

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

Chapter 4. Program and Project Requirements by Phase

4.1 Programs—Formulation Phase

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

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

- a. For all programs—
 - (1) Plan, prepare for, and support the Acquisition Strategy Meeting (ASM) prior to partnership commitments and obtain the ASM minutes.
 - (2) Support the MDAA in developing and obtaining approval of the FAD, PCA, and appropriate annual budget submissions.
 - (3) Prepare and obtain approval of the Program Plan that follows the template in Appendix E. (See Table 4-2 for a list of required Program Plan Control Plans and their required maturity.)
 - (4) Support the MDAA and the NASA HQ Office of External Relations in obtaining approved inter-agency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation in reviews, integration and test, and risk management).
 - (5) Document the traceability of program requirements on individual projects to Agency needs, goals, and objectives, as described in the NASA Strategic Plan.
 - (6) Initiate the development of technologies that cut across multiple projects within the program.
 - (7) Prior to the program life cycle formulation reviews shown in Figure 2-3, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

- (8) Plan, prepare for, and support the program life cycle formulation reviews shown in Figure 2-3 in accordance with NPR 7123.1, Center practices, and the requirements of this document.
 - (9) If required by the DA, obtain KDP 0 readiness products as shown in Table 4-1.
 - (10) If required by the DA, plan, prepare for, and support the governing PMC review prior to KDP 0.
 - (11) Obtain KDP I readiness products as shown in Table 4-1.
 - (12) Plan, prepare for, and support the governing PMC review prior to KDP I.
- b. For *single-project* and *tightly coupled programs*, implement the requirements in paragraphs 4.3.2 and 4.4.2 (Pre-Phase A and Phase A) with the following stipulations:
- (1) In *single-project programs*, the Project Plan may serve as the Program Plan and KDP 0 (if required by the DA) and KDP I serve in lieu of KDP A and KDP B, respectively. In keeping with this, single-project programs are approved for implementation at KDP II. (At the discretion of the MDAA, there may also be a Project Plan separate from the Program Plan. In either case, all content required in Program and Project Plan templates must be included.)
 - (2) In *tightly coupled programs*, separate Project Plans are prepared for projects during their formulation. The program manager may allocate portions of the Program Plan to these individual Project Plans.

Table 4-1 Program Gate Products Maturity Matrix

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

Table 4-2 Program Plan Control Plan Maturity Matrix

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

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

4.2 Programs—Implementation Phase

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

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

a. *For all programs—*

- (1) Execute the Program Plan.
- (2) Support the MDAA in updating the PCA, as appropriate.
- (3) Update the Program Plan at KDP II and other KDPs, as appropriate. See Table 4-2 for a list of required Program Plan Control Plans and their required maturity.
- (4) Support the MDAA and the NASA HQ Office of External Relations in obtaining updated inter-agency and international agreements (including the planning and negotiation of updated agreements and recommendations on joint participation in reviews, integration and test, and risk management).
- (5) Conduct planning, program-level systems engineering, and integration, as appropriate, to support the MDAA in initiating the project selection process.
- (6) Support the MDAA in the selection of projects, either assigned or through a competitive process.

- (7) Approve project FADs and Project Plans.
- (8) Prior to the program life cycle implementation reviews shown in Figure 2-3, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- (9) Plan, prepare for, and support the program life cycle implementation reviews shown in Figure 2-3 in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- (10) Maintain programmatic and technical oversight of the projects within the program and report their status periodically.
- (11) Review and approve annual project budget submission inputs and prepare annual program budget submissions.
- (12) Continue to develop technologies that cut across multiple projects within the program.
- (13) Obtain KDP readiness products as shown in Table 4-1.
- (14) Conduct program-level completion activities for each project in accordance with the project life cycle for Phase F (see paragraph 4.9.2).

b. For *single-project programs*—

- (1) For KDP II, implement the requirements in paragraph 4.5.2 (Phase B).
- (2) For KDP III, implement the requirements of paragraph 4.6.2 (Phase C).
- (3) For KDP IV, implement the requirements of paragraph 4.7.2 (Phase D).
- (4) For KDP V, implement the requirements of paragraph 4.8.2 (Phase E).

c. For *tightly coupled programs*—

- (1) For KDP II, implement the requirements in paragraph 4.5.2 (Phase B) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).
- (2) For KDP III, implement the requirements in paragraph 4.6.2 (Phase C) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).
- (3) For KDP IV, implement the requirements of paragraph 4.7.2 (Phase D) in the manner documented in the Program Plan (except those requirements allocated to specific projects and documented in their Project Plans).

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

4.3 Projects—Pre-Phase A

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

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

- a. Support Headquarters and program activities, in particular —
 - (1) Obtain an approved project FAD.
 - (2) Support the program manager and the MDAA in the development of the draft program requirements on the project.
- b. Perform technical activities—
 - (1) Develop and document preliminary mission concept(s).
 - (2) Prior to the project independent life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.
 - (3) Plan, prepare for, and support the project independent life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- c. Perform project planning, costing, and scheduling activities—
 - (1) Develop and document a *draft* Management Baseline for all work to be performed by the project that includes the following:
 - (i) A high-level Work Breakdown Structure (WBS) consistent with the NASA standard space flight project WBS (Appendix G), a schedule, and a rough-order-of-magnitude cost estimate and cost range. Document the basis for the cost estimate and range.
 - (ii) An assessment of potential technology needs versus current and planned technology readiness levels, as well as potential opportunities to use

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

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

(iv) Identification of potential partnerships.

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

d. Conduct KDP readiness activities—

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

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

Table 4-3 Project Gate Products Maturity Matrix

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

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

* See Section 4.5.2a (2) for exceptions.

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

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

4.4 Projects—Phase A

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

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

- a. Support Headquarters- and program-related activities—
 - (1) Support the program manager and the MDAA in the development of the baseline program requirements on the project.¹⁷
 - (2) Plan, prepare for, and support the Acquisition Strategy Meeting (ASM) prior to partnership agreements and obtain the ASM minutes.
 - (3) Support the program manager, the MDAA, and the NASA HQ Office of External Relations in initiating inter-agency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation in reviews, integration and test, and risk management).
- b. Perform technical activities—
 - (1) Develop preliminary system-level (and lower level, as needed) requirements.
 - (2) Develop and document a baseline mission concept (including key risk drivers and mitigation options and mission descope options).
 - (3) Develop a preliminary mission operations concept.
 - (4) Initiate technology developments, as required.

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

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

- (5) Develop an initial orbital debris assessment in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA-STD-8719.14, *Process for Limiting Orbital Debris*.
 - (6) Prior to the project independent life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.
 - (7) Plan, prepare for, and support the project independent life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- c. Perform project planning, costing, and scheduling activities—
- (1) As early as practical, prepare and finalize Phase A work agreements.
 - (2) Prepare a *preliminary* Project Plan that follows the template in Appendix F. See Table 4-4 for a list of the Control Plans and their required maturity by phase.

