requirements; to determine if the project is sufficiently mature to begin Phase C.	Overall KDP C Expected Maturity: Project's planning, technical, cost and schedule baselines developed during Formulation are complete and consistent; the preliminary design complies with its requirements; the project is sufficiently mature to begin Phase C; and the cost and schedule are adequate to enable mission success with acceptable risk.
KDP D	**CDR**	To evaluate the integrity of the project design and its ability to meet mission requirements, with appropriate margins and acceptable risk, within defined project constraints, including available resources; to determine if the design is appropriately mature to continue with the final design and fabrication phase.	Overall KDP D Expected Maturity: Project is still on plan; the risk is commensurate with the project's payload classification; and the project is ready for AI&T with acceptable risk within Agency Baseline Commitment.
	PRR	To evaluate the readiness of system developer(s) to produce the required number of systems within defined project constraints, for projects developing multiple similar flight or ground support systems; to evaluate the degree to which the production plans meet the system's operational support requirements.	

KDP Review	Associated Lifecycle Review	LCR Objectives	Overall Expected Maturity State at KDP
	SIR	To evaluate the readiness of the project and associated supporting infrastructure to begin system assembly, integration and test; to evaluate whether the remaining project development can be completed within available resources; to determine if the project is sufficiently mature to begin Phase D.	
KDP E	ORR	To evaluate the readiness of the project to operate the flight system and associated ground system(s), in compliance with defined project requirements and constraints, during the operations/sustainment phase of the project lifecycle.	Overall KDP E Expected State: Project and all supporting systems are ready for safe, successful launch/early operations with acceptable risk, w/in Agency Baseline Commitment.
	MRR/FRR	To evaluate the readiness of the project and all project and supporting systems for a safe and successful launch and flight/mission.	
NA	PLAR	To evaluate in-flight performance of the flight system early in the mission and determine whether the project is sufficiently prepared to begin phase E.	PLAR Expected State: Project ready to conduct mission operations with acceptable risk, w/in Agency B/L Commitment.
	CERR	To evaluate the readiness of the project and the flight system for execution of a critical event during the flight operations phase of the lifecycle.	Mission CERR Expected State: Project ready to conduct critical mission activity with acceptable risk.
	PFAR	To evaluate how well mission objectives were met during a human spaceflight mission; to evaluate the status of the returned vehicle.	PFAR Expected State: All anomalies that occurred in flight are identified; actions necessary to mitigate or resolve these anomalies are in place; and lessons learned identified and documented.
KDP F	DR	To evaluate the readiness of the project to conduct closeout activities, including final delivery of all remaining project deliverables and safe decommissioning of spaceflight systems and other project assets; to determine if the project is appropriately prepared to begin Phase F.	Overall KDP F Expected State: Project decommissioning is consistent with program objectives, and project is ready for safe decommissioning of its assets and closeout of activities, including final delivery of all remaining project deliverables and disposal of its assets.
Non-KDP Disposal Readiness Review	DRR	To evaluate the readiness of the project and the flight system for execution of the spacecraft disposal event.	Mission DRR Expected State: Project ready to conduct disposal activity with acceptable risk.

Table 2-5 Objectives for Other Reviews

Review Name	Review Objective
System Acceptance Review (SAR)	To evaluate whether a specific end item is sufficiently mature to be shipped from the supplier to its designated operational facility or launch site.
Safety and Mission Success Review (SMSR)	To evaluate the program/project readiness to proceed with SMA, Engineering, and Health and Medical Technical Authority requirements and topics to support critical program/project reviews and decision forums prior to launch and other mission-critical events.
Launch Readiness Review (LRR)	To evaluate the readiness for launch of a program/project, and ground hardware and software systems.

2.4 Approving and Maintaining Program and Project Plans, Baselines, and Commitments

2.4.1 After reviewing the supporting material and completing discussions with all parties, the Decision Authority determines whether and how the program or project proceeds into the next phase and approves any additional actions. These decisions shall be summarized and recorded in the Decision Memorandum signed at the conclusion of the governing PMC and, once signed, appended to the Program Plan (if a program), the Project Plan, or the project Formulation Agreement as appropriate.

2.4.1.1 The Decision Memorandum shall describe the constraints and parameters within which the Agency, the program manager, and the project manager will operate; the extent to which changes in plans may be made without additional approval; and any additional actions that came out of the KDP. The *NASA Program and Project Management Handbook* provides an example of the Decision Memorandum to illustrate the level and types of information that are documented.

2.4.1.2 Within the Decision Memorandum, the parameters and authorities over which the program or project manager has management control constitute the program or project Management Agreement. A program or project manager has the authority to manage within the Management Agreement and is accountable for compliance with the terms of the agreement. The Management Agreement, which is documented at every KDP, may be changed between KDPs as the program or project matures and in response to internal and external events. A significant divergence from the Management Agreement must be accompanied by an amendment to the Decision Memorandum.

2.4.1.3 During Formulation, the Decision Memorandum shall establish a target life cycle cost range (and schedule range, if applicable) as well as a Management Agreement addressing the schedule and resources required to complete Formulation.

2.4.1.4 The Decision Memorandum also documents any additional resources beyond those explicitly estimated/requested by the program/project (e.g., additional schedule margin) when the Decision Authority determines that this is appropriate. This includes Unallocated Future Expenses (UFE) assigned to the program or project manager, which are costs that are expected to be incurred but cannot yet be allocated to a specific WBS sub-element of a program's or project's plan. Management control of some UFE may be retained above the level of the project (i.e., Agency or program). (See Figure 2-5, Example of Agreements)

2.4.1.5 All projects shall document the Agency's life cycle cost estimate and other parameters in the Decision Memorandum for Implementation (KDP C), and this becomes the Agency Baseline Commitment (ABC). The ABC is the baseline against which the Agency's performance is measured during the Implementation Phase. The ABC for projects with a life cycle cost of $250 million or more forms the basis for the Agency's external commitment to the Office of Management and Budget (OMB) and Congress.

2.4.1.5.1 Tightly coupled programs also shall document their life cycle cost estimate in their Decision Memorandum and ABC at KDP I.

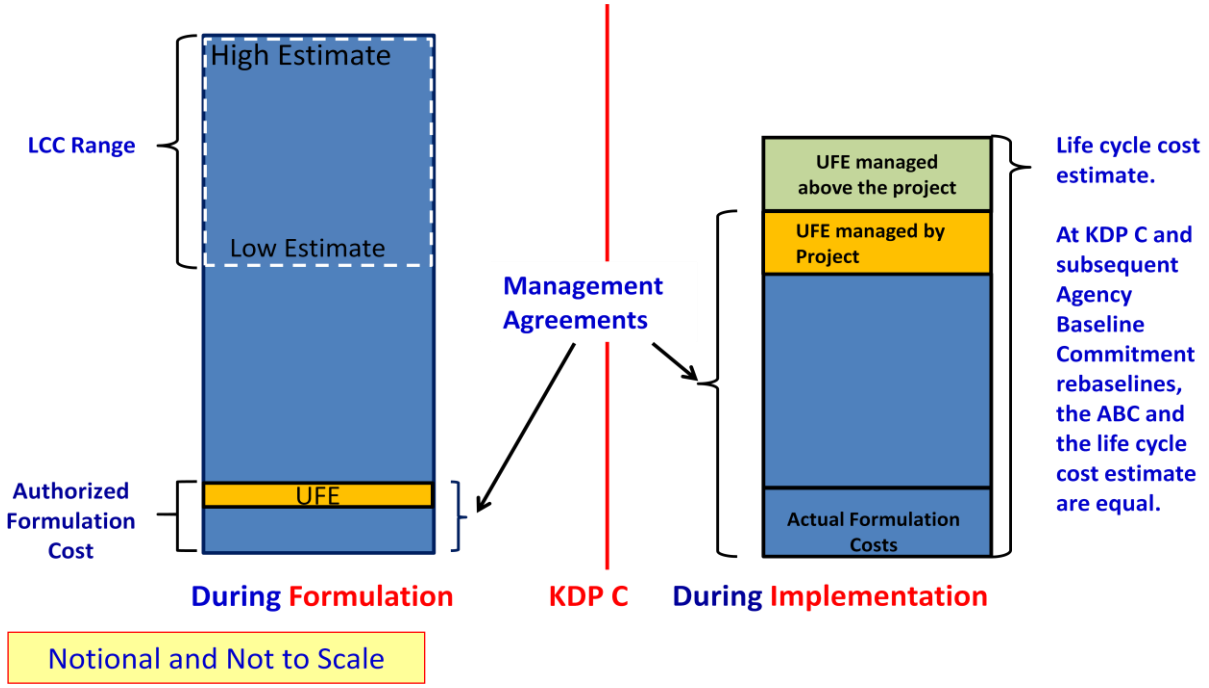

Figure 2-5 Example of Agreements and Commitments in Terms of Cost for Projects

2.4.1.6 Programs or projects shall be rebaselined when: (1) the estimated development cost[7] exceeds the ABC development cost by 30 percent or more and Congress has reauthorized the project; (2) events external to the Agency make a rebaseline appropriate; or (3) the NASA Associate Administrator judges that the program or project scope defined in the ABC has been changed or the tightly coupled program or project has been interrupted. ABCs for projects are not rebaselined to reflect cost or schedule growth that does not meet one or more of these requirements. When an ABC is rebaselined, the Decision Authority will direct that a Rebaseline Review be conducted by the SRB or as determined by the Decision Authority.

2.4.2 All programs and projects develop cost estimates and planned schedules for the work to be performed in the current and following life cycle phases (see Appendix C tables). As part of developing these estimates, the program or project shall document the basis of estimate.

2.4.3 Tightly coupled programs, single-project programs, and projects with an estimated life cycle cost greater than $250 million shall develop probabilistic analyses of cost and/or schedule estimates to obtain a quantitative measure of the likelihood that the estimate will be met in accordance with the following requirements.

2.4.3.1 Tightly coupled programs, single-project programs, and projects with an estimated life cycle cost greater than $250 million shall provide a range of cost and a range for schedule at KDP 0/KDP B with a confidence level established by a probabilistic analysis and based on identified resources by fiscal year. Separate analyses of cost and schedule, each with an

[7] 'Development cost" includes all project costs from authorization to Implementation through operational readiness at the end of Phase D.

associated confidence level, meet the requirement. A joint confidence level (JCL) is not required but may be used at KDP 0 and KDP B.

2.4.3.2 At KDP 1/KDP C, these programs or projects shall generate a cost-loaded schedule and a probability calculation that meet cost, schedule, and a JCL. The JCL is the probabilistic analysis of the coupled cost and/or schedule to measure the likelihood of completing all remaining work, including mitigating risks and conducting any operations prior to transition to Phase E, while meeting both cost and schedule simultaneously.

