



Responsible Office: Office of Director

Subject: NASA Langley Project Management Requirements

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Change Log

Change Number	Date	Location	Change Description
N/A	N/A	N/A	N/A

Preface

P.1 Purpose

The purpose of this document is to define the Langley Research Center (“Langley”) procedure and requirements for planning and managing projects (as defined in section P.2). This document provides a framework for requirements and responsibilities associated with project management and includes rationales to enhance the understanding of each requirement. Additionally, this document provides references to other processes, resources, and tools available to project teams. Project Management spans several disciplines including Project Planning and Control, Engineering, Safety and Mission Assurance, and Knowledge Management; refer to these organizations’ guidelines and best practices for policies and processes that interface with the duties of project management. [Appendix D](#) provides a list of reference documents.

A key goal of this document is to emphasize and encourage tailoring of the requirements early in the project life cycle to optimize the project management initiation, formulation, implementation, and closeout processes in relation to the size, scope, and complexity of the project. Tailoring empowers the project team to propose a balance between the agreed-to risk posture for the project and the agreed-to level of management, while still ensuring controls and communications are in place for the required Center-level insight and oversight.

This document has broad applicability to projects governed by NPR 7120.5, NASA Space Flight Program and Project Management Requirements, NPR 7120.8, NASA Research and Technology Program and Project Management Requirements, and other small projects not governed by either of the above listed Agency requirements documents (see section P.2 for specific applicability and exclusions). This document is intended to supplement, not repeat or supersede, NPR 7120.5, NPR 7120.8, or other Agency and Center requirements.

P.2 Applicability

a. This document is applicable to Langley projects, with “project” defined as:

A specific investment having some or all of the following characteristics defined: goals, objectives, requirements, life cycle cost, a beginning, and an end. A project may be performed in support of non-Langley-led programs, which yields new or revised products, knowledge, or services that directly address NASA’s strategic needs. They may be performed wholly in-house; by government, industry, or academia partnerships; or through contracts with private industry.

This definition includes, but may not be limited to: human spaceflight, robotic spaceflight, technology development, research and technology, aeronautics projects, flight demonstrations, sub-projects, tasks, technical challenges, partnered projects (NASA, government, commercial, educational institutions), reimbursable projects, organizational initiatives, and other activities such as: Instrument Incubator Programs (IIPs) and Science Innovation Fund (SIF) projects.

- b. This document is not applicable to Small Business Innovation Research (SBIR) projects, Space Act Agreements less than \$1M (total life cycle) or projects that are governed by NPR 7120.7, the NASA Information Technology Program, and Project Management Requirements.
- c. The Langley Center Director, or designee, has discretion to apply or exclude any project, effort, or unit of work from the governance by this document.
- d. For existing projects at the time of this document's approval, the requirements of this document apply to their current and future phases as determined by the Center Director or designee.
- e. In this document, all mandatory actions (i.e., requirements) are denoted by statements containing the term "shall." The terms "may" or "can" denote discretionary privilege or permission, "should" denotes a good practice and is recommended but not required, "will" denotes expected outcome, and "are/is" denotes descriptive material.
- f. In this document, all document citations are assumed the latest version unless otherwise noted.

P.3 Authority

- a. NASA Policy Directive – NPD 1000.0, NASA Governance and Strategic Management Handbook
- b. NASA Policy Directive – NPD 7120.4, NASA Engineering and Program/Project Management Policy
- c. NASA Procedural Requirements – NPR 7120.5, NASA Space Flight Program and Project Management Requirements
- d. NASA Procedural Requirements – NPR 7120.8, NASA Research and Technology Program and Project Management Requirements
- e. Langley Procedural Requirements – LPR 7120.4, Langley Research Center Technical Authority Implementation Plan

P.4 Applicable Documents and Forms

- a. NASA Procedural Requirements – NPR 7120.5, NASA Space Flight Program and Project Management Requirements
- b. NASA Procedural Requirements – NPR 7120.8, NASA Research and Technology Program and Project Management Requirements

Note: A list of reference documents and forms is provided in [Appendix D](#).

P.5 Measurement/Verification

Compliance with this document is verified by responsible NASA Langley officials through submission of products and control plans due across the project life cycle, and by internal and external controls.

P.6 Waivers

LMS-CP-7151, Obtaining Waivers for Langley Management System (LMS) Requirements, outlines the process for obtaining waivers to the requirements in this document.