Table 4-4 Project Plan Control Plan Maturity Matrix

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

- (3) For contracts requiring Earned Value Management (EVM) (refer to the NASA FAR Supplement), conduct required Integrated Baseline Reviews (IBRs).
- (4) For all flight projects, provide a draft Cost Analysis Data Requirement (CADRe) (Parts A, B, C) consistent with the NASA Cost Estimating Handbook (CEH) 60 days prior to the KDP B milestone with a final version 30 days after the KDP event to reflect any decisions from the KDP. This CADRe is based on the SDR/PNAR Management Baseline. (Note: For competed projects, a copy of the winning proposal and concept study report is acceptable.)
- (5) Develop and document a *preliminary* Management Baseline for all work to be performed by the project, noting the following:
 - (i) The project's preliminary Management Baseline is consistent with the NASA standard space flight project WBS (see Appendix G) and has an associated WBS dictionary.
 - (ii) The project's preliminary Management Baseline includes a preliminary integrated master schedule, preliminary life cycle cost estimate, workforce estimates, and the project's technical baseline/mission concept, all consistent with the program requirements levied on the project.
 - (iii) The preliminary life cycle cost estimate is based on the project's technical baseline/mission concept and preliminary integrated master schedule.
 - (iv) The preliminary life cycle cost estimate uses the latest accounting guidance and practices.
 - (v) The preliminary life cycle cost estimate including UFE, along with confidence level and a cost and risk analysis.
 - (vi) The preliminary life cycle cost estimate is time-phased by Government Fiscal Year (GFY) to WBS Level 2.
- (6) Complete a *preliminary* business case analysis for infrastructure for each proposed project real property infrastructure investment consistent with NPD 8820.2, *Design and Construction of Facilities* and NPR 8820.2, *Facility Project Requirements*, and for the acquisition of new aircraft consistent with NPR 7900.3, *NASA Aircraft Operations Management*.¹⁸

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

- (7) Work with the appropriate NASA Headquarters offices to initiate the development of MOUs/MOAs with external partners, as needed.
- (8) Obtain a planetary protection certification for the mission (if required) in accordance with NPD 8020.7, *Biological Contamination Control for Outbound and Inbound Planetary Spacecraft*, and NPR 8020.12, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*.
- (9) Develop a Nuclear Safety Launch Approval Plan (for missions with nuclear materials) in accordance with NPR 8715.3, *NASA General Safety Program Requirements*.
- (10) Prepare and finalize work agreements for Phase B.
- (11) Prepare for approval by the program manager a list of long-lead procurements that need to be procured in Phase B.
- (12) In accordance with NPR 2190.1, *NASA Export Control Program*, support the appropriate NASA export control officials to identify and assess export-controlled technical data that potentially will be provided to foreign partners and the approval requirements for release of that data, all as a part of developing the project's Export Control Plan.
- (13) In coordination with the OCFO and in accordance with NPR 9250.1, *Property, Plant, and Equipment and Operating Materials and Supplies* complete the Alternative Future Use Questionnaire (Form NF 1739), Section A, to determine the appropriate accounting treatment of capital assets. Once completed, forward the questionnaire to the OCFO, Property Branch. (Note: The questionnaire can be found in NASA's Electronics Forms Database.)

d. Conduct KDP readiness activities—

- (1) Obtain KDP readiness products as shown in Table 4-3.
- (2) Plan, prepare for, and support the governing PMC review prior to KDP B. (Note: This does not apply to competed missions.)

4.5 Projects—Phase B

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

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

- a. Support Headquarters- and program-related activities:

- (1) Obtain an update to the baseline program requirements on the project.
- (2) Complete the environmental planning process as explained in NPR 8580.1, *Implementing the National Environmental Policy Act*, and *Executive Order 12114*. (Note: For certain projects utilizing nuclear power sources, completion of the environmental planning process can be extended, with the approval of the DA, into Phase C, but must be completed by the project CDR.)
- (3) In coordination with the program manager, the MDAA, and the NASA HQ Office of External Relations, support the development of external agreements, such as inter-agency and international agreements (including the planning and negotiation of agreements and recommendations on joint participation in reviews, integration and test, and risk management).
- (4) Coordinate with the Space Operations Mission Directorate (SOMD) if the project involves space transportation services, space communication and navigation capabilities, or launch services, in compliance with NPD 8610.7, *Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions*, and NPD 8610.12, *Office of Space Operations (OSO) Space Transportation Services for NASA and NASA-Sponsored Payloads*.

b. Perform technical activities:

- (1) Implement the *preliminary* Project Plan.
- (2) Baseline the system-level requirements and develop the subsystem and lower-level technical requirements leading to the PDR baseline.
- (3) Develop a set of system and associated subsystem preliminary designs, including interface definitions, and document this work in a preliminary design report.
- (4) As part of baselining the interface control documents, document compliance with NPD 7120.4, *NASA Engineering and Program/Project Management Policy*, and/or obtain any necessary waivers or deviations.
- (5) Develop and document a baseline mission operations concept.
- (6) Complete development of mission-critical or enabling technology, as needed, with demonstrated evidence of required technology qualification (i.e., component and/or breadboard validation in the relevant environment) or execute off-ramps (i.e., substitution of more mature or proven technologies) and document this work in a technology readiness assessment report.
- (7) Plan and execute long-lead procurements in accordance with the Acquisition Plan. (Note: Long-lead procurements can be initiated in Phase B only when specifically approved by the MDAA.)

- (8) Identify any risk drivers (and proposed mitigation plans for each risk).
- (9) Develop a list of descope options.
- (10) Develop a *preliminary* orbital debris assessment in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA–STD-8719.14, *Process for Limiting Orbital Debris*.
- (11) Develop and document a *preliminary* Missile System Pre-Launch Safety Package (MSPSP) in accordance with NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program* and Air Force Space Command Manual 91-710, *Range Safety User Requirements Manual Volume 3 - Launch Vehicles, Payloads, and Ground Support Systems Requirements*.
- (12) Prior to the project life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this NID.
- (13) Plan, prepare for, and support the project life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.

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

- (1) Complete and obtain approval of the Project Plan that follows the template in Appendix F. See Table 4-4 for a list of the Control Plans and their required maturity by phase.
- (2) For contracts requiring EVM (refer to the NASA FAR Supplement), conduct required IBRs.
- (3) For all flight projects, provide a draft CADRe (Parts A, B, and C) consistent with the NASA Cost Estimating Handbook 60 days prior to KDP C with a final version 30 days after the event to reflect any changes from the KDP. This CADRe is based on the PDR baseline.)
- (4) Prepare and finalize Phase C and D work agreements. (Note: Prior to approval to proceed, Phase C and D contracts' work scope and cost/price can be negotiated but not executed. Once the project has been approved and funding is available, the negotiated contracts can be executed, assuming nothing material has changed.)
- (5) Develop, document, and maintain a project Management Baseline for all work performed by the project noting the following:

- (i) The project's Management Baseline is consistent with the NASA standard space flight project WBS (see Appendix G) and has an associated WBS dictionary.
 - (ii) The project's Management Baseline includes the integrated master schedule, baseline life cycle cost estimate, workforce estimates, and the PDR-technical baseline, all consistent with the program requirements levied on the project. For KDP C project baselines are to be based on a joint cost and schedule confidence level consistent with the program confidence level approved by the decision authority.
 - (iii) The baseline life cycle cost estimate is based on the PDR-technical baseline and integrated master schedule and is expected to include a review of the entire scope of work with a series of in-depth assessments of selected critical work elements of the WBS prior to and following the project's PDR/NAR preceding KDP C. (Note: The CADRe is updated to reflect changes.)
 - (iv) The baseline life cycle cost estimate uses the latest accounting guidance and practices.
 - (v) The baseline life cycle cost estimate including UFE, along with the level of confidence estimate provided by a joint cost and schedule confidence level.
 - (vi) The baseline life cycle cost estimate is time-phased by Government Fiscal Year (GFY) to WBS Level 2.
- (6) When an Independent Cost Estimate is required or performed, explain any significant differences with the project's baseline life cycle independent cost estimate (ICE).
 - (7) Complete a business case analysis for infrastructure for each of the project's proposed real property infrastructure investments consistent with NPD 8820.2, *Design and Construction of Facilities*, and NPR 8820.2, *Facility Project Requirements*, and for the acquisition of new aircraft consistent with NPR 7900.3, *Aircraft Operations Management*.¹⁹ (Note: Business case analyses require the approval of the MDAA and the Assistant Administrator for Infrastructure and Administration, or designee.)
 - (8) Develop a baseline planetary protection plan (if required) in accordance with NPD 8020.7, *Biological Contamination Control for Outbound and Inbound Planetary Spacecraft*, and NPR 8020.12, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*.