2.4.4 Mission Directorates shall plan and budget these programs and projects based on a 70 percent joint cost and schedule confidence level or as approved by the Decision Authority. Any JCL approved by the Decision Authority at less than 70 percent must be justified and documented.

2.4.4.1 Mission Directorates shall ensure funding for these programs and projects are consistent with the Management Agreement and in no case less than the equivalent of a 50 percent joint confidence level.

2.4.5 Loosely coupled and uncoupled programs are not required to develop program cost and schedule confidence levels. These programs shall provide analysis that provides a status of the program's risk posture that is presented as each new project reaches KDP B and C or when a project's ABC is rebaselined.

Chapter 3 Program and Project Management Roles and Responsibilities

3.1 Governance

3.1.1 The fundamental principles of governance are defined in NPD 1000.0, *NASA Governance and Strategic Management Handbook* and depict two lines of authority: programmatic and institutional. 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.[8] Institutional Authority encompasses all those organizations and authorities not in the Programmatic Authority. This includes Engineering, Safety and Mission Assurance, and Health and Medical organizations; Mission Support organizations; and Center Directors.

3.1.2 This NASA governance model prescribes a management structure that employs checks and balances among key organizations to ensure that decisions have the benefit of different points of view and are not made in isolation. As part of this structure, NASA established the Technical Authority process as a 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 with delegated levels of authority. The requirements for Technical Authority are contained in paragraph 3.3.

3.2 Roles and Responsibilities

3.2.1 The roles and responsibilities of NASA management 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. The NASA Administrator approves acquisition strategies and commitments.

b. The NASA Associate Administrator is responsible for the technical and programmatic integration of programs at the Agency level; serves as the Decision Authority for programs and Category 1 projects with the advice of the Agency PMC; and approves the PCA and the ABC. He or she monitors the status and performance of the programs and projects via reports from the MDAA and Baseline Performance Review (BPR) process. The NASA AA may delegate Decision Authority to MDAAs.

c. A Mission Directorate Associate Administrator is responsible for Programmatic Authority in managing programs and projects within the Mission Directorate. He/she establishes directorate policies applicable to programs, projects, and supporting elements; supports the Agency's strategic acquisition process; initiates new programs and projects; recommends 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; is responsible for all

[8] Some mission directorates may have additional personnel in the flow down chain, e.g., a Program Director.

program-level requirements; establishes program and project budgets; approves Formulation Agreements and Program and Project Plans; oversees program and project performance via the MDPMC; and approves launch readiness. The MDAA may delegate some of his/her Programmatic Authority to deputy associate administrators, division directors, or their equivalent, such as program directors, and Center Directors. The MDAA proactively works with Center Directors to develop constructive solutions for the formulation and implementation of programs and projects conducted at their Centers and to resolve issues as they arise.

d. The Center Director is responsible for both Institutional Authority responsibilities and execution of programs and projects assigned to the Center. He/she is responsible for:

(1) **Institutional Authority:** This includes ensuring that program/project teams at their Center accomplish their goals in accordance with the prescribed requirements and the Agency's and Center's procedures and processes. In accomplishing this role, Center Directors are delegated Technical Authority in accordance with Section 3.3 and approve the Center's Technical Authority implementation plan; establish and maintain ongoing processes and forums, including the Center Management Council to monitor the status and progress of programs and projects at their Center and to provide a summary status at the BPR and other suitable venues; periodically review programs and projects to ensure they are performing in accordance with their Center's and the Agency's requirements, procedures, processes, etc.; keep the Decision Authority advised of the executability of all aspects of their programs and projects (programmatic, technical, and all others) along with major risks, mitigation strategies, and significant concerns; approve the adequacy of cost/schedule estimates, workforce, and other resources stipulated in proposed Program and Project Plans; certify that programs and/or projects have been accomplished properly as part of the launch approval process; and ensure that Center training and certification programs for program and project managers are in place and that program and project managers have met the training requirements.

(2) **Execution of Programs and Projects:** This includes ensuring the Center is capable of accomplishing the programs, projects, other activities assigned to it in accordance with Agency policy and the Center's best practices and institutional policies by: establishing, developing, and maintaining institutional capabilities (processes and procedures, human capital—including trained/certified program/project personnel, facilities, and infrastructure) required for the execution of programs and projects; working with the Mission Directorate and the programs and project managers, once assigned, to assemble the program/project team(s) to accomplish the program or project; supporting the program and projects by providing needed Center resources, providing support and guidance to programs and projects in resolving technical and programmatic issues and risks, monitoring the technical and programmatic progress of programs and projects to help identify issues as they emerge, proactively working with the Mission Directorates, programs, projects, and other Institutional Authorities to find constructive solutions to problems; and proactively working on cross-Center activities to benefit both the programs/projects and the overall Agency long-term health.

e. The program manager is responsible for the formulation and implementation of the program as described in this document, the NASA Program and Project Management Handbook, and NPR 7123.1. This includes responsibility and accountability for the safety, technical integrity, performance, and mission success of the program.

f. The project manager is responsible for the formulation and implementation of the project as described in this document, the NASA Program and Project Management Handbook, and NPR 7123.1. This includes responsibility and accountability for the safety, technical integrity, performance, and mission success of the project.

g. The Director, IPAO, is responsible for enabling independent review (an unbiased, objective review of the maturity, health, and status) of the Agency's programs and projects at life cycle milestones to ensure the highest probability of mission success. The IPAO ensures the objectivity, quality, integrity, and consistency of the independent review process.

h. The NASA Chief Engineer establishes policy, oversight, and assessment of the NASA engineering and program/project management processes; 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); 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; leads the mission and program/project performance assessment for the BPR; and co-chairs the SMSR with OSMA.

i. The 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, quality, and risk management 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; and co-chairs the Safety and Mission Success Review (SMSR) with the OCE.

j. The 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 the Health and Medical Technical Authority process and serves as principal advisor to the Administrator and other senior officials on health and medical issues related to the Agency workforce.

k. The Mission Support Directorate Associate Administrator establishes policy and procedures for institutional oversight for mission support functional area (e.g., procurement).

l. Roles and responsibilities for other NASA organizations can be found in NPR 1000.3.

3.3 Technical Authority

3.3.1 Programs and projects shall follow the Technical Authority process established in this section. NASA established this system 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 with delegated levels of authority. These individuals are the Technical Authorities. In this document, the term Technical Authority (TA) is used to refer to such an individual, but is also used 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.

3.3.1.1 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; the Chief Health and Medical Officer for Health and Medical Technical Authority; and then to the Center Directors. Subsequent Technical Authority delegations are made to selected individuals who are funded independent of the Programmatic Authority. Such delegations are formal and traceable to the Administrator. Individuals with Technical Authority are funded independent 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. The Center Director (or designee) is responsible for establishing and maintaining Center Technical Authority policies and practices, consistent with Agency policies and standards.

3.3.2 Other Technical Authority Roles

3.3.2.1 Top-level documents developed by a program detailing Agency-level requirements for human-rated systems are to be signed by the Administrator or his/her formally delegated designee.

3.3.2.2 On decisions related to technical and operational matters involving safety and mission success residual risk, formal concurrence by the responsible Technical Authority(ies) (Engineering, Safety and Mission Assurance, and/or Health and Medical) is required. This concurrence is to be based on the technical merits of the case. For residual risks to personnel or high-value hardware, the cognizant safety organization must agree 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.

3.3.3 At the program or project level, the responsibilities common to each of the individuals with delegated Technical Authority (Engineering Technical Authority (ETA), SMA TA, and Health and Medical Technical Authority (HMTA)) are delineated below. (See 3.3.6 to 3.3.8 for unique aspects of individual Technical Authorities.) These individuals:

a. Serve as members of program or project control boards, change boards, and internal review boards.

b. Work with the Center management and other Technical Authority personnel, as necessary, to ensure that the quality and integrity of program or project processes, products, and standards of performance related to engineering, SMA, and medical health reflect the level of excellence expected by the Center or, where appropriate, by the NASA Technical Authority community.

c. Ensure that requests for waivers or deviations from Technical Authority requirements (as defined in Appendix A) are submitted to and acted on by the appropriate level of Technical Authority.

d. Assist the program/project in making risk-informed decisions that properly balance technical merit, cost, schedule, and safety across the system.

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

f. Serve as an effective part of NASA's overall system of checks and balances.

3.3.3.1 In cases where the Center does not have a chief medical officer, the program/project-level ETA and SMA TA are responsible to serve as the awareness and communication links for potential HMTA issues and to inform the appropriate level of HMTA, the program/project manager, and Center management of potential HMTA issues.

3.3.4 The day-to-day involvement of the Technical Authorities (TAs) in program/project activities ensures that significant views from the TAs will be available to the program/project in a timely manner and should be handled during the normal program/project processes.

3.3.5 Infrequent circumstances may arise when a Technical Authority or the program/project manager disagrees on a proposed programmatic or technical action and judges that the issue rises to a level of significance that should be brought to the attention of the next higher level of management (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 the pursuit of a 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.

3.3.6 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.

3.3.6.1 The NASA Chief Engineer provides overall leadership for the engineering technical authority process for programs and 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. The NASA Chief Engineer hears appeals of engineering decisions when they cannot be resolved at lower levels.

3.3.6.2 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—The Center Director (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 Center Director may delegate Center Engineering Technical Authority implementation responsibility to an individual in the Center's engineering leadership.) The Center Engineering Technical Authority supports the Technical Authorities in processing changes to and waivers or deviations from requirements that are the responsibility of the Engineering Technical Authority. This includes all applicable Agency and Center engineering directives, requirements, procedures, and standards. The Center Director 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).[9] The Center Director appoints Category 2 and 3 project chief engineers and lead discipline engineers.

b. Program/Project Chief Engineer (PCE)—The PCE is the position to which the program/project-level Engineering Technical Authority has been delegated. Different Centers use different titles for this position. (See also 3.3.1.1, 3.3.3, and 3.3.6.3.)

c. Lead Discipline Engineer (LDE)—The LDE is a senior technical engineer in a specific discipline at the Center. Different Centers use different titles for this position. The LDE assists the program/project through direct involvement with working-level engineers to identify engineering requirements in accordance with NPR 7120.10 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 who have formally delegated Technical Authority traceable to the Administrator and are funded independent of programs and projects are Technical Authorities.

3.3.6.3 The Engineering Technical Authority for the program or project leads and manages the engineering activities, including systems engineering, design, development, sustaining engineering, and operations. A Center may have more than one engineering organization and delegates Engineering Technical Authority to different areas as needed. To support the program/project and maintain Engineering Technical Authority independence and an effective check and balance system:

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

b. The Engineering Technical Authority cannot be the decision maker on a board or panel that provides relief to a derived requirement. This provision does not preclude such an Engineering

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

Technical Authority from chairing preliminary boards that provide input to the change or control board.