P.7 Cancellation

- a. LPR 7120.5 B-2, Space Flight Project Practices Handbook dated March 17, 2014.
- b. CID 7120.5, Interim Cost and Schedule Reserve Requirement for LPR 7120.5, Space Flight Project Practices Handbook dated December 18, 2019.
- c. LPR 7510.1, Project Initiation and Proposal Procedural Requirements dated March 24, 2014.
- d. Appendix D of LPR 7123.1, LaRC Systems Engineering Processes and Requirements dated May 28, 2015.

<u>/s/ David Young</u>	<u>July 28, 2021</u>
Center Deputy Director	Date

Distribution: Approved for public release via the Langley Management System (LMS); distribution is unlimited.

Chapter 1. Introduction

This document establishes Langley-specific requirements by which Langley implements projects, with the goal that projects will deliver products and services meeting Center commitments and customer needs. This document is intended to supplement, not repeat or supersede, NPR 7120.5, NPR 7120.8, or other Agency and Center requirements.

1.1 Project Governance

Most projects within scope of this document will be formally governed by a NASA Procedural Requirement for Program and Project Management, either NPR 7120.5 (space flight projects) or NPR 7120.8 (research and technology). This governance is typically determined by the project's customer such as the project's Mission Directorate Associate Administrator or designee, and is communicated in a Formulation Authorization Document.

For projects that are not provided Agency direction regarding governance to NPR 7120.5 or NPR 7120.8, the head of the Sponsoring Organization (SO) or designee is responsible for determining whether the project is governed by NPR 7120.5, NPR 7120.8, or solely by this document. The Project Manager, Deputy Center Director, Center Chief Engineer, Director of Safety and Mission Assurance (SMA), or designees provide input and concurrence to this designation.

1.2 Project Classification

This document summarizes a Langley-specific project classification model, referred to as "Langley Mission Type" (LMT), to encourage tailoring and assist in the appropriate application of requirements across projects of varying size, scope, and complexity.

1.2.1 Langley Mission Type

A Langley Mission Type is a Center-defined project designator applied to each project. This designation provides direction for projects on the appropriate application of the requirements contained within this document. LMT designations include A-F (see [Appendix E](#) for criteria for Langley Mission Types A-F), and Type O. The LMT is based on the individual project's characteristics such as priority, acceptable risk, national significance, complexity, mission lifetime, cost guidance, launch constraints, and alternate opportunities.

LMT A-F projects will comply with requirements within this document, subject to tailoring. All other projects that do not meet the LMT criteria A-F will be assigned a Langley Mission Type O designation, requiring minimal governance and will comply with the limited requirements and expectations referenced and outlined in [section 1.2.2](#) only.

Langley utilizes the Classifier Tool, which is available in the online NPR Tailoring Application (NTA) (<https://oneplace.larc.nasa.gov/nta>), to assist projects and project stakeholders in classifying the project's LMT A-F.

The LMT will be agreed to prior to the project's New Project Briefing, and formally approved in the project's Project Initiation Memorandum. The LMT may change if there are significant changes in any of its original key characteristics during its life cycle.

1.2.2 Langley Mission Type O

The Langley Mission Type O designation is intended to capture project work that is deemed to not be on the more formal Type A-F classification scale. These activities will typically meet one or more of the following criteria:

- a. Research activity targeting expanding the state of the art or expanding the knowledge base in a specific discipline
- b. Planned investment is less (typically much less) than \$1M Life Cycle Cost
- c. Significant risk of not achieving planned objectives is permitted
- d. Impact of not achieving planned objectives is low to very low
- e. Other projects, as designated by the head of the Sponsoring Organization or designee

Projects assigned a Type O designation will comply with the requirements and expectations listed within this section. The rest of this document may serve as a resource or handbook for additional project management processes and controls for Type O projects.

1.2.2.1 Langley Mission Type O Requirement References

- a. The head of the project's Sponsoring Organization designates a Sponsoring Organization Official (see [section 3.2](#) for requirement).
- b. The project's Sponsoring Organization Official ensures selection of a Project Manager or equivalent (ie. Principle Investigator) (see [section 3.2](#) for requirement).
- c. The Project Manager ensures completion of a simplified Project Initiation Memorandum documenting project expectations between the Sponsoring Organization Official and the project (see [section 3.6](#) for requirement).
- d. The project will work with the Sponsoring Organization Official to determine the applicability of reviewing and capturing lessons learned at the end of the project.