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

- (9) Develop a *preliminary* Range Safety Risk Management Plan in accordance with NPR 8715.5, *Range Safety Program*.
- (10) In coordination with the OCFO, complete the Alternative Future Use Questionnaire (Form NF 1739), Section B, to identify the acquisition components of the project and to determine the appropriate accounting treatment of the capital acquisitions within the project. Once completed, forward the questionnaire to the OCFO, Property Branch. (Note: The questionnaire can be found in NASA's Electronics Forms Database.)

d. Conduct KDP readiness activities:

- (1) Obtain KDP readiness products as shown in Table 4-3.
- (2) Plan, prepare for, and support the governing PMC review prior to KDP C.

4.6 Projects—Phase C

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

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

a. Perform technical activities:

- (1) Implement the *baseline* Project Plan.
- (2) Complete all requisite flight and ground designs/analyses through their respective CDRs in accordance with NPR 7123.1 and document this work in detailed design report(s).
- (3) Develop and test all requisite engineering models (brass boards, breadboards, full-up models) sufficiently prior to lower level CDRs to enable test results to affect detailed designs.
- (4) Develop requisite system and subsystem test beds needed for qualification and acceptance testing of flight articles.
- (5) Following the appropriate lower level CDR, initiate fabrication/procurement of flight article components, assemblies, and/or subsystems.
- (6) Initiate the qualification and acceptance testing of flight article components, assemblies, and/or subsystems.

- (7) Hold peer reviews, as appropriate, prior to major project reviews in accordance with the Project Review Plan.
- (8) Develop a *baseline* orbital debris assessment a minimum of 45 days prior to the project CDR in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA-STD-8719.14, *Process for Limiting Orbital Debris*.
- (9) Develop a *preliminary* Operations Handbook that will be used to support the operations team.
- (10) Develop and document a *baseline* Missile System Pre-Launch Safety Package (MSPSP) by the project-level CDR in accordance with NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*, and Air Force Space Command Manual 91-710, *Range Safety User Requirements Manual Volume 3 - Launch Vehicles, Payloads, and Ground Support Systems Requirements*.
- (11) Prior to the project independent life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- (12) Plan, prepare for, and support the project independent life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- (13) Following the SIR and/or PRR (unless otherwise directed by the program manager), initiate system assembly and integration and test activities even if KDP D has not occurred.

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

- (1) Provide a draft CADRe (Parts A, B, and C) consistent with the NASA Cost Estimating Handbook 60 days prior to KDP D with a final version 30 days after the event to reflect any changes from the KDP. This CADRe is based on the CDR baseline.
- (2) Update work agreements for Phase D.
- (3) Maintain the Management Baseline under configuration management with traceability to the KDP C-approved baseline.
- (4) Mature preliminary Project Plan Control Plans, as required by Table 4-4.
- (5) Develop a *baseline* Range Safety Risk Management Plan in accordance with NPR 8715.5, *Range Safety Program*.
- (6) Develop a *preliminary* End of Mission Plan per NPR 8715.6.

c. Implement project cost and schedule control activities:

- (1) Implement Earned Value Management (EVM) as documented in the Project Plan.
- (2) For contracts requiring EVM (refer to the NASA FAR Supplement), conduct required IBRs.
- (3) Provide immediate written notice and a recovery plan to the program manager and the MDAA if the latest Phase C through D Estimate at Completion (EAC) of the project exceeds by 15 percent or more the KDP C-approved Management Baseline cost for Phases C through D. (Note: Since the Management Baseline cost contains project UFE, an EAC exceeding the Management Baseline cost presumes that these UFE will be exhausted.)
- (4) Provide immediate written notice and a recovery plan to the program manager and the MDAA if a milestone listed for Phases C and D on the project life cycle chart (Figure 2-4) is estimated to be delayed in excess of six months from the date scheduled in the KDP C-approved Management Baseline.
- (5) If the trigger points in (2) or (3) above are breached and upon written notice from the program manager, update the Project Plan per direction received from the program manager.

d. Conduct KDP readiness activities:

- (1) Obtain KDP readiness products as shown in Table 4-3.
- (2) Plan, prepare for, and support the governing PMC review prior to KDP D.

4.7 Projects—Phase D

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

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

a. Support Headquarters- and program-related activities:

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

b. Perform technical activities:

- (1) Implement the Project Plan.
- (2) Initiate system assembly, integration, and test.

- (3) As required by NPR 7123.1, execute and document the results of the project's multi-tiered Verification and Validation (V&V) Plan.
- (4) Resolve all test, analysis, and inspection discrepancies.
- (5) Integrate payload/launch vehicle and test.
- (6) Prepare "as-built" and "as-deployed" hardware and software documentation, including "close-out" photographs.
- (7) Complete all operational support and other enabling developments (e.g., facilities, equipment, and updated databases), including a *baseline* Operations Handbook to support the operations team.
- (8) Conduct operational tests and training, including normal and anomalous scenarios.
- (9) Prior to the project independent life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- (10) Plan, prepare for, and support the project independent life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- (11) Establish and maintain an integrated logistics support (ILS) capability, including spares, ground support equipment, and system maintenance and operating procedures, in accordance with the project's Logistics Plan.
- (12) Forty-five (45) days prior to delivery of the spacecraft to the launch facility, update the Missile System Pre-Launch Safety Package (MSPSP) in accordance with NPR 8715.7, *Expendable Launch Vehicle Payload Safety Program*, and Air Force Space Command Manual 91-710, *Range Safety User Requirements Manual Volume 3 - Launch Vehicles, Payloads, and Ground Support Systems Requirements*. Launch and perform system checkout. (Note: The checkout period is specified in the Project Plan.)
- (13) Develop a final orbital debris assessment and a pre-launch End-of-Mission Plan a minimum of 30 days prior to the project Safety and Mission Success (SMSR) review in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA-STD-8719.14, *Process for Limiting Orbital Debris*.

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

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

- (2) For contracts requiring EVM (refer to the NASA FAR Supplement), conduct required IBRs.
 - (3) Prepare and finalize work agreements for Phase E.
- d. Implement project cost and schedule control activities:
- (1) Provide immediate written notice and a recovery plan to the program manager and the MDAA if the latest Phase C through D Estimate at Completion (EAC) of the project exceeds by 15 percent or more the KDP C-approved Management Baseline cost for Phases C through D. (Note: Since the Management Baseline cost contains project UFE, an EAC exceeding the Management Baseline cost presumes that these UFE will be exhausted.)
 - (2) Provide immediate written notice and a recovery plan to the program manager and the MDAA if a milestone listed for Phases C and D on the project life cycle chart (Figure 2-4) is estimated to be delayed in excess of 6 months from the date scheduled in the KDP C-approved Management Baseline.
 - (3) If the trigger points in (1) or (2) above are breached and upon written notice from the program manager, update the Project Plan per direction received from the program manager.
- e. Conduct KDP readiness activities:
- (1) Obtain approved launch approval documents.
 - (2) Obtain KDP readiness products as shown in Table 4-3.
 - (3) Plan, prepare for, and support the governing PMC review prior to KDP E.

4.8 Projects—Phase E

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

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

- a. Perform technical activities:
 - (1) Implement the Project Plan.
 - (2) Execute the mission in accordance with the Mission Operations Plan and document this work in a Mission Report.
 - (3) Prior to the project life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.

- (4) Plan, prepare for, and support the project life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.
- (5) Monitor system incidents, problems, and anomalies, as well as system margins to ensure that deployed project systems function as intended, and investigate system behavior that is observed to exceed established operational boundaries or expected trends, and implement corrective actions, as necessary.
- (6) Provide sustaining engineering, as appropriate, to the mission to enhance efficiency, safety, and accommodate obsolescence.
- (7) Monitor for potential conjunctions with other space objects in accordance with paragraph 3.4 of NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris*.
- (8) Develop a final End-of-Mission Plan a minimum of 6 months prior to the system decommissioning/disposal in accordance with NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris* using the format and requirements contained in NASA-STD-8719.14, *Process for Limiting Orbital Debris*.
- (9) Capture and archive mission results, including engineering data on system and subsystem performance, in an MDAA-approved data depository.