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.

3.3.7 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 do not have formally delegated Technical Authority 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 products (e.g., hardware, software, designs, analysis, and technical alternatives) that conform 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.

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

3.3.8.1 The Chief, SMA hears appeals of SMA decisions when issues cannot be resolved below the Agency level.

3.3.8.2 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 ensuring 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 SMA financial metrics and performance results.

3.3.9 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.

3.3.9.1 Due to Center infrastructure differences, the flow down of HMTA processes and responsibilities 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. This NID to NPR 7120.5D recognizes that medical staff has a special obligation to protect the handling and dissemination of an individual's medical information. These restrictions must be respected.

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

3.4 Process for Handling Dissenting Opinions

3.4.1 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. Programs and projects shall follow the dissenting opinion process in NPD 1000.0A, paragraph 3.4.2.2.3. 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.

3.4.2 When time permits, the disagreeing parties jointly 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.

3.4.3 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.

3.5 Principles Related to Tailoring Requirements

3.5.1 It is NASA policy to comply with all prescribed directives, requirements, procedures, and processes unless relief is formally granted. 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) shall comply with the following (refer to the NASA Program and Project Management Handbook for additional information regarding the tailoring process):

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.

3.5.1.1 The tailoring process results in the generation of **deviations** or **waivers** depending on the timing of the request. **Deviations** apply before a requirement is put under configuration control at the level the requirement will be implemented and **waivers** apply after.

3.5.1.2 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 at the level where the requirement is implemented or as delegated.

3.5.2 A request for a permanent change to a prescribed requirement in an Agency or Center document that is applicable to all programs and projects shall be submitted as a "change request" to the office responsible for the document unless formally delegated elsewhere.

3.5.2.1 The *NASA Program and Project Management Handbook* provides details for processing requests for relief from a prescribed requirement. All requirement relief requests (deviations or waivers) are also copied to the SMA TA at the program/project level for risk review. Additional process, requirements, and required data elements for requesting tailoring of Agency-level SMA TA requirements can be found in NPR 8715.3.

3.5.2.2 Waivers or deviations from NPR 7120.5 requirements may be granted by the officials shown in Table 3-1, unless formally delegated elsewhere. This tailoring may be submitted in existing Program or Project Plans or equivalent documentation as part of the normal approval process provided the required signatures are obtained. Examples of existing plans include the Project Plan and the Formulation Agreement (for those that occur in Formulation). Tailoring of the product deliverables in Appendices C-1 through C-4 is expected since, as a minimum, there are products that will not be applicable to every program or project. For products required by other NASA NPDs, NPRs or Federal regulations (referenced in the tables), program or project managers, Center Directors, and MDAAs are responsible for ensuring the Institutional Authority owner agrees to the proposed change or deletion.

Table 3-1 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		R	A	R	A	I	NASA AA
Category 1,2, and 3 Projects	R	R	A	R	A	I	NASA AA
Reimbursable Space Flight Projects	R		A	R*	A	I	NASA AA

R = Recommends; A = Approves; I = Informed
* As applicable

3.5.3 A Center negotiating Reimbursable Space Flight Work for another agency shall 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 interagency Memorandum of Understanding/Memorandum of Agreement (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 must not accept the work.

3.5.4 The International System of Units (commonly known as the System Internationale (SI) or metric system of measurement) is to be used for all new space flight projects and programs, especially in cooperative efforts with International Partners. Public Laws 94-168 and 100-418 and Executive Order 12770 provide relief from this preferential use of SI if it is found that obtaining components in SI units would result in a substantial increase in cost or unacceptable delays in schedule. Each project shall perform and document an assessment to determine an approach that maximizes the use of SI. This assessment will document an integration strategy if both SI and U.S. customary units are used in a project or program. The assessment is to be completed and documented in the program/project plan no later than the SDR.

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 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 for the future portfolio, high-level make-or-buy strategy, industrial base considerations, 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. The development of an acquisition strategy will also include an analysis of the industrial base capability to design, develop, produce, support, and, if appropriate, restart an acquisition program or project as well as the mechanisms used to identify, monitor, and mitigate industrial base and supply chain risks.

Agency Baseline Commitment. 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 Agency Baseline Commitment.

Agency Program Management Council. 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 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 analysis of alternatives

broadly examines multiple elements of program/ project alternatives (including technical performance, risk, LCC, and programmatic aspects).

Announcement of Opportunity. An AO is one of two forms of NASA Broad Agency Announcement, which are forms of public/private competition. NASA solicits, accepts, and evaluates proposals submitted by NASA Centers in response to an AO. Regulatory coverage of AOs appears in NASA Federal Acquisition Regulation (FAR) Supplement (NFS) Part 1872

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

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.

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 (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 (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 Performance Review. A monthly Agency-level independent assessment to inform senior leadership of performance and progress toward the Agency's mission and program/project performance. The monthly meeting encompasses a review of crosscutting mission support issues and all NASA mission areas.

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

Basis of Estimate. The documentation of the ground rules, assumptions, and drivers used in developing the cost or schedule estimates including applicable model inputs, rationale/justification for analogies, and details supporting cost and schedule estimates.

Budget. A financial plan that provides a formal estimate of future revenues and obligations for a definite period of time for approved programs, projects, and activities. (See NPR 9420.1 and NPR 9470.1 for other related financial management terms and definitions.)

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.

Concept Documentation (formerly Mission Concept Report). Documentation that captures and communicates a feasible concept that meets the goals and objectives of the mission including results of analyses of alternative concepts, the concept of operations, preliminary risks, and potential descopes. It may include images, tabular data, graphs, and other descriptive material.

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

Confidence Level. A probabilistic assessment of the level of confidence of achieving a specific goal.

Configuration Management. A management discipline applied over a 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 Cost Analysis Data Requirement (CADRe) consists of a Part A "Narrative" and a Part B "Technical Data" in tabular form, both provided by the program/project. Also, the project team produces the project life cycle cost estimate, schedule, and risk identification, which is appended as Part C.

Decision Authority (program and project context). The individual authorized by the Agency to make important decisions on programs and projects under their authority.

Decision Memorandum. The document that summarizes the decisions made at KDPs or as necessary in between KDPs. The decision memorandum includes the Agency Baseline Commitment (if applicable), Management Agreement cost and schedule, UFE, and schedule margin managed above the project, as well as the total project cost and schedule estimate.

Decommissioning. The process of ending an operating mission and the attendant project as a result of a planned end of the mission or project termination. Decommissioning includes final delivery of any remaining project deliverables, disposal of the spacecraft and all its various supporting systems, closeout of contracts and financial obligations, and archiving of project/mission operational and scientific data and artifacts. Decommissioning does not mean that scientific data analysis ceases, only that the project will no longer provide the resources for continued research and analysis.

Derived Requirements. Requirements arising 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 operational readiness at the end of Phase D.

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.

Disposal. The process of getting rid of a project's assets, including the spacecraft and ground systems. Disposal includes the reorbiting, deorbiting, and/or passivation (i.e., the process of removing stored energy from a space structure at the end of mission that could result in an explosion or deflagration of the space structure) of a spacecraft.

Dissenting Opinion. 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 e.g., identification of risky WBS elements).

Earned Value Management System. An integrated management system and its related subsystems that allow for planning all work scope to completion; assignment of authority and responsibility at the work performance level; integration of the cost, schedule, and technical aspects of the work into a detailed baseline plan; objective measurement of progress (earned value) at the work performance level; accumulation and assignment of actual costs; analysis of variances from plans; summarization and reporting of performance data to higher levels of management for action; forecast of achievement of milestones and completion of events; forecast of final costs; and disciplined baseline maintenance and incorporation of baseline revisions in a timely manner.

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 may potentially affect or damage the environment are assessed during the Formulation 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- 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 goals; 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 Mission Support Office Director (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 provided by law to incur financial obligations that will result in expenditures. There are four basic forms of budget authority, but only two are applicable to NASA: appropriations and spending authority from offsetting collections (reimbursables and working capital funds). Budget authority is provided/delegated to programs and projects through the Agency's funds distribution process.

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

Highly Specialized Information Technology. Highly specialized Information Technology (IT) is a part of, internal to, or embedded in a mission platform. The platform's function (e.g., avionics, guidance, navigation, flight controls, simulation, radar, etc.) is enabled by IT but not driven by IT itself (e.g., computer hardware and software to automate internal functions of a spacecraft or spacecraft support system such as spacecraft control and status, sensor signal and data processing, and operational tasking.) Highly specialized IT acquisitions may include full development (where the information technology is a primary issue) to modification of existing systems (information architecture is firm and demonstrated in an operational environment) where information technology is not an issue. Real time is often critical and few opportunities exist to use Commercial Off The Shelf (COTS) or Government Off The Shelf (GOTS) beyond microprocessors and operating systems because these systems are largely unprecedented or largely unique applications. Certain IT program and projects are considered mission critical because the loss would cause the stoppage of mission operations supporting real-time, on-orbit mission operations and are identified as "highly specialized" by the Mission Directorate Associate Administrator. Highly specialized IT is largely custom, as opposed to COTS or commodity IT systems or applications and includes coding/applications that are integral parts of the research or science requirements, e.g., Shuttle Avionics Upgrade. Common engineering IT tools such as Product Life Cycle Management systems, Computer-Aided Design (CAD) systems, and collaborative engineering systems and environments are not highly specialized IT. Representative examples of highly specialized IT include: avionics software, real-time control systems, onboard processors, Deep Space Network, spacecraft instrumentation software, wind tunnel control system, human physiology monitoring systems, ground support environment, experiment simulators, Mission Control Center, and launch cameras.

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 and without any conflict of interest or inappropriate interference or influence, particularly from the organization(s) being assessed.

Industrial Base. The capabilities residing in either the commercial or government sector required to design, develop, manufacture, launch, and service the program or project. This

encompasses related manufacturing facilities, supply chain operations and management, a skilled workforce, launch infrastructure, research and development, and support services.

Information Technology. Any equipment or interconnected system(s) or 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 and 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.

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 Logistics Support. The management, engineering activities, analysis, and information management 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.

Integrated Master Schedule. A logic network-based schedule that reflects the total project scope of work, traceable to the WBS, as discrete and measurable tasks/milestones and supporting elements that are time phased through the use of valid durations and well-defined interdependencies.

Integration Plan. The integration and verification strategies for a project interface with the system design and decomposition into the lower level elements. The integration plan is structured to bring the elements together to assemble each subsystem and to bring all of the subsystems together to assemble the system/product. The primary purposes of the integration plan are: (1) To describe this coordinated integration effort that supports the implementation strategy, (2) to describe for the participants what needs to be done in each integration step, and (3) to identify the required resources and when and where they will be needed.