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

- (1) For all flight projects, provide an *updated* CADRe (Parts A, B, and C) consistent with the NASA Cost Estimating Handbook within 60 days after the completion of spacecraft post-launch checkout. This CADRe is based on the “as built” launched baseline.
- (2) As directed by the program manager, support the development of Project Plan revisions to continue the mission into extended operations beyond the primary mission phase or beyond any extension previously included in the plan.
- (3) Prepare and document a *baseline* Systems Decommissioning/Disposal Plan.
- (4) Prepare or update work agreements for Phase F.

c. Conduct KDP readiness activities:

- (1) Obtain KDP readiness products as shown in Table 4-3.
- (2) Plan, prepare for, and support the governing PMC review prior to KDP F.

4.9 Projects—Phase F

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

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

- a. Perform technical activities:
 - (1) Complete analysis and archiving of mission and science data and curation of any returned samples, as well as archiving of project engineering and technical management data and documentation, and lessons learned in accordance with agreements, the Project Plan and Program Plan, and Center and Agency policies.
 - (2) Prior to the project life cycle reviews shown in Figure 2-4 for this phase, conduct internal reviews in accordance with NPR 7123.1, Center practices, and the requirements of this document.
 - (3) Plan, prepare for, and support the project life cycle reviews shown in Figure 2-4 for this phase in accordance with NPR 7123.1, Center practices, and the requirements of this document.
 - (4) Implement the Systems Decommissioning/Disposal Plan and safely dispose of project systems.
- b. Provide a final CADRe (Parts A, B, and C) consistent with the NASA Cost Estimating Handbook within 60 days after End of Planned Mission.

APPENDIX A Definitions

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Decommissioning Review. Confirms the decision to terminate or decommission the system and assesses the readiness of the system for the safe decommissioning and disposal of system assets.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Reserves. Obsolete term. See Unallocated Future Expenses.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX B Acronyms

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

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

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

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

APPENDIX C Formulation Authorization Document Template

C.1 Program FAD Title Page

Program Formulation Authorization Document	
<p>(Provide a title for the candidate program and designate a short title or proposed acronym in parenthesis, if appropriate.)</p>	
_____ Mission Directorate Associate Administrator	_____ Date

Figure C-1 Program Formulation Authorization Document Title Page

C.2 Project FAD Title Page

**Project
Formulation Authorization Document**

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

Mission Directorate Associate Administrator

Date

Program Manager

Date

Figure C-2 Project Formulation Authorization Document Title Page

C.3 Program/Project FAD Template

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

1.0 PURPOSE

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

2.0 AUTHORITY

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

3.0 PROGRAM / PROJECT GOALS AND OBJECTIVES

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

4.0 INTERNAL PARTICIPANTS

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

5.0 EXTERNAL PARTICIPANTS

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

6.0 FUNDING

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

7.0 REVIEWS

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

APPENDIX D Program Commitment Agreement Template

D.1 PCA Title Page

Program Commitment Agreement	
<p>(Provide a title for the candidate program and designate a short title or proposed acronym in parenthesis, if appropriate.)</p> <p>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.</p>	
_____	_____
Mission Directorate Associate Administrator	Date
_____	_____
Associate Administrator	Date

Figure D-1 Program Commitment Agreement Title Page

D.2 PCA Template

PROGRAM COMMITMENT AGREEMENT (PROGRAM TITLE)

1.0 PROGRAM OBJECTIVES

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

2.0 PROGRAM OVERVIEW

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

3.0 PROGRAM AUTHORITY

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

4.0 TECHNICAL PERFORMANCE COMMITMENT

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

5.0 SCHEDULE COMMITMENT

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

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

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

6.0 COST COMMITMENT

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

7.0 ACQUISITION STRATEGY

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

8.0 HIGH RISK AREAS

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

9.0 INTERNAL AGREEMENTS

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

10.0 EXTERNAL AGREEMENTS

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

11.0 REVIEWS

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

12.0 OUTCOMES

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

13.0 WAIVERS AND DEVIATIONS

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

14.0 PCA ACTIVITIES LOG

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

Table D-1 Sample Program Commitment Agreement Activities Log

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

APPENDIX E Program Plan Template

E.1 Template Instructions

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

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

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

E.2 Program Plan Title Page

Program Plan

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

Mission Directorate Associate Administrator

Date

Center Director (as many signature lines as needed)

Date

Program Manager

Date

Figure E-1 Program Plan Title Page

E.3 Program Plan Template

PROGRAM PLAN (PROGRAM TITLE)

1.0 PROGRAM OVERVIEW

1.1 Introduction

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

1.2 Goals and Objectives

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

1.3 Program Architecture

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

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

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

- a. For organizations within NASA, describe the roles of each in the program, including technology efforts, space communications, and launch services.
- b. For organizations outside NASA, describe the role of each in the program, including other government agencies, academia, industry, and international partners as they are known at the start of the program.

1.4 Stakeholder Definition

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

1.5 Program Authority, Management Approach and Governance Structure

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

- a. The Center where the program manager resides.
- b. Each Center's responsibilities, as they relate to their respective requirement allocations referenced in Section 2.1, Requirements Baseline, below.

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

1.6 Implementation Approach

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

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

2.0 PROGRAM BASELINE

2.1 Requirements Baseline

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

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

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

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

2.2 WBS Baseline

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

2.3 Schedule Baseline

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

2.4 Resource Baseline

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

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

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

Document the project Commitment Baselines.

2.5 Joint Cost and Schedule Confidence Level

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

3.0 PROGRAM CONTROL PLANS

3.1 Technical, Schedule, and Cost Control Plan

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

- a. Describe the plan to monitor and control the requirements, technical design, schedule, and cost of the program.
- b. Describe the program's performance measures in objective, quantifiable, and measurable terms and document how the measures are traced from the program high-level requirements. Establish goal and threshold values for the performance metrics to be achieved at each KDP, as appropriate. In addition, document the minimum mission success criteria associated with the high-level program requirements that, if not met, trigger consideration of a Termination Review.
- c. Describe the project's implementation of Technical Authority (Engineering, Safety and Mission Assurance, and Health and Medical).
- d. Describe the program's Earned Value Management System (EVMS), if EVM requirements are to be levied at the program level.
- e. Describe any additional specific tools the program will use to implement the program control processes, e.g., the requirements management system, the program scheduling system, the program information management systems.
- f. Describe how the program will monitor and control the integrated master schedule (IMS).

- g. Describe how the program will utilize its technical and schedule margins and UFE to control the Management Baseline.
- h. Describe how the program plans to report technical, schedule, and cost status to the MDAA, including frequency and the level of detail.
- i. Describe how the program will address technical waivers and deviations and how dissenting opinions will be handled.

3.2 Safety and Mission Assurance Plan

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

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

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

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

3.3 Risk Management Plan

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

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

3.4 Acquisition Plan

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

- a. Identify all major proposed acquisitions (such as engineering design study, hardware and software development, and mission and data operations support) in relation to the program WBS. Provide summary information on each such proposed acquisition, including a Contract WBS; major deliverable items; type of procurement (competitive, AO for instruments); type of contract (cost-reimbursable, fixed-price); source (institutional, contractor, other U.S. Government agency, or international organization); procuring activity; and surveillance approach. Identify those major procurements that require a Procurement Strategy Meeting (PSM).
- b. Describe completed or planned studies supporting make-or-buy decisions, considering NASA's in-house capabilities and the maintenance of NASA's core competencies, as well as cost and best overall value to NASA.
- c. Identify the program's approach to creating contractor incentives that strengthen safety and mission assurance.
- d. Describe how the program will establish and implement a risk management process per NPR 8000.4.
- e. Describe all agreements, memoranda of understanding, barter, in-kind contributions, and other arrangements for collaborative and/or cooperative relationships. Include partnerships created through mechanisms other than those prescribed in the FAR and NFS. List all such agreements (the configuration control numbers, the date signed or projected dates of approval, and associated record requirements) necessary for program success. Include or reference all agreements concluded with the authority of the program manager and reference agreements concluded with the authority of the MDAA and above. Include the following:
 - (1) NASA agreements, e.g., space communications, launch services, inter-Center memoranda of agreement.
 - (2) Non-NASA agreements:
 - (i) Domestic, e.g., U.S. Government agencies.
 - (ii) International, e.g., memoranda of understanding.