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. The JCL calculation includes consideration of the risk associated with all elements, regardless of whether or not they are funded from appropriations or managed outside of the project. JCL calculations include the period from KDP C through the hand over to operations, i.e., end of the on-orbit checkout.

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, deployment, prime mission operation, maintenance, support, and disposal of a project including closeout, but not extended operations. The LCC of a project or system can also be defined as the total cost of ownership over the project or system's planned life cycle from Formulation (excluding Pre-Phase A) through Implementation (excluding extended operations).

Life Cycle Review. A review of a program or project designed to provide a periodic assessment of the technical and programmatic status and health of a program or project at a key point in the life cycle, e.g., Preliminary Design Review (PDR) or Critical Design Review (CDR). Certain life cycle reviews provide the basis for the Decision Authority to approve or disapprove the transition of a program/project at a KDP to the next life cycle phase.

Loosely Coupled Programs. These programs address specific 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.

Management Agreement. The portion cost (by year) and schedule within which the program or project will complete the approved project scope along with the associated JCL, if required. The Management Agreement forms the agreement between a project manager and his/her management about what he/she will manage to, which provides the basis for NASA's performance assessment.

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.

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-Applicable Requirement. Any requirement not relevant; not capable of being applied.

Operations Concept (formerly Mission Operations Concept)**.** A description of how the flight system and the ground system are used together to ensure that the concept of operation is reasonable. This might include how mission data of interest, such as engineering or scientific data, are captured, returned to Earth, processed, made available to users, and archived for future reference. The Operations Concept should describe how the flight system and ground system work together across mission phases for launch, cruise, critical activities, science observations, and end of mission to achieve the mission.

Orbital Debris. Any object placed in space by humans that remains in orbit and no longer serves any useful function. Objects range from spacecraft to spent launch vehicle stages to components and also include materials, trash, refuse, fragments, and other objects that are overtly or inadvertently cast off or generated.

Performance Measurement Baseline. The time-phased cost plan for accomplishing all authorized work scope in a project's life cycle, which includes both NASA internal costs and supplier costs. The project's performance against the PMB is measured using earned value management, if required, or other performance measurement techniques if EVM is not required. The PMB does not include UFE.

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.

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

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

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 Procurement Strategy Meeting (PSM) addresses and documents information, activities, and decisions required by the Federal Acquisition

Regulation (FAR) and NASA Federal Acquisition Regulation Supplement (NFS) and incorporates NASA strategic guidance and decisions from the ASM strategic acquisition meeting to ensure 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 management structure that initiates and directs one or more projects. A program defines a strategic direction that the Agency has identified as critical. (See Section 2.1.2.)

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

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

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 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, safety requirements, and schedule, cost, and similar nontechnical constraints.

Project. A specific investment having defined goals, objectives, requirements, life cycle cost, a beginning, and an end. A project yields new or revised products or services that directly address NASA's strategic needs. They may be performed wholly in house; by Government, industry, or academic partnerships; or through contracts with private industry.

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 that results in a change to a project's Agency Baseline Commitment.

Reimbursable Program/Project. A project (including work, commodities, or services) for customers other than NASA for which reimbursable agreements have been signed by both the customer and NASA. The customer provides funding for the work performed on their behalf.

Replanning. The process by which a program or project updates or modifies its plans.

Reserves. Obsolete term. See Unallocated Future Expenses (UFE).

Residual Risk. The remaining risk that exists after all mitigation actions have been implemented or exhausted in accordance with the risk management process. (See NPR 8700.1)

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 the uncertainties are that are associated with the likelihood and consequences.

Risk Management. Risk management includes risk-informed decision making (RIDM) and continuous risk management (CRM) in an integrated framework. RIDM informs systems engineering decisions through better use of risk and uncertainty information in selecting alternatives and establishing baseline requirements. CRM manages risks over the course of the development and the Implementation Phase of the life cycle to ensure that safety, technical, cost, and schedule requirements are met. This is done 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*). These processes are applied at a level of rigor commensurate with the complexity, cost, and criticality of the program.

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.

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 that covers physical assets, personnel, IT, communications, and operations.

Signature. A distinctive mark, characteristic, or thing that indicates identity; one's name as written by oneself.

Single-Project Programs. These programs 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.

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. 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 this document 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.

Suppliers. Each project office is a customer having a unique, multi-tiered hierarchy of suppliers to provide it products and services. A supplier may be a contractor, grantee, another NASA Center, university, international partner, or other government agency. Each project supplier is also a customer if it has authorized work to a supplier lower in the hierarchy.

Supply Chain. The specific group of suppliers and their interrelationships that is necessary to design, develop, manufacture, launch, and service the program or project. This encompasses all levels within a space system including providers of raw materials, components, subsystems, systems, systems integrators, and services.

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 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. Part of NASA's system of checks and balances that provides 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 technical standards cited as program or project requirements) 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, voluntary consensus, and other Government documents that contain common and repeated use of rules, conditions, guidelines, or characteristics for products or related processes, production methods, and related management systems practices. (See NPR 7120.10, *Technical Standards for NASA Programs and Projects*.)

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.)

Tightly Coupled Programs. Programs with multiple projects that execute portions of a mission(s). 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.

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

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

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 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 reflecting the way in which program/project costs and schedule, technical, and risk data are to be accumulated, summarized, and reported.

APPENDIX B Acronyms

AA	Associate Administrator
ABC	Agency Baseline Commitment
ACD	Architectural Control Document
AO	Announcement of Opportunity
ASM	Acquisition Strategy Meeting
BOE	Basis of Estimate
BPR	Baseline Performance Review
CADRe	Cost Analysis Data Requirement
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
CMC	Center Management Council
COI	Conflict of Interest
CPD	Center Policy Directive
CPR	Center Procedural Requirements (also Contract Performance Report)
CRM	Continuous Risk Management
CSO	Chief Safety Officer
DA	Decision Authority (also Deputy Administrator)
DR	Decommissioning Review
DRM	Design Reference Mission
DRR	Disposal Readiness Review
EAC	Estimate at Completion
EC	Executive Council
ELV	Expendable Launch Vehicle
EOMP	End of Mission Plan
EPO	Education and Public Outreach
ETA	Engineering Technical Authority
EVM	Earned Value Management
FAD	Formulation Authorization Document
FAR	Federal Acquisition Regulation
FRR	Flight Readiness Review
GDS	Ground Data System
GFY	Government Fiscal Year
ICMC	Integrated Center Management Council
IMS	Integrated Master Schedule
IPAO	Independent Program Assessment Office
IPCE	Independent Program and Cost Evaluation
IT	Information Technology

JCL	Joint Cost and Schedule Confidence Level
JPL	Jet Propulsion Laboratory
KDP	Key Decision Point
LCC	Life Cycle Cost
LCR	Life Cycle Review
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
MOA	Memorandum of Agreement
MOS	Mission Operations System
MOU	Memorandum of Understanding
MRB	Mission Readiness Briefing
MRR	Mission Readiness Review
MSO	Mission Support Office
MSOD	Mission Support Office Director
NEN	NASA Engineering Network
NEPA	National Environmental Policy Act
NESC	NASA Engineering and Safety Center
NFS	NASA Federal Acquisition Regulation (FAR) Supplement
NID	NASA Interim Directive
NOA	New Obligation 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
ODAR	Orbital Debris Assessment Report
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
PCA	Program Commitment Agreement
PCE	Program (or Project) Chief Engineer
PDLM	Product Data and Life Cycle Management
PDR	Preliminary Design Review
PFAR	Post-Flight Assessment Review
PI	Principal Investigator

PIR	Program Implementation Review
PLAR	Post-Launch Assessment Review
PMB	Performance Measurement Baseline
PMC	Program Management Council
PPBE	Planning, Programming, Budgeting, and Execution
PRR	Production Readiness Review
PSM	Procurement Strategy Meeting
RFP	Request for Proposal
RIDM	Risk-Informed Decision Making
SAR	System Acceptance Review
SDR	System Definition Review
SEMP	Systems Engineering Management Plan
SI	Système Internationale (or metric) system of measurement
SIR	System Integration Review
SMA	Safety and Mission Assurance
SMATA	Safety and Mission Assurance Technical Authority
SMC	Strategic Management Council
SMD	Science Mission Directorate
SMSR	Safety and Mission Success Review
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 Expenses
V&V	Verification and Validation
WBS	Work Breakdown Structure

APPENDIX C Program and Project Products by Phase

The terms “Preliminary,” “Baseline,” “Initial,” and “Update” are used in Tables C-1 through C-4 with the following definitions:

“Preliminary” is the documentation of information as it stabilizes but before it goes under configuration control. It is the initial development leading to a baseline.

“Baseline” indicates putting the product under configuration control so that changes can be tracked, approved, and communicated to the team and any relevant stakeholders. The expectation on products labeled “baseline” is that they will be at least final drafts going into the designated LCR and baselined coming out of the LCR. Updates to baselined documents require the same formal approval process as the original baseline.

“Initial” is applied to products that are continuously developed and updated as the program or project matures. They are not generally put under configuration management control.

“Update” is applied to products that are expected to evolve as the formulation and implementation processes evolve.

Only expected updates are indicated below. However, any document may be updated as needed. Updates to baselined documents require the same formal approval process as the original baseline.

Table C-1 Tightly Coupled Program Milestone Products Maturity Matrix

Products	Formulation			Implementation				
		KDP 0	KDP I		KDP II		KDP III	KDP n
	SRR	SDR	PDR	CDR	SIR	ORR	FRR	DR
1. Program Plan	Preliminary	Baseline	Update	Update	Update	Update	Update	Update
1.a. Mission Directorate requirements and constraints	Baseline	Update	Update					
1.b. Traceability of program-level requirements on projects to the Agency strategic goals and Mission Directorate requirements and constraints	Preliminary	Baseline	Update					
1.c. Documentation of driving ground rules and assumptions on the program	Preliminary	Baseline	Update	Update	Update			
2. Interagency and international agreements	Preliminary	Baseline	Update					
3. ASM minutes		Final						
4. Risk mitigation plans and resources for significant risks	Initial	Update	Update	Update	Update	Update	Update	Update
5. Documented Cost and Schedule Baselines	Preliminary	Preliminary	Baseline	Update	Update	Update	Update	Update
6. Documentation of Basis of Estimate (cost and schedule)	Preliminary	Preliminary	Baseline	Update	Update	Update	Update	Update
7. JCL and supporting documentation		Preliminary	Baseline					
8. Shared Infrastructure,* Staffing, and Scarce Material Requirements and Plans	Preliminary	Baseline	Update	Update				
9. Documentation of Performance against plan/baseline, including status/closure of formal actions from previous KDP		Summary	Summary	Summary	Summary	Summary	Summary	Summary
10. Plans for work to be accomplished during next Life Cycle Phase	Plan		Plan	Plan		Plan		Plan

* Shared infrastructure includes facilities that are required by more than one of the program's projects.

Table C-2 Tightly Coupled Program Plan Control Plan Maturity Matrix

NPR 7120.5 Program Plan—Control Plans (See template in Appendix F for control plan details.)	Formulation			Implementation				
		KDP 0	KDP I		KDP II		KDP III	KDP n
	SRR	SDR	PDR	CDR	SIR	ORR	MRR/FRR	DR
1. Technical, Schedule, and Cost Control Plan	Preliminary	Baseline	Update					
2. Safety and Mission Assurance Plan	Preliminary	Baseline	Update	Update				
3. Risk Management Plan	Preliminary	Baseline	Update	Update	Update	Update	Update	
4. Acquisition Plan	Preliminary	Baseline	Update					
5. Technology Development Plan	Preliminary	Baseline	Update					
6. Systems Engineering Management Plan	Preliminary	Baseline	Update					
7. PDLM Plan		Preliminary	Update annually thereafter					
8. Verification and Validation Plan		Preliminary	Baseline	Update	Update			
9. Information Technology Plan	Preliminary	Baseline	Update					
10. Review Plan*	Baseline	Update	Update					
11. Missions Operations Plan		Preliminary	Baseline	Update		Update		
12. Environmental Management Plan		Preliminary	Baseline	Update				
13. Integrated Logistics Support Plan		Preliminary	Baseline	Update				
14. Science Data Management Plan		Preliminary	Baseline			Update		
15. Configuration Management Plan**		Preliminary	Baseline	Update				
16. Security Plan		Preliminary	Baseline					
17. Threat Summary		Preliminary	Baseline	Update	Update	Update	Update annually	
18. Export Control Plan		Preliminary	Baseline	Update				
19. Education and Public Outreach Plan		Preliminary	Baseline	Update		Update		
20. Lessons Learned Plan	Preliminary	Baseline	Update					

* Review Plan should be baselined before the first review.

** Software and hardware configuration management may be preliminary at SRR and updated at SDR.

Table C-3 Project Milestone Products Maturity Matrix

Products	Pre-Phase A KDP A	Phase A	KDP B	Phase B KDP C	Phase C	KDP D	Phase D	KDP E	Phase E KDP F	Phase F
	MCR	SRR	SDR/MDR	PDR	CDR	SIR	ORR	MRR/ FRR	DR	DRR
Headquarters and Program Products										
1. Project Plan			Preliminary	Baseline						
1.a. Applicable Agency strategic goals	Baseline	Update	Update							
1.b. Documentation of program-level requirements and constraints on the project (from the Program Plan) and stakeholder expectations, including mission objectives/goals and mission success criteria	Preliminary	Baseline	Update	Update						
1.c. Documentation of driving mission, technical, and programmatic ground rules and assumptions	Preliminary	Preliminary	Baseline	Update	Update	Update				
2. Partnerships and Inter-agency and international agreements	Preliminary	Update	Baseline U.S. partnerships and agreements	Baseline international agreements						
3. ASM minutes		Approved								
4. NEPA compliance documentation per NPR 8580.1				Baseline appropriate document per NPR 8580.1						
5. Mishap Preparedness and Contingency Plan				Preliminary		Update		Baseline (SMSR)	Update	Update
Project Technical Products[1]										
1. Concept Documentation	Baseline	Update	Update	Update						
2. Mission, Spacecraft, Ground, and Payload Architectures	Preliminary mission and spacecraft architecture(s)	Baseline mission and spacecraft architecture, preliminary ground	Update mission and spacecraft architecture,	Update mission, spacecraft, ground and						

Products	Pre-Phase A KDP A	Phase A		Phase B KDP C	Phase C KDP D		Phase D KDP E		Phase E KDP F	Phase F
	MCR	SRR	SDR/MDR	PDR	CDR	SIR	ORR	MRR/ FRR	DR	DRR
	with key drivers	and payload architectures. Classify payload(s) by risk per NPR 8705.4.	baseline ground and payload architectures	payload architectures						
3. Project-Level, System and Subsystem Requirements	Preliminary project-level requirements	Baseline project-level and system-levelrRequirements	Update Project-level and system-level requirements, Preliminary subsystem requirements	Update project-level and system-level requirements, Baseline subsystem requirements						
4. Preliminary Design Documentation			Preliminary	Baseline						
5. Operations Concept	Preliminary	Preliminary	Preliminary	Baseline			Update			
6. Technology Readiness Assessment Documentation	Initial	Update	Update	Update	Update					
7. Engineering Development Assessment Documentation	Initial	Update	Update	Update						
8. Heritage Assessment Documentation	Initial	Update	Update	Update						
9. Safety Data Packages				Preliminary	Baseline	Update	Update	Update		
10. Detailed Design Documentation					Baseline	Update				
11. As-built Hardware and Software Documentation								Baseline		
12. Verification and Validation Report							Preliminary	Baseline		
13. Operations Handbook						Preliminary	Baseline	Update		

Products	Pre-Phase A KDP A	Phase A	KDP B	Phase B KDP C	Phase C	KDP D	Phase D	KDP E	Phase E KDP F	Phase F
	MCR	SRR	SDR/MDR	PDR	CDR	SIR	ORR	MRR/ FRR	DR	DRR
14. Orbital Debris Assessment per NPR 8715.6	Preliminary ODAR			Preliminary design ODAR	Detailed design ODAR			Baseline Final ODAR (SMSR)		
15. End of Mission Plans per NPR 8715.6/NASA-STD 8719.14, App B								Baseline End of Mission Plan (SMSR)	Update EOMP annually	Update EOMP
16. Decommissioning/Disposal Plan									Baseline	Update Disposal portions
17. Mission Report									Final	
Project Management, Planning, and Control Products										
1. Formulation Agreement	Baseline for Phase A; Preliminary for Phase B		Baseline for Phase B							
2. Plans for work to be accomplished during next Implementation life cycle phase				Baseline for Phase C		Baseline for Phase D		Baseline for Phase E	Baseline for Phase F	
3. Documentation of performance against Formulation Agreement (see #1 above) OR against plans for work to be accomplished during Implementation life cycle phase (see #2 above) including performance against baselines		Summary	Summary	Summary	Summary	Summary	Summary	Summary	Summary	
4Project Baselines			Preliminary	Baseline	Update	Update	Update	Update		
4.a. Top technical, cost, schedule and safety risks, risk mitigation plans and associated resources	Initial	Update	Update	Update	Update	Update	Update	Update	Update	Update
4.b. Staffing requirements and plans	Initial	Update	Update	Update	Update		Update			

Products	Pre-Phase A KDP A	Phase A	KDP B	Phase B KDP C	Phase C KDP D		Phase D KDP E		Phase E KDP F	Phase F
	MCR	SRR	SDR/MDR	PDR	CDR	SIR	ORR	MRR/ FRR	DR	DRR
4.c. Infrastructure requirements and plans, business case analysis for infrastructure Alternative Future Use Questionnaire (Form NF 1739), per NPR 9250.1	Initial	Update	Update Baseline for NF 1739 Section A	Update Baseline for NF 1739 Section B	Update					
4.d. Schedule	Risk informed at project level with preliminary Phase D completion ranges	Risk informed at system level with preliminary Phase D completion ranges	Risk informed at subsystem level with preliminary Phase D completion ranges. Preliminary Integrated Master Schedule	Risk informed and cost- or resource-loaded. Baseline Integrated Master Schedule	Update IMS	Update IMS	Update IMS			
4.e. Cost Estimate (Risk-Informed or Schedule-Adjusted Depending on Phase)	Preliminary Range estimate	Update	Risk-informed schedule-adjusted range estimate	Risk-informed and schedule-adjusted Baseline						
4.f. Basis of Estimate (cost and schedule)	Initial (for range)	Update (for range)	Update (for range)	Update for cost and schedule estimate						
4.g.Confidence Level(s) and supporting documentation			Preliminary cost confidence level and preliminary schedule confidence level	Joint Cost and Schedule Confidence Level						
4.h.External Cost and Schedule Commitments			Preliminary for ranges	Baseline						
4.i. CADRe			Preliminary	Baseline	Update			Update	Update	

[1] These document the work of the key technical activities performed in the associated phases.

Table C-4 Project Control Plan Maturity Matrix

NPR 7120.5 Project Plan—Control Plans (see template in Appendix F for control plan details)	Pre-Phase A	Phase A	KDP B	Phase B	KDP C	Phase C	KDP D	Phase D	KDP E	Phase E	KDP F
	MCR	SRR	SDR/MDR	PDR		CDR	SIR	ORR	FRR	DR	
1. Acquisition Plan	Preliminary	Baseline	Update	Update							
2. Technical, Schedule, and Cost Control Plan	Approach for managing schedule and cost during Phase A***	Preliminary	Baseline	Update							
3. Safety and Mission Assurance Plan		Baseline	Update	Update			Update				
4. Risk Management Plan	Approach for managing risks during Phase A***	Baseline	Update	Update			Update		Update		
5. Technology Development Plan	Baseline	Update	Update	Update							
6. Systems Engineering Management Plan	Preliminary	Baseline	Update	Update							
7. Information Technology Plan		Preliminary	Baseline	Update							
8. Software Management Plan		Preliminary	Baseline	Update							
9. Verification and Validation Plan	Preliminary Approach**		Preliminary	Baseline		Update	Update				
10. Review Plan	Preliminary	Baseline	Update	Update							
11. Mission Operations Plan			Preliminary	Baseline		Update		Update			
12. Environmental Management Plan			Baseline								
13. Integrated Logistics Support Plan	Approach for managing logistics**	Preliminary	Preliminary	Baseline		Update					
14. Science Data Management Plan				Preliminary			Baseline				
15. Integration Plan	Preliminary approach**		Preliminary	Baseline		Update					

NPR 7120.5 Project Plan—Control Plans (see template in Appendix F for control plan details)	Pre-Phase A	Phase A	KDP B	Phase B KDP C	Phase C	KDP D	Phase D	KDP E	Phase E KDP F
	MCR	SRR	SDR/MDR	PDR	CDR	SIR	ORR	FRR	DR
16. Configuration Management		Baseline	Update	Update					
17. Security Plan			Preliminary	Baseline					
18. Project Protection Plan			Preliminary	Baseline	Update	Update	Update	Update	Update annually
19. Export Control Plan			Preliminary	Baseline	Update				
20. Lessons Learned Plan	Approach for managing during Phase A***		Preliminary	Baseline	Update				
21. Human Certification Rating Package	Preliminary approach **	Preliminary	Baseline	Update	Update		Update		
22. Planetary Protection Plan			Planetary Protection Certification (if required)	Baseline					
23. Nuclear Safety Launch Approval Plan			Baseline (mission has nuclear materials)						
24. Range Safety Risk Management Plan				Preliminary	Preliminary	Baseline			

*Depending on project specifics, this maturity can be done one phase earlier as specified in the Program/Project Plan

** Not the Plan, but documentation of considerations that might impact the cost and schedule baselines. May be documented in MCR briefing package.