3.5 Technology Development Plan

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

- a. Describe how the program will assess its technology development requirements, including how the program will evaluate the feasibility, availability, readiness, cost, risk, and benefit of the new technologies.
- b. Describe how the program will identify opportunities for leveraging ongoing technology efforts.
- c. Describe the program's strategy for assuring that there are alternative development paths available if/when technologies do not mature as expected.
- d. Describe how the program will remove technology gaps, including maturation, validation, and insertion plans, performance measurement at quantifiable milestones, decision gates, and resources required.
- e. Describe briefly how the program will ensure that all planned technology exchanges, contracts, and partnership agreements comply with all laws and regulations regarding export control and the transfer of sensitive and proprietary information.
- f. Describe the program's technology utilization plan that meets the requirements of NPD 7500.2, *NASA Technology Commercialization Policy*, and NPR 7500.1, *NASA Technology Commercialization Process*.

3.6 Systems Engineering Management Plan

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

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

3.7 Review Plan

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

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

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

3.8 Mission Operations Plan

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

- a. MOS and GDS human resources and training requirements.
- b. Procedures to ensure that operations are conducted in a reliable, consistent, and controlled manner using lessons learned during the program and from previous programs.
- c. Facilities requirements (offices, conference rooms, operations areas, simulators, and test beds).
- d. Hardware (ground-based communications and computing hardware and associated documentation).
- e. Software (ground-based software and associated documentation).

3.9 Environmental Management Plan

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

3.10 Logistics Plan

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

3.11 Science Data Management Plan

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

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

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

3.12 Information and Configuration Management Plan

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

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

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

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

3.13 Security Plan

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

- a. **Security Requirements:** Describe the program's approach for planning and implementing the requirements for information, physical, personnel, industrial, and counterintelligence/counterterrorism security, and for security awareness/education requirements in accordance with NPR 1600.1, *NASA Security Program Procedural Requirements*, and NPD 1600.2, *NASA Security Policy*. Include in the plan provisions to protect personnel, facilities, mission-essential infrastructure, and critical program information from potential threats and other vulnerabilities that may be identified during the threat and vulnerability assessment process.
- b. **Information Technology (IT) Security Requirements:** Document the program's approach to implementing IT security requirements in accordance with NPR 2810.1, *Security of Information Technology*.

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

3.14 Export Control Plan

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

3.15 Education and Public Outreach Plan

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

- a. Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals.
- b. Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty.
- c. Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

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

4.0 WAIVERS OR DEVIATIONS LOG

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

5.0 CHANGE LOG

Record changes in the Program Plan.

6.0 APPENDICES

Appendix A Acronyms

Appendix B Definitions

APPENDIX F Project Plan Template

F.1 Template Instructions

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

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

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

F.2 Project Plan Title Page

[*Project Name*] Project Plan

(*short title or acronym*)

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

Mission Directorate Associate Administrator Date

Center Director (as many signature lines as needed) Date

Program Manager Date

Project Manager Date

Figure F-1 Project Plan Title Page

F.3 Project Plan Template

[PROJECT NAME] PROJECT PLAN

1.0 PROJECT OVERVIEW

1.1 Introduction

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

1.2 Objectives

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

1.3 Mission Description and Technical Approach

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

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

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

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

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

Describe the project management structure consistent with the project WBS, including organization and responsibilities, its integration with the parent program management structure, and NASA Center(s) participation. Describe clear lines of authority within the project team and between the project, the program office, the primary Center, the MD, other participating Centers, and other participating organizations. Illustrate the organization graphically.

Describe briefly the implementation approach of the project, including any guidance or direction from the applicable ASP and ASM reviews, the acquisition strategy (e.g., in-house, NASA Centers, and contractor primes), partners and partner contributions, if appropriate. Describe briefly other program/project dependencies with NASA, other U.S. Government agencies, and international activities, studies, and agreements. Include make-or-buy decision plans and trade studies.

Describe how lessons learned and participating NASA Centers' implementation policies and practices will be utilized in the execution of the project. Document the agreements on the use of implementation policies and practices between the project manager and contributing NASA Centers in this section (or in appendices to the document), along with the project's approach to ensuring that interfaces do not increase risk to mission success.

1.5 Stakeholder Definition

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

2.0 PROJECT BASELINE

2.1 Requirements Baseline

List or reference the requirements levied on the project by the program in the Program Plan and discuss how these are flowed down to lower levels by summarizing the requirements allocation process. Reference requirements documents used by the project.

2.2 WBS Baseline

Provide the project's WBS and WBS dictionary to the Level 2 elements. (See Appendix G of this NID.)

2.3 Schedule Baseline

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

2.4 Resource

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

Level 2 elements. (See Appendix G of this NID.) Throughout the Implementation Phase, cost and schedule baselines are to be based on and maintained consistent with the approved joint cost and schedule confidence level in accordance with the NPD 1000.5 and NPR 7120.5.

Present the project's workforce requirements by fiscal year, consistent with the project funding requirements and WBS. The workforce estimate is to encompass all work required to achieve project objectives. Include the actual full-cost civil service and support contractor workforce by providing organization for any prior fiscal years. Include full-cost civil service and support contractor workforce requirements by providing organization for the current fiscal year and remaining fiscal years.

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

2.5 Joint Cost and Schedule Confidence Level

For implementation and beyond, document the project's joint cost and schedule confidence level approved by the decision authority and the basis for its consistency with the program's JCL.

3.0 PROJECT CONTROL PLANS

3.1 Technical, Schedule, and Cost Control Plan

Document how the project plans to control project requirements, technical design, schedule, and cost to achieve the program requirements on the project. (If this information is best documented in other control plans, e.g., the Systems Engineering Management Plan, then reference those control plans.) This control plan documents the following:

- a. Describe the plan to monitor and control the project requirements, technical design, schedule, and cost of the project to ensure the high-level requirements levied on the project are met.
- b. Describe the project's performance measures in objective, quantifiable, and measurable terms and document how the measures are traced from the program requirements on the project. In addition, document the minimum mission success criteria associated with the program requirements on the project that, if not met, trigger consideration of a Termination Review.
- c. Describe the project's implementation of Technical Authority (Engineering, Health and Medical, and Safety and Mission Assurance).
- d. Describe the project's implementation of Earned Value Management (EVM). The following requirements apply:
 - (1) The project's EVM approach is consistent with the participating Center's best practices.

- (2) The project's EVM approach is in-place by KDP C and implemented in Phase C through KDP E.
 - (3) Project EVM reporting begins within 60 days after the start of Phase C.
 - (4) As a minimum, EVM principles, as defined by ANSI/EIA-748-B , *Earned Value Management Systems*, apply from KDP C through KDP E, if the project's life cycle cost is at or greater than \$20M.
 - (5) If the project's primary NASA Center has a fully validated Earned Value Management System (EVMS), the project uses that system rather than EVM principles.
 - (6) For contracts and subcontracts, refer to the NASA FAR Supplement. In addition:
 - (i) A Contract Performance Report (CPR), Integrated Master Schedule (IMS), WBS, and WBS Dictionary are required whenever EVMS is required for contracts and subcontracts.
 - (ii) EVM and IBRs will be implemented on contracts and subcontracts in accordance with the requirements in the NASA FAR Supplement on Implementation of EVM.
- e. Describe any additional specific tools necessary to implement the project's control processes (e.g., the requirements management system, project scheduling system, project information management systems, budgeting, and cost accounting system).
 - f. Describe the process for monitoring and controlling the IMS.
 - g. Describe the process for utilizing the project's technical and schedule margins and UFE to meet the Management and Commitment Baselines.
 - h. Describe how the project plans to report technical, schedule, and cost status to the program manager, including the frequency and level of detail of reporting.
 - i. Describe the project's internal processes for addressing technical waivers and deviations and handling dissenting opinions.
 - j. Describe the project's descope plans, including key decision dates and savings in cost and schedule and show how the descopes are related to the project's threshold performance requirements.
 - k. Include a description of the systems engineering organization and structure and how the Project Chief Engineer (PCE) executes the overall systems engineering functions.