***Not the Plan, but documentation of high-level process. May be documented in MCR briefing package.

APPENDIX D Formulation Authorization Document Template

D.1 Program FAD Title Page

Program
Formulation Authorization Document
KDP 0 Decision Memorandum

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

_____	_____
Mission Directorate Associate Administrator	Date
_____	_____
Program Manager	Date
_____	_____
Associate Administrator	Date

By signing this document, you are certifying that the content herein is acceptable as direction for managing this program (or project) and that you will ensure its implementation by those over whom you have authority.

Figure D-1 Program Formulation Authorization Document Title Page

D.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

By signing this document, you are certifying that the content herein is acceptable as direction for managing this program (or project) and that you will ensure its implementation by those over whom you have authority.

Figure D-2 Project Formulation Authorization Document Title Page

D.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 Mission Directorate Associate Administrator (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 BUDGET AND COST ESTIMATE

Identify, by fiscal year, the funding that will be committed to the program/project during each year of project Formulation. If the Formulation period is less than 5 years, provide estimated annual costs through the next 5 years. For projects, provide an estimated life cycle cost range that is consistent with this 5-year cost runout.

7.0 SCHEDULE

For each project, provide the planned date for the completion of Phase A and estimated completion of Phase B. Provide an estimated date (or range) for the completion of project development. Specify the planned prime operations period.

8.0 LIFE CYCLE REVIEWS

Specify the program and project life cycle reviews (per figures 2-3a, 2-3b and 2-4 in Chapter 2) that are required to be conducted during the Formulation Phase. Include any other requirements, e.g., the ASM, and any known unique considerations, e.g., international participation.

APPENDIX E Project Formulation Agreement Template

Project Formulation Agreement Template

Date

Approvals:

Project Manager: _____

Program Manager: _____

Center Director: _____

NASA Mission Directorate AA: _____

By signing this document, you are certifying that the content herein is acceptable as direction for managing this program (or project) and that you will ensure its implementation by those over whom you have authority.

Table of Contents

Purpose

The Formulation Agreement represents the project's response to the Formulation Authorization Document. It establishes technical and acquisition work that must be conducted during Formulation and defines the schedule and funding requirements during Phase A and Phase B for that work. The Agreement focuses on the project activities necessary to accurately characterize the complexity and scope of the project; increase understanding of requirements; and identify and mitigate high technical, acquisition, safety, cost, and schedule risks. It identifies and prioritizes the Phase A and Phase B technical and acquisition work that will have the most value and enables the project to develop high-fidelity cost and schedule range estimates at KDP B and high-fidelity cost and schedule commitments at KDP C.

The Formulation Agreement serves as a tool for communicating and negotiating the project's Formulation plans and resource allocations with the program and Mission Directorate. It allows for differences in approach between competed versus assigned missions. Variances with NPR 7120.5 tables C-3 and C-4 are identified with supporting rationale in the Agreement. The approved Agreement serves as authorization for these variances. The Agreement is approved and signed at KDP A and is updated and resubmitted for signature at KDP B. The Formulation Agreement for KDP A includes detailed Phase A information and preliminary Phase B information. The Formulation Agreement for KDP B identifies the progress made during Phase A and updates and details Phase B.

In addition, the project's Compliance Matrix for this NID to NPR 7120.5D is attached to the Formulation Agreement

1. Project Formulation Framework

Identify the project organization chart for Formulation; identify the initial project team, key personnel, and responsible Centers and partnerships (as known) that will contribute during Formulation. Define major roles and responsibilities and identify any Boards and Panels that will be used during Formulation for decision making and managing project processes.

2. Project Plan and Project Control Plans

Document the project's proposed milestones for delivery of the Project Plan and project control plans on the project schedule and provide rationale for any differences from requirements in tables C-3 and C-4 of this NID to NPR 7120.5D.

3. Project, System and Subsystem Requirements Flow Down

Document the project's proposed milestones for flow down of requirements to the project, system, and subsystem levels on the project schedule and provide rationale for any differences from requirements in tables C-3 and C-4 of this NID to NPR 7120.5D. Document the project schedule for development of any models needed to support requirements development.

4. Mission Scenario, Architectures and Interfaces

Document the project's proposed milestones for producing the mission concept, mission scenario (or design reference mission), concept of operations, and mission, spacecraft, payload, and ground systems architectures down to the level of subsystem interfaces. Include these milestones

on the project schedule and provide rationale for any differences from requirements in C-3 and C-4 of this NID to NPR 7120.5D.

Reference documentation of the feasible concept, concepts already evaluated, and plans for additional concepts to be evaluated during Formulation. Documentation should include ground rules, assumptions, and constraints used for analysis; key architecture drivers, such as redundancy; preliminary key performance parameters; top-level technical parameters and associated margins; and preliminary driving requirements. Documentation should also include feasible candidate architectures; open architecture issues and how and when those issues will be resolved; basic descriptions of each element; and descriptions of interfaces between elements.

At KDP B update the baselined concept and architecture including a preliminary definition of the operations concept and updated description of composition of payload/suite of instruments. Identify the work required to close all architecture and architectural interface issues.

5. Trade Studies

[Identify spacecraft and ground systems design trade studies planned during phases A and B, including trade studies that address performance versus cost and risk.]

6. Risk Mitigation

[Document plans for managing risks during Formulation. Identify the project's major technical, acquisition, safety, cost and schedule risks to be addressed during Formulation, including risks likely to drive the project's cost and schedule range estimates at KDP B, and cost and schedule estimates at KDP C. Describe the associated risk mitigation plans. Provide rationale for addressing these risks during Formulation.

Document the project's risk mitigation schedule and funding requirements. Include intermediate milestones and expected progress by KDP B and KDP C.]

7. Technology Readiness Assessment and Development

[Identify the specific new technologies (TRL<6) that are part of this project; their criticality to the project's objectives, goals, and success criteria; and the current status of each planned technology development, including TRL level, and associated risks. Describe the specific activities and risk mitigation plans, the responsible organizations, models, and key tests to ensure that the technology maturity reaches TRL 6 by PDR.

Identify off-ramp decision gates and strategies for ensuring there are alternative development paths available if technologies do not mature as expected. Identify potential cost, schedule, or performance impacts if the technology developments do not reach the required maturity levels. Provide technology development schedules, including intermediate milestones and funding requirements, during Phases A and B for each identified technology development to achieve TRL 6 by PDR. Describe expected status of each technology development at SRR, MDR/ SDR and PDR. Reference the preliminary or final Technology Development Plan for details as applicable. Describe how the program will transition technologies from the development stage to manufacturing, production, and insertion into the end system. Identify any potential costs and

risks associated with the transition to manufacturing, production, and insertion. Develop and document appropriate mitigation plans for the identified risks.]

8. Engineering Development Assessment, Prototyping and Software Models

[Identify major engineering development risks and any engineering prototyping or software model development that needs to be accomplished during phases A and B to reduce development risk (Engineering development risks include components and assemblies that have not been previously built or flown in the planned environment or that have been significantly modified in functionality, interfaces, power consumption, size, or use of materials.). Provide rationale and potential impacts to project performance, cost and schedule if development risks are not addressed. Describe the scope of the prototyping and modeling activities and the expected reduction of cost and risk by performing this work during Formulation. Include the project's testing philosophy, including functional, environmental, and qualification testing, and any life testing and protoflight test plans, and rationale.

Describe the prototypes and software models to be built, their fidelity (form, fit and function, etc.), test environments and objectives, and test dates. Identify any design alternatives if irresolvable problems are encountered.

Provide prototype and software model development and test schedules, including intermediate milestones and funding requirements during phases A and B. Describe expected status and accomplishments for each prototype or software model at SRR, MDR/ SDR and PDR.]

Focus during Phase A should be on component and subassembly prototypes built to approximately the correct size, mass and power, with “flight-like” parts and materials, and tested in a laboratory environment over the extremes of temperature and radiation (if relevant). Focus during Phase B should be on testing form, fit, and function prototypes over the extremes of what will be experienced during flight.

Identify key performance parameters, associated modeling methodologies and methods for tracking KPPs throughout formulation.

9. Heritage Assessment and Validation

[Identify the major heritage hardware and software assumptions and associated risks and the activities and reviews planned to validate those assumptions during Formulation. Identify schedule and funding requirements for those activities.]

10. Acquisition Strategy and Long-lead Procurements

Identify acquisition and partnership plans during Formulation. Document the project’s proposed milestones for in-house work and procurements, including completing any Contract Statements of Work (SOW) and Requests for Proposal (RFP) during the Formulation phase. Identify long-lead procurements to be initiated, and provide associated rationale. Identify anticipated partnerships (other government agencies, U.S. and foreign partners), if any, including roles and contributed items and plans for getting commitments for contributions and finalizing open inter-agency agreements, domestic partnerships, and foreign contributions. Point to the preliminary or final Acquisition Plan for details as applicable.

Identify major acquisition risks, including long-lead procurement risks and partnership risks.

Identify funding requirements for procurement activities, long-lead procurements, and partnerships.

11. Formulation Phase Reviews

[Identify and provide schedules for the project life cycle reviews (SRR, SDR/MDR), and the system and subsystem-level reviews to be held during Formulation. Include inheritance reviews, prototype design reviews, technology readiness reviews, fault protection reviews, etc. necessary to reduce risk and enable more accurate cost and schedule range estimates at KDP B and more accurate cost and schedule estimates at KDP C.]

12. Formulation Phase Cost and Schedule Estimates

[Document the project's Formulation Phase schedule and phased funding requirements, including cost and schedule margins, aligned with the project WBS. Identify the critical path. Ensure that all funding requirements in this Agreement are included and clearly identifiable. Summarize funding requirements both in dollars and estimated percent of total development costs (A –D excluding launch vehicle).

Ensure that the schedules for all technology development, engineering prototyping, procurement and risk mitigation activities and milestones identified in this Agreement are included and clearly identifiable. Provide schedule details to the appropriate level to justify Formulation funding requirements (typically subsystem level).

Include any additional milestones required in tables C-3 and C-4 in this NID to NPR 7120.5D.]

13. Other provisions:

[TBS]

APPENDIX F Program Commitment Agreement Template

F.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.

_____	_____
Program Manager	Date
_____	_____
Center Director(s)	Date
_____	_____
Mission Directorate Associate Administrator	Date
_____	_____
Associate Administrator	Date

By signing this document, you are certifying that the content herein is acceptable as direction for managing this program (or project) and that you will ensure its implementation by those over whom you have authority.

Figure E-1 Program Commitment Agreement Title Page

F.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 Program Management Councils (PMCs) 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 NPR.

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 strategic goals and outcomes 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 .
3. Target date or timeframe for the PDR 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. Either reference the most recent Agency budget to provide the first five years of the estimated program cost or provide the budget required for the next five years. The cost range should be updated when program content changes, such as the addition of new projects entering Implementation or when the estimated cost changes. 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 F, Section 3.4) to reflect the results of the Agency strategic acquisition and partnering process and the Acquisition Strategy Meeting (ASM).

8.0 HIGH RISK AREAS

Identify the areas of highest risk for the program (covering safety, technical, institutional, cost, and schedule issues) in which failure may result in changes to the program/project baseline cost, schedule, safety, 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 program and project life cycle reviews (per figures 2-3a, 2-3b and 2-4 in Chapter 2) that are required to be conducted during the Implementation Phase. Include any other

requirements, e.g., the ASM, and any known unique considerations, e.g., international participation.

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 a 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 E-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 E-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 G Program Plan Template

G.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 Agreement commitments of the program, including identifying the high-level requirements on both the program and each constituent project. These requirements on the project 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 Agreement commitments.

In this Program Plan template, all subordinate plans, collectively called control plans, are required unless they are not applicable. 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. If a control plan is not applicable to a particular program, indicate that by stating it is not applicable in the appropriate section and provide a rationale. 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 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. In addition, the program's Compliance Matrix for this NID to NPR 7120.5D is attached to the Program Plan.

The approval signatures of MDAA, the Center Director, and the program manager certify that the program plan implements all the Agency's applicable institutional requirements or that the owner of those requirements, e.g., Safety and Mission Assurance, have agreed to the modification of those requirements contained in the Program Plan.

G.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

By signing this document, you are certifying that the content herein is acceptable as direction for managing this program (or project) and that you will ensure its implementation by those over whom you have authority.

Figure F-1 Program Plan Title Page

G.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 strategic goals and to Mission Directorate strategic goals and objectives. Program performance goals and their relationship to NASA program goals 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 driving ground rules and assumptions, and 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, Acquisition Plan of this document (below) or provide the following information here:

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

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:

The Center where the program manager resides.

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 Mission Directorate 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 Mission Directorate, 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 applicable guidance or direction from the ASM review, 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 BASELINES

2.1 Requirements Baseline

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.

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).

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 threshold science requirements. State each requirement in objective, quantifiable, and verifiable terms. Identify the project's principal schedule milestones, including Preliminary Design Review (PDR), Critical Design Review (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 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 Work Breakdown Structure (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, life cycle reviews, and KDPs throughout the program life cycle. The summary schedule should include the logical relationships (interdependencies) for the various program elements and projects and critical paths, as appropriate. Identify driving ground rules, assumptions, and constraints affecting the schedule baseline.

2.4 Resource Baseline

Present the program's funding requirements by fiscal year. State the New Obligation Authority (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 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.

Identify driving ground rules, assumptions, and constraints affecting the resource baseline.

Document the project Commitment Baselines.

2.5 Joint Cost and Schedule Confidence Level

For implementation and beyond for single project and tightly coupled programs, 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:

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

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 baseline and threshold values for the performance metrics to be achieved at each Key Decision Point (KDP), as appropriate. In addition, document the mission success criteria associated with the program-level requirements that, if not met, trigger consideration of a Termination Review.

For tightly coupled programs, describe the approach to monitor and control the project's Agency Baseline Commitment (ABC). Describe how the project will periodically report performance. Describe mitigation approach if the project is exceeding the development cost documented in the ABC to enable corrective action prior to triggering the 30 percent breach threshold. Describe how the project will support a baseline review in the event the DA directs one.

Describe how the program will implement the SI and other systems of measurement and the identification of units of measure in all product documentation. Where full implementation of the SI system of measurement is not practical, hybrid configurations (i.e., a controlled mix of SI/non-SI system elements) may be used to support maximum practical use of SI units for design, development and operations. Where hybrid configurations are used, describe the specific requirements established to control interfaces between elements using different measurement systems.

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

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

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.

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

Describe how the program will utilize its technical and schedule margins and Unallocated Future Expense (UFE) to control the Management Agreement.

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

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 Standard for Software Assurance*; 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 problems 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 Agency strategic acquisition and partnering process and the ASM. The elements of the program Acquisition Plan should be reflected in any resulting Procurement Strategy Meeting (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:

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 PSM.

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.

Describe the state of the industrial base capability and identify potential critical and single-source suppliers needed to design, develop, produce, support, and, if appropriate, restart an acquisition program or project. The acquisition plan should promote sufficient program/project stability to encourage industry to invest, plan, and bear their share of risk. Describe the internal and external mechanisms and procedures used to identify, monitor, and mitigate industrial base and supply chain risks. Include data reporting relationships to allow continuous surveillance of the entire supply chain that provides for timely notification and mitigation of potential risks associated with the industrial base or supply chain. Describe the process for reporting industrial base and supply chain risks to the MDAA.

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

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

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 the NASA Federal Acquisition Regulation Supplement (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:

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

(b) 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.

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.

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

Describe how the project will transition technologies from the development stage to the manufacturing and production phases. Identify the supply chain needed to manufacture the technology and any costs and risks associated with the transition to the manufacturing and production phases. Develop and document appropriate mitigation plans for the identified risks.

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

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

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.

Describe the program's technology utilization plan that meets the requirements of NPD 7500.2, NASA Innovative Partnerships Program and NPR 7500.1, NASA Technology Commercialization Process.

Describe how the program will transition technologies from the development stage to manufacturing, production, and insertion into the end system. Identify any potential costs and risks associated with the transition to manufacturing, production, and insertion. Develop and document appropriate mitigation plans for the identified risks.

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 PDLM Plan

Document agreement among the program manager and various providers of Product Data and Life Cycle Management (PDLM) services on how the identified PDLM capabilities will be provided and how authoritative data will be managed effectively by tightly coupled and single-project programs in compliance with NPR 7120.9.

3.8 Verification and Validation Plan

Summarize the approach for performing verification and validation of the program products. Indicate the methodology to be used in the verification/validation (test, analysis, inspection, or demonstration) as defined in NPR 7123.1, *NASA Systems Engineering Processes and Requirements.*

3.9 Information Technology Plan

Describe how the program will acquire and use information technology, addressing the following:

a. 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*.

b. 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.*

c. Document the program's approach to implementing IT security requirements in accordance with NPR 2810.1, *Security of Information Technology.*

d. Describe the steps the program will take to ensure that the information technology it acquires and/or uses will comply with NPR 2830.1, *NASA Enterprise Architecture Procedures*

3.10 Review Plan

Summarize the program's approach for conducting a series of reviews including internal reviews and program life cycle reviews. In accordance with Center best practices, MD review requirements, and the requirements in NPR 7123.1, *NASA Systems Engineering Processes and Requirements* and NPR 7120.5, *NASA Space Flight Program and Project Management Requirements*, provide the names, purposes, content, and timing of the life cycle reviews.

Identify any deviations from these documents that the program is planning. 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 life cycle 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. For each program life cycle review and Key Decision Point (KDP), document the sequencing of the associated project life cycle reviews and KDPs, i.e., whether the associated project life cycle reviews and KDPs precede or follow the program life cycle review and KDP. In addition, document which projects should proceed to their KDPs together, which projects should proceed to their KDPs simultaneously with the program KDP, and which projects may proceed to their KDPs as individual projects.

The sequencing of project life cycle reviews and KDPs with respect to program life cycle reviews and KDPs is especially important for project PDR life cycle reviews that precede KDP Cs. At KDP C, the Agency makes project technical, cost, and schedule commitments to its external stakeholders at the established JCL in accordance with NPR 7120.5 requirements. Since changes to one project can easily impact other projects' technical, cost, schedule and risk baselines, projects and their program may need to proceed to KDP C/KDP I together.

3.11 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:

MOS and GDS human resources and training requirements.

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

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

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

Software (ground-based software and associated documentation).

3.12 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.

3.13 Integrated Logistics Support 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.

3.14 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 definitions 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*.

3.15 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.

3.16 Security Plan

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

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.

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.

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.

3.17 Threat Summary

Threat summaries attempt to document the threat environment that a NASA space system is most likely to encounter as it reaches operational capability. These documents contain Top Secret/Sensitive Compartmented Information and are the basis for establishing threat levels that the program office will use to develop survivability strategies and risk avoidance or mitigation measures. Threat summaries draw their information from intelligence community documents and address all segments of a space system with emphasis on the space segment. Whenever possible coordinated intelligence community documents, i.e., National Intelligence Estimates and Intelligence Community Briefs are used as reference sources in writing the summaries. Where there is a difference of opinion between organizations about a threat, the threat summary will give a range of threat estimates and identify each agency's position.

3.18 Export Control Plan

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

3.19 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:

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

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

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.

3.20 Lessons Learned Plan

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

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.

5.0 CHANGE LOG

Record changes in the Program Plan.

6.0 APPENDICES

Appendix A Acronyms

Appendix B Definitions

Appendix Compliance Matrix for this NID to NPR 7120.5D

APPENDIX H Project Plan Template

H.1 Template Instructions

The Project Plan is an agreement among the project manager, program manager, Center Director, and 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 unless they are not applicable. 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. If a control plan is not applicable to a particular project, indicate that by stating it is not applicable in the appropriate section and provide a rationale. 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. In addition, the project's Compliance Matrix for this NID to NPR 7120.5D is attached to the Project Plan.

The approval signatures of MDAA, the Center Director, program manager and project manager certify that the Project Plan implements all the Agency's applicable institutional requirements or that the owner of those requirements, e.g., Safety and Mission Assurance, have agreed to the modification of those requirements contained in the Project Plan.

H.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

By signing this document, you are certifying that the content herein is acceptable as direction for managing this program (or project) and that you will ensure its implementation by those over whom you have authority.

Figure G-1 Project Plan Title Page

H.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. Identify program requirements and constraints on the project. Provide clear traceability to applicable Agency strategic goals.

1.3 Mission Description and Technical Approach

Describe briefly the mission and the mission design. Include mission objectives and goals, mission success criteria, and driving ground rules and assumptions affecting the mission and mission design. Identify 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 driving technical ground rules and assumptions, and 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 Center Management Council (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 Mission Directorate, other participating Centers, and other participating organizations. Illustrate the organization graphically.

Describe briefly the implementation approach of the project, including any applicable guidance or direction from the ASM review, 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 BASELINES

Project baselines (set of requirements, cost (including project-held UFE), schedule, and technical content that forms the foundation for program/project execution and reporting done as part of NASA's performance assessment and governance process) form the basis for the Management Agreement, which is presented in preliminary form at KDP B and then approved at KDP C in the KDP C Decision Memorandum. The latest approved Decision Memorandum is attached to the Project Plan.