3.2 Safety and Mission Assurance Plan

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

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

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

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

Reference the stand-alone SMA Plan here.

3.3 Risk Management Plan

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

Develop a stand-alone Risk Management Plan that includes the content required by NPR 8000.4. Reference the stand-alone plan here.

3.4 Acquisition Plan

The Project Acquisition Plan is developed by the project manager, supported by the host Center's Procurement Officer, and must be consistent with the results of the ASP meeting and

ASM. It documents an integrated acquisition strategy that enables the project to meet its mission objectives and provides the best value to NASA. In addition, the Acquisition Plan should:

- a. Identify all major proposed acquisitions (such as engineering design study, hardware and software development, and mission and data operations support) in relation to the project WBS. Provide summary information on each such proposed acquisition, including a Contract WBS; major deliverable items; type of procurement (competitive, AO for instruments); type of contract (cost-reimbursable, fixed-price); source (institutional, contractor, other U.S. Government organizations); procuring activity; and surveillance approach. Identify those major procurements that require a Procurement Strategy Meeting (PSM).
- b. Describe completed or planned studies supporting make-or-buy decisions, considering NASA's in-house capabilities and the maintenance of NASA's core competencies, as well as cost and best overall value to NASA.
- c. Identify the project's approach to creating contractor incentives that strengthen safety and mission assurance.
- d. Describe how the project will establish and implement a risk management process per NPR 8000.4.
- e. Describe all agreements, memoranda of understanding, barter, in-kind contributions, and other arrangements for collaborative and/or cooperative relationships. Include partnerships created through mechanisms other than those prescribed in the FAR. List all such agreements (the configuration control numbers, the date signed or projected dates of approval, and associated record requirements) necessary for project success. Include or reference all agreements concluded with the authority of the project manager and reference agreements concluded with the authority of the program manager and above. Include the following:
 - (1) NASA agreements, e.g., space communications, launch services, inter-Center memoranda of agreement.
 - (2) Non-NASA agreements:
 - (i) Domestic, e.g., U.S. Government agencies.
 - (ii) International, e.g., memoranda of understanding.

3.5 Technology Development Plan

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

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

- b. Describe how the project will identify opportunities for leveraging ongoing technology efforts.
- c. Describe the project's strategy for assuring that there are alternative development paths available if/when technologies do not mature as expected.
- d. Describe how the project will remove technology gaps, including maturation, validation, and insertion plans, performance measurement at quantifiable milestones, decision gates, and resources required.
- e. Describe briefly how the project will ensure that all planned technology exchanges, contracts, and partnership agreements comply with all laws and regulations regarding export control and the transfer of sensitive and proprietary information.
- f. Describe the program's technology utilization plan that meets the requirements of NPD 7500.2, *NASA Technology Commercialization Policy*, and NPR 7500.1, *NASA Technology Commercialization Process*.

3.6 Systems Engineering Management Plan

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

Develop a stand-alone SEMF that includes the content required by NPR 7123.1, *NASA Systems Engineering Processes and Requirements*. Reference the stand-alone Plan here.

3.7 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.

3.8 Review Plan

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

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

3.9 Mission Operations Plan

Describe the activities required to perform the mission. Describe how the project will implement the associated facilities, hardware, software, and procedures required to complete the mission. Describe mission operations plans, rules, and constraints. Describe the Mission Operations System (MOS) and Ground Data System (GDS) in the following terms:

- a. MOS and GDS human resources and training requirements.
- b. Procedures to ensure that operations are conducted in a reliable, consistent, and controlled manner using lessons learned during the program and from previous programs.
- c. Facilities requirements (offices, conference rooms, operations areas, simulators, and test beds).
- d. Hardware (ground-based communications and computing hardware and associated documentation).
- e. Software (ground-based software and associated documentation).

3.10 Environmental Management Plan

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

- a. Identify all required permits, waivers, documents, approvals, or concurrences required for compliance with applicable Federal, State, Tribal Government, and local environmental regulations.
- b. Describe the documentation and schedule of events for complying with these regulations, including identifying any modifications to the Center's Environmental Management System (EMS) that would be required for compliance.
- c. Insert into the project schedule the critical milestones associated with complying with these regulations.

3.11 Logistics Plan

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

3.12 Science Data Management Plan

Describe how the project will manage the scientific data generated and captured by the operational mission(s) and any samples collected and returned for analysis. Include descriptions of how data will be generated, processed, distributed, analyzed, and archived, as well as how any samples will be collected, stored during the mission, and managed when returned to Earth. The

Plan should include definition of data rights and services and access to samples, as appropriate. Explain how the project will accomplish the knowledge capture and information management and disposition requirements in NPD 2200.1, *Management of NASA Scientific and Technical Information*, NPR 2200.2, *Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information*, NPR 1441.1, *NASA Records Retention Schedules*, as applicable to project science data.

3.13 Information and Configuration Management Plan

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

Describe how the project will manage information throughout its life cycle, including the development and maintenance of an electronic program library. Explain how the project will ensure identification, control, and disposition of project records in accordance with NPD 1440.6, *NASA Records Management*, and NPR 1441.1, *NASA Records Retention Schedules*. Reference the stand-alone Records Management Plan, if applicable, to address all records described in NPR 7120.5.

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

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

3.14 Security Plan

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

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

- b. Information Technology (IT) Security Requirements: Document the project's approach to implementing IT security requirements in accordance with NPR 2810.1, *Security of Information Technology*.
- c. Emergency Response Requirements: Describe the project's emergency response plan in accordance with NPR 1040.1, *NASA Continuity of Operations (COOP) Planning Procedural Requirements*, and define the range and scope of potential crises and specific response actions, timing of notifications and actions, and responsibilities of key individuals.

3.15 Export Control Plan

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

4.0 WAIVERS OR DEVIATIONS LOG

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

5.0 CHANGE LOG

Track and document changes to the Project Plan.

6.0 APPENDICES

Appendix A Acronyms

Appendix B Definitions

APPENDIX G Space Flight Project Work Breakdown Structure

G.1 Introduction

G.1.1 The Project Work Breakdown Structure (WBS) is a key element of project management. The purpose of a WBS is to divide the project into manageable pieces of work to facilitate planning and control of cost, schedule, and technical content.

G.2 Assumptions

G.2.1 The WBS standard elements defined in this appendix are only applicable to space flight projects.

G.2.2 The following list of assumptions is provided as background information to assist in the development of the project WBS:

- a. The CADRe captures major assembly actuals (one level lower than subsystem (as defined in the *NASA Systems Engineering Handbook* (SP-2007-6105 Rev1) and NPR 7123.1)) at major milestones (PDR, CDR, etc.).
- b. There are both political and technical requirement drivers to a WBS.

G.3 Project Business Rules

G.3.1 Purpose: The standardization of WBS elements for space flight projects is being driven by requirements for more effective cost estimating and consistency of project work packages across the Agency. The standard WBS is intended to apply to projects, not programs. There are no *program* WBS standard requirements due to the variance in structure of the Mission Directorates.