The Management Agreement is generally a summary of these project baselines and is updated as required in accordance with paragraph 2.5 of this NID to NPR 7120.5 when changes warrant such action.

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 C of this NID to NPR 7120.5.)

2.3 Schedule Baseline

Present a summary of the project's integrated master schedule (IMS), including all critical milestones, major events, life cycle reviews, and KDPs throughout the project life cycle. The summary schedule should include the logical relationships (interdependencies) for the various project elements and critical paths, as appropriate. Identify driving ground rules, assumptions, and constraints affecting the schedule baseline.

2.4 Resource

Present the project funding requirements by fiscal year. State the New Obligation Authority (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 C of this NID to NPR 7120.5D.) 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 NPD 1000.5 and this NID to 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.

Identify driving ground rules, assumptions, and constraints affecting the resource baseline.

2.5 Joint Cost and Schedule Confidence Level

For Implementation and beyond of projects with an estimated LCC greater than $250 million, 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:

Describe the plan to monitor and control the project requirements, technical design, schedule, and cost of the project to ensure that the high-level requirements levied on the project are met.

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.

Describe the approach to monitor and control the project's Agency Baseline Commitment (ABC). Describe how the project will periodically report performance. Describe mitigation approach if the project is exceeding the development cost documented in the ABC to take corrective action prior to triggering the 30 percent breach threshold. Describe how the project will support a baseline review in the event the DA directs one.

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

Describe how the project will implement the SI and other systems of measurement and the identification of units of measure in all product documentation. Where full implementation of the SI system of measurement is not practical, hybrid configurations (i.e., a controlled mix of SI/non-SI system elements) may be used to support maximum practical use of SI units for design, development and operations. Where hybrid configurations are used, describe the specific requirements established to control interfaces between elements using different measurement systems.

Describe the project's implementation of Earned Value Management (EVM) including:

(1) How the PMB will be developed and maintained for the project and how UFE will be established and controlled.

(2) The methods the project will use to authorize the work and to communicate changes for the scope, schedule, and budget of all suppliers. This plan is updated as make-buy decisions and agreements are made.

(3) The process to be used by the project to communicate the time-phased levels of funding that have been forecast to be made available to each supplier.

(4) For the class of suppliers not required to use EVM, the schedule and resource information required of the suppliers to establish and maintain a baseline and to quantify schedule and cost variances.

(5) How the cost and schedule data from all partners/suppliers will be integrated to form a total project-level assessment of cost and schedule performance.

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).

Describe the process for monitoring and controlling the IMS.

Describe the process for utilizing the project's technical and schedule margins and UFE to meet the Management and Commitment Baselines.

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.

Describe the project's internal processes for addressing technical waivers and deviations and handling dissenting opinions.

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.

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-level 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 Standard for Software Assurance*; 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 Agency strategic acquisition and partnering process 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:

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).

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.

Describe the supply chain and identify potential critical and single-source suppliers needed to design, develop, produce, support, and, if appropriate, restart an acquisition program or project. The acquisition plan should promote sufficient program/project stability to encourage industry to invest, plan, and bear their share of risk. Describe the internal and external mechanisms and procedures used to identify, monitor, and mitigate supply chain risks. Include data reporting relationships to allow continuous surveillance of the supply chain that provides for timely notification and mitigation of potential risks. Describe the process for reporting supply chain risks to the program.

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

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

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:

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

(b) 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.

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.

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

Describe how the project will transition technologies from the development stage to the manufacturing and production phases. Identify the supply chain needed to manufacture the technology and any costs and risks associated with the transition to the manufacturing and production phases. Develop and document appropriate mitigation plans for the identified risks.

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

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

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.

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 Information Technology Plan

Describe how the project will acquire and use information technology, addressing the following:

Document the project's approach to implementing IT security requirements in accordance with NPR 2810.1, Security of Information Technology. Place special emphasis on describing how the project will meet the following requirements:

(1) Conduct the Information/System Security Categorization required by NPR 2810.1 for IT systems during Phase A of the project.

(2) Perform the IT system risk assessment required by NPR 2800.1, Security of Information Technology during Phase B of the project.

(3) Document and implement all technical, management, and operational security controls as required by NPR 2810.1 for IT systems during Phase D of the project.

(4) Meet the IT security certification and accreditation requirements specified in NPR 2810.1 for IT systems during Phase D of the project.

(5) Conduct an annual IT security assessment of IT systems in conformance to the requirements of NPR 2810.1 during Phase E of the project.

Describe the steps the project will take to ensure that the information technology it acquires and/or uses will comply with NPR 2830.1, NASA Enterprise Architecture Procedures.

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.

3.8 Software 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.

3.9 Verification and Validation Plan

Summarize the approach for performing verification and validation of the project products. Indicate the methodology to be used in the verification/validation (test, analysis, inspection or demonstration) as defined in NPR 7123.1, *NASA Systems Engineering Processes and Requirements*.

3.10 Review Plan

Summarize the project's approach for conducting a series of reviews, including internal reviews and project life cycle reviews. In accordance with Center best practices, program review requirements, and the requirements in NPR 7123.1, *NASA Systems Engineering Processes and Requirements* and NPR 7120.5, *NASA Space Flight Program and Project Management Requirements*, provide the names, purposes, content, and timing of the life cycle reviews.

Identify any deviations from these documents that the project is planning. Provide the technical, scientific, schedule, cost, and other criteria that will be utilized in the consideration of a Termination Review.

For projects that are part of tightly coupled programs, project life cycle reviews and KDPs should be planned in accordance with the project life cycle and KDP sequencing guidelines in the Program Plan. Document the sequencing of each project life cycle review and KDP with respect to the associated Program life cycle review and KDP. In addition, document which project KDPs should be conducted simultaneously with other projects' KDPs, and which project KDPs should be conducted simultaneously with the associated program KDPs.

The sequencing of project life cycle reviews and KDPs with respect to program life cycle reviews and KDPs is especially important for project PDR life cycle reviews that precede KDP Cs. At KDP C, the Agency makes project technical, cost and schedule commitments to its external stakeholders at the established JCL in accordance with NPR 7120.5 requirements. Since changes to one project can easily impact other projects' technical, cost, schedule and risk baselines, projects and their program may need to proceed to KDP C/KDP I together.

3.11 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:

MOS and GDS human resources and training requirements.

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

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

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

Software (ground-based software and associated documentation).

3.12 Environmental Management Plan

Describe the activities to be conducted with support from the responsible Environmental Management Office to comply with NPR 8580.1, *Implementing the National Environmental Policy Act and Executive Order 12114*. Specifically:

Identify all required permits, waivers, documents, approvals, or concurrences required for compliance with applicable Federal, State, Tribal Government, and local environmental regulations.

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.

Insert into the project schedule the critical milestones associated with complying with these regulations.

3.13 Integrated Logistics Support Plan

Describe how the project will implement NPD 7500.1, *Program and Project Logistics Policy.* The Integrated Logistics Support Plan should include a maintenance and support concept and define an integrated logistics support 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.

3.14 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.

3.15 Integration Plan

Prepare an integration plan that defines the integration and verification strategies for a project interface with the system design and decomposition into the lower level elements. The integration plan is structured to bring the elements together to assemble each subsystem and to bring all of the subsystems together to assemble the system/product. The primary purposes of the integration plan are: (1) to describe this coordinated integration effort that supports the implementation strategy, (2) to describe for the participants what needs to be done in each integration step, and (3) to identify the required resources and when and where they will be needed.

3.16 Configuration Management

Describe the configuration management (CM) approach that the project team will implement, consistent with NPR 7123.1 and NASA-STD-0005. 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.

3.17 Security Plan

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

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.

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.

3.18 Project Protection Plan

Ensure that a Project Protection Plan is completed according to the schedule identified in Table C-4 of this document. Project Protection Plans are classified documents (Secret) and have three purposes:

Project Protection Plans document the survivability strategy(ies) used by a project, identify the valid threats and corresponding vulnerabilities to a mission, and recommend potential countermeasures to ensure the protection of the infrastructure elements that support a NASA space system.

Protection plans provide project management personnel (project managers, project scientists, mission systems engineers, operations managers, and the user community, etc.) with an interface management tool to identify to institutional security providers (both internal and external to NASA) the critical nodes and single points-of-failure in their space system(s).

Protection plans provide technical information on NASA space systems to specific commands and agencies in the Department of Defense (DOD) and Intelligence Community (IC) to assist those organizations in providing timely support to NASA in the event of an incident involving one of our missions.

3.19 Export Control Plan

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

3.20 Lessons Learned Plan

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

3.21 Human Rating Certification Package

For human space flight missions, develop a Human Rating Certification Package per NPR 8705.2, *Human Rating Requirements for Space Systems*. Human rating certification focuses on the integration of the human into the system, preventing catastrophic events during the mission, and protecting the health and safety of humans involved in or exposed to space activities, specifically the public, crew, passengers, and ground personnel.

3.22 Planetary Protection Plan

Prepare a plan that specifies management aspects of the planetary protection activities of the project. Planetary protection encompasses: (1) the control of terrestrial microbial contamination associated with space vehicles intended to land, orbit, flyby, or otherwise encounter extraterrestrial solar system bodies, and (2) the control of contamination of the Earth by extraterrestrial material collected and returned by missions. The scope of plan contents and level of detail will vary with each project based upon the requirements in NASA policies NPR

8020.12, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*, and NPD 8020.7, *Biological Contamination Control for Outbound and Inbound Planetary Spacecraft*.

3.23 Nuclear Safety Launch Approval Plan

Prepare a nuclear safety launch approval plan for any U.S. space mission involving the use of radioactive materials. Procedures and levels of review and analysis required for nuclear launch safety approval vary with the quantity of radioactive material planned for use and potential risk to the general public and the environment. NPR 8715.3, *NASA General Safety Program Requirements*, specifies the procedural requirements for characterizing and reporting potential risks associated with a planned launch of radioactive materials into space, on launch vehicles and spacecraft, and during flight.

3.24 Range Safety Risk Management Plan

Develop a plan and documentation that details the Range Safety Risk Management process in accordance with NPR 8715.5, *Range Safety Progr*am that defines the protection of the public, workforce, and property during range operations associated with flight. The Range Safety Risk Management plan is developed for projects that operate and use launch ranges for the purpose of launching, flying, landing, and testing space and aeronautical vehicles, and associated technologies.

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.

5.0 CHANGE LOG

Track and document changes to the Project Plan.

6.0 APPENDICES

Appendix A Acronyms

Appendix B Definitions

Appendix Compliance Matrix for this NID to NPR 7120.5D