G.3.2 Business Rules:

- a. The standard space flight project WBS applies to projects established on or after June 1, 2005. It is not intended to be applied retroactively to existing projects.
- b. The standard space flight project WBS applies to the entire life cycle of the project, including disposal and decommissioning.
- c. The standard space flight project WBS applies to both crewed and robotic projects.
- d. Space flight projects will use the standard Level 1/2 WBS elements (See Section G.5.). Specifically:
 - (1) The Project Name will be WBS Level 1.
 - (2) The title of each WBS Level 2 element can be modified to facilitate project-unique titles, but the content of each must remain the same. If the linkage of

the project-unique title to the standard title is not intuitive, the project-unique title is cross-referenced to the standard.

- (3) If the set of standard WBS Level 2 elements does not comprise an exhaustive set of WBS elements, additional WBS elements may be added horizontally (i.e., at Level 2) as long as their content does not fit into the content of any existing standard WBS elements.
 - (4) For each standard WBS Level 2 element, the subordinate (children) WBS elements at Level 3 and lower will be determined by the project.
 - (5) The Level 3 and lower elements can differ from project to project but will include only work that rolls up to the standard WBS Dictionary definition of the Level 2 element. (See Section G.5.)
 - (6) If there is no work to fit into a standard WBS element, then an inactive placeholder element (and an inactive placeholder financial code) will be established.
 - (7) A single WBS will be used for both technical/business management and reporting.
 - (8) The management assigned to each WBS element may differ from project to project.
- e. Changes to the standard space flight project WBS will be governed by the requirement tailoring approval process in Chapter 3 of this document.

G.4 Space Flight Project WBS Standard Elements

Standard Level 2 WBS elements for space flight projects are shown in Figure G-1. The standard WBS template below assumes a typical spacecraft flight development project with relatively minor ground or mission operations elements. For major launch or mission operations ground development activities which are viewed as projects unto themselves, the WBS may be modified. For example, the spacecraft element may be changed to reflect the ground project major deliverable product (such as a facility). The elements such as payload, launch vehicle/services, ground system(s), and mission operations (system) that are not applicable may be deleted.

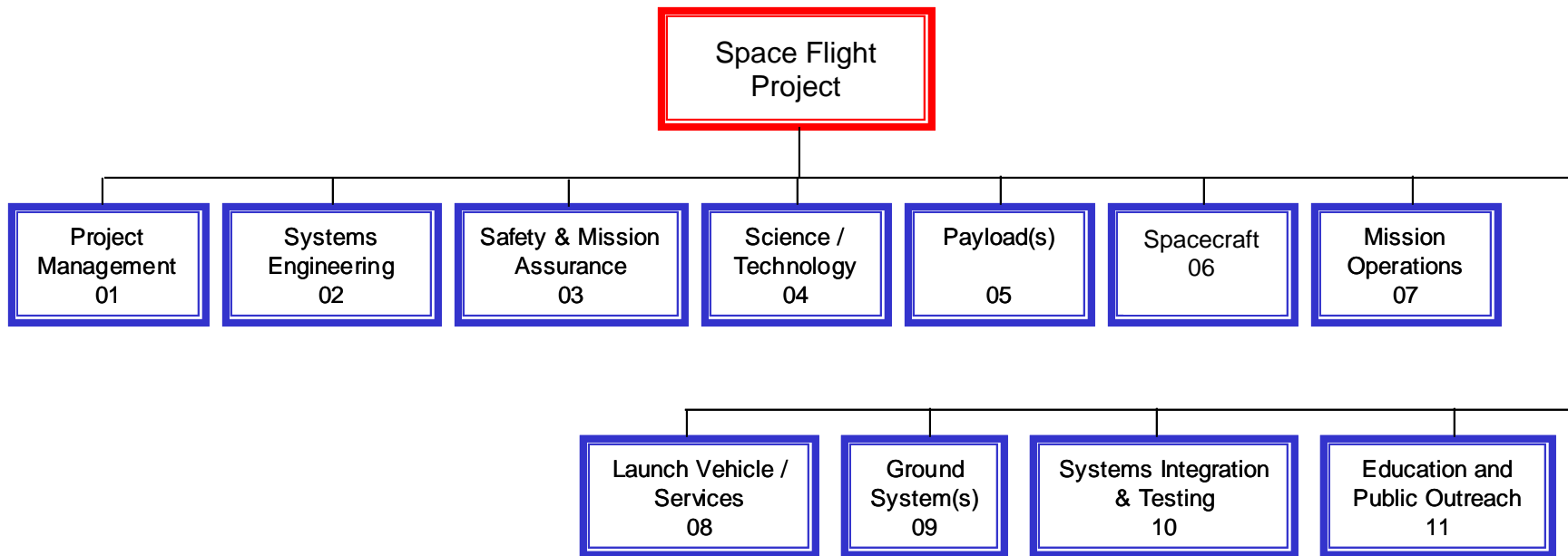


Figure G-1 Standard Level 2 WBS Elements for Space Flight Projects

G.5 Space Flight Project Standard WBS Dictionary

Element 1 – Project Management: The business and administrative planning, organizing, directing, coordinating, analyzing, controlling, and approval processes used to accomplish overall project objectives, which are not associated with specific hardware or software elements. This element includes project reviews and documentation, non-project owned facilities, and project UFE. It excludes costs associated with technical planning and management and costs associated with delivering specific engineering, hardware, and software products.

Element 2 – Systems Engineering: The technical and management efforts of directing and controlling an integrated engineering effort for the project. This element includes the efforts to define the project space flight vehicle(s) and ground system, conducting trade studies, the integrated planning and control of the technical program efforts of design engineering, software engineering, specialty engineering, system architecture development and integrated test planning, system requirements writing, configuration control, technical oversight, control and monitoring of the technical program, and risk management activities. Documentation products include requirements documents, interface control documents (ICDs), Risk Management Plan, and master verification and validation (V&V) plan. Excludes any design engineering costs.

Element 3 – Safety and Mission Assurance: The technical and management efforts of directing and controlling the safety and mission assurance elements of the project. This element includes design, development, review, and verification of practices and procedures and mission success criteria intended to ensure that the delivered spacecraft, ground systems, mission operations, and payload(s) meet performance requirements and function for their intended lifetimes. This element excludes mission and product assurance efforts directed at partners and subcontractors other than a review/oversight function, and the direct costs of environmental testing.

Element 4 – Science / Technology: This element includes the managing, directing, and controlling of the science investigation aspects, as well as leading, managing, and performing the technology demonstration elements of the Project. The costs incurred to cover the Principal Investigator, Project Scientist, science team members, and equivalent personnel for technology demonstrations are included. Specific responsibilities include defining the science or demonstration requirements; ensuring the integration of these requirements with the payloads, spacecraft, ground systems, and mission operations; providing the algorithms for data processing and analyses; and performing data analysis and archiving. This element excludes hardware and software for onboard science investigative instruments/payloads.

Element 5 – Payload: This element includes the equipment provided for special purposes in addition to the normal equipment (i.e., GSE) integral to the spacecraft. This includes leading, managing, and implementing the hardware and software payloads that perform the scientific experimental and data gathering functions placed on board the spacecraft, as well as the technology demonstration for the mission.

Element 6 – Spacecraft(s): The spacecraft that serves as the platform for carrying payload(s), instrument(s), humans, and other mission-oriented equipment in space to the mission destination(s) to achieve the mission objectives. The spacecraft may be a single spacecraft or multiple spacecraft/modules (i.e., cruise stage, orbiter, lander, or rover modules). Each spacecraft/module of the system includes the following subsystems, as appropriate: Crew,

Power, Command & Data Handling, Telecommunications, Mechanical, Thermal, Propulsion, Guidance Navigation and Control, Wiring Harness, and Flight Software. This element also includes all design, development, production, assembly, test efforts, and associated GSE to deliver the completed system for integration with the launch vehicle and payload. This element does not include integration and test with payloads and other project systems.

Element 7 - Mission Operations System: The management of the development and implementation of personnel, procedures, documentation, and training required to conduct mission operations. This element includes tracking, commanding, receiving/processing telemetry, analyses of system status, trajectory analysis, orbit determination, maneuver analysis, target body orbit/ephemeris updates, and disposal of remaining end-of-mission resources. The same WBS structure is used for Phase E Mission Operation Systems but with inactive elements defined as “not applicable.” (See “Other Policy Documents” section of NODIS for WBS handbook.) However, different accounts must be used for Phase E due to NASA cost reporting requirements. This element does not include integration and test with the other project systems.

Element 8 – Launch Vehicle / Services: The management and implementation of activities required to place the spacecraft directly into its operational environment, or on a trajectory towards its intended target. This element includes launch vehicle, launch vehicle integration, launch operations, any other associated launch services (frequently includes an upper-stage propulsion system), and associated ground support equipment. This element does not include the integration and test with the other project systems.

Element 9 – Ground System(s): The complex of equipment, hardware, software, networks, and mission-unique facilities required to conduct mission operations of the spacecraft systems and payloads. This complex includes the computers, communications, operating systems, and networking equipment needed to interconnect and host the Mission Operations software. This element includes the design, development, implementation, integration, test, and the associated support equipment of the ground system, including the hardware and software needed for processing, archiving, and distributing telemetry and radiometric data and for commanding the spacecraft. Also includes the use and maintenance of the project testbeds and project-owned facilities. This element does not include integration and test with the other project systems and conducting mission operations.

Element 10 – Systems Integration and Testing: This element includes the hardware, software, procedures, and project-owned facilities required to perform the integration and testing of the project’s systems, payloads, spacecraft, launch vehicle/services, and mission operations.

Element 11 – Education and Public Outreach: Provide for the education and public outreach (EPO) responsibilities of NASA’s missions, projects, and programs in alignment with the Strategic Plan for Education. This includes management and coordinated activities, formal education, informal education, public outreach, media support, and Web site development.

APPENDIX H References

NASA programs/projects and Centers are required to comply with all applicable Agency directives, not limited to those listed in this Appendix. The directives listed in Section H.1 are those cited in this document. Applicable directives not cited in this document should be identified in Center policies and procedures.

Similarly, not all related references or other resources for program/project management teams are identified. The related references listed in Section H.2 are those cited in this document.

H.1 NASA Policy Directives and NASA Procedural Requirements

- a. NPD 1000.0, NASA Governance and Strategic Management Handbook
- b. NPD 1000.3, The NASA Organization
- c. NPD 1000.5, Policy for NASA Acquisition
- d. NPD 1001.0, 2006 NASA Strategic Plan
- e. NPD 1200.1, NASA Internal Control
- f. NPD 1440.6, NASA Records Management
- g. NPD 1600.2, NASA Security Policy
- h. NPD 2200.1, Management of NASA Scientific and Technical Information (STI)
- i. NPD 7120.4, NASA Engineering and Program/Project Management Policy
- j. NPD 7500.1, Program and Project Logistics Policy
- k. NPD 7500.2, NASA Technology Commercialization Policy
- l. NPD 8010.3, Notification of Intent to Decommission or Terminate Operating Space Missions and Terminate Missions
- m. NPD 8020.7, Biological Contamination Control for Outbound and Inbound Planetary Spacecraft
- n. NPD 8610.7, Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions
- o. NPD 8610.12, Office of Space Operations (OSO) Space Transportation Services for NASA and NASA-Sponsored Payloads
- p. NPD 8700.3, Safety and Mission Assurance Policy for NASA Spacecraft, Instruments, and Launch Services

- q. NPD 8710.5, Policy for Pressure Vessels and Pressurized Systems
- r. NPD 8720.1, NASA Reliability and Maintainability (R&M) Program Policy
- s. NPD 8730.5, NASA Quality Assurance Program Policy
- t. NPD 8820.2, Design and Construction of Facilities
- u. NPD 8900.5, NASA Health and Medical Policy for Human Space Exploration
- v. NPR 1040.1, NASA Continuity of Operations (COOP) Planning Procedural Requirements
- w. NPR 1441.1, NASA Records Retention Schedules
- x. NPR 1600.1, Security Program Procedural Requirements
- y. NPR 2190.1, NASA Export Control Program
- z. NPR 2200.2, Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information
- aa. NPR 2810.1, Security of Information Technology
- bb. NPR 7120.6, Lessons Learned Process
- cc. NPR 7120.7, NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements
- dd. NPR 7120.8, NASA Research and Technology Program and Project Management Requirements
- ee. NPR 7123.1, NASA Systems Engineering Processes and Requirements
- ff. NPR 7150.2, NASA Software Engineering Requirements
- gg. NPR 7500.1, NASA Technology Commercialization Process
- hh. NPR 7900.3, NASA Aircraft Operations Management
- ii. NPR 8000.4, Agency Risk Management Procedural Requirements
- jj. NPR 8020.12, Planetary Protection Provisions for Robotic Extraterrestrial Missions
- kk. NPR 8580.1, Implementing the National Environmental Policy Act and Executive Order 12114
- ll. NPR 8621.1, NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping

- mm. NPR 8705.2, Human-Rating Requirements for Space Systems
- nn. NPR 8705.4, Risk Classification of NASA Payloads
- oo. NPR 8705.6, Safety and Mission Assurance Audits, Reviews, and Assessments
- pp. NPR 8715.1 NASA Occupational Safety and Health Programs
- qq. NPR 8715.3, NASA General Safety Program Requirements
- rr. NPR 8715.5, Range Safety Program
- ss. NPR 8715.6, NASA Procedural Requirements for Limiting Orbital Debris
- tt. NPR 8715.7, Expendable Launch Vehicle Payload Safety Program
- uu. NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts
- vv. NPR 8820.2, Facility Project Implementation Guide
- ww. NPR 8900.1, Health and Medical Requirements for Human Space Exploration
- xx. NPR 9250.1, Property, Plant, and Equipment and Operating Materials and Supplies

H.2 NASA Standards

- a. NASA-STD-0005, NASA Configuration Management (CM) Standard
- b. NASA-STD-8719.7, Facility System Safety Guidebook
- c. NASA-STD-8719.9, Standard for Lifting Devices and Equipment
- d. NASA-STD-8719.10, Standard for Underwater Facility and Non-Open Water Operations
- e. NASA-STD-8719.11, NASA Safety Standard for Fire Protection
- f. NASA-STD-8719.12, Safety Standard for Explosives, Propellants, and Pyrotechnics
- g. NASA-STD-8719.13, NASA Software Safety Standard
- h. NASA-STD-8719.14, Process for Limiting Orbital Debris
- i. NASA-STD-8719.17, NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems (PV/S)
- j. NASA-STD-8739.8, Software Assurance Standard

H.3 Non-NASA Standards

- a. Air Force Space Command Manual 91-710, Range Safety User Requirements Manual Volume 3 - Launch Vehicles, Payloads, and Ground Support Systems Requirements
- b. ANSI/EIA-748-B , Earned Value Management Systems

H.2 Related References

Manuals and Reports

Columbia Accident Investigation Board Report, Volume 1, August 2003.
(Available at http://www.nasa.gov/columbia/home/CAIB_Vol_1.html)

NASA Special Publications and Similar Documents

- (1) Program and Project Management Handbook
- (2) NASA Standing Review Board Handbook
- (3) NASA Project Management Competency Model
- (4) The Federal Acquisition Certification for Program/Project Managers- Center Implementation Guidelines.

Web Sites

- (1) NASA Cost Estimating Handbook,
http://www.nasa.gov/offices/pae/organization/cost_analysis_division.html
- (2) NASA Technical Standards Program Web site, <http://standards.nasa.gov>
- (3) NASA POLARIS Web site, <https://polaris.nasa.gov>
- (4) NASA Business Case Guide for Facilities Projects,
<http://www.hq.nasa.gov/office/codej/codejx/codejx.html>
- (5) NASA Online Directives Information System (NODIS),
<http://nodis3.gsfc.nasa.gov>
- (6) NASA forms Web site, <http://server-mpo.arc.nasa.gov/Services/NEFS/>