1.2.2.2 Langley Mission Type O Expectations

The Sponsoring Organization Official is responsible for:

- a. Ensuring the Project Initiation Memorandum is reviewed and approved by the appropriate organizations to maintain awareness of the activities within those organizations
- b. Maintaining awareness of the progress of the activity to assist (as necessary) in managing stakeholder expectations and to ensure Langley delivers on the commitment to customers
- c. Defining the level of internal/independent review that is appropriate for the project activities, key work products, and final deliverables
- d. Ensuring the review of key work products and final deliverables is conducted
- e. Ensure all safety and mission assurance and personnel safety practices are followed

1.2.3 Comparison to Other Project Classifications

The project's Langley Mission Type is a distinct designation that is independent of a project's Risk Classification, as defined in NPR 8705.4, Risk Classification for NASA Payloads, and a project's Category, as defined in NPR 7120.5. The LMT and Risk Classification are based on similar criteria (factors). Due to this fact, a project's LMT could be the same as the project's Risk Classification (e.g., a project is a LMT D and Risk Classification D). Because the LMT is assigned at the Center-level and the Risk Classification is assigned at the Mission Directorate-level, these two designations may not be the same (e.g., a project with a LMT C might also be a Risk Classification D). [Table A-1](#) outlines the key differences between the LMT, Risk Classification, and Category.

Table A-1. Comparison between Langley Mission Type, Risk Classification, and Category

	Langley Mission Type	Risk Classification	Category
Prescribing document and governance	Prescribed by this document; required for all projects governed by this document.	Prescribed by NPR 8705.4; required for projects governed by NPR 7120.5.	Prescribed by NPR 7120.5; required for projects governed by NPR 7120.5.
Ratings	Types A-F, O	Classifications A-D	Categories 1-3
Authority	Established by Langley Sponsoring Organization with input from internal Center stakeholders; approved in the Project Initiation Memorandum.	Established by the Mission Directorate with input from the Project, Governing Program Management Council, and other customers.	Approved by the NASA Associate Administrator with recommendation from the Mission Directorate Associate Administrator.
Designation level	Designated at a project level.	Designated at a payload or sub payload level.	Designated at a project level.
Purpose	Used to apply the appropriate level of management rigor and control, as well as Center management oversight and organizational insight.	Used to apply the appropriate design and management controls, systems engineering processes, mission assurance requirements, and risk management processes.	Used to apply management requirements and Agency attention and oversight, as well as establishing the oversight council and approval requirements.

1.3 Project Life Cycle

This document has been structured to follow standard NASA project life cycles, while also focusing on distinct sets of activities in Langley's project management process. NASA project life cycles are defined in both NPR 7120.5 and NPR 7120.8. These governing documents have similar project life cycles which identify three periods: a period that occurs prior to Formulation (referred to as "Pre-Phase A" in NPR 7120.5 or "pre-formulation" in NPR 7120.8), Formulation, and Implementation. Given the similarities, the life cycle described in these governing documents are the basis for the structuring of the requirements within this document.

NPR 7120.5 further breaks up formulation into Phases A – B, and implementation into Phases C – F, which are gated by Key Decision Point (KDP) reviews. Additionally, the NPR 7120.5 project life cycle includes a series of life cycle reviews. These additional phases, decision points, and reviews are shown in the following section for context, however, this document focuses on broader periods of the project life cycle as described within the following sections.

NPR 7120.8 uses Continuation Assessments (CA) as Key Decision Point reviews and Periodic Project Reviews throughout the project's Implementation period.

1.3.1 Langley Process and Requirements

This document structures Langley's project management requirements across five sections (Chapters) that represent overlapping periods throughout the project life cycle. These Chapters include Life Cycle, Initiation, Formulation, Implementation, and Closeout periods. The five periods are shown in [Figure 1-1](#) and are described in further detail below.

Competed and directed projects both adhere to the same project management requirements, but due to the differences in how these projects come into existence, the Initiation requirements will start at different points in the project life cycle and be applied over different lengths of time. [Figure 1-1](#) shows a row for competed projects and a row for directed projects, each denoting where the Initiation period overlaps the other periods in their respective swim lanes. More information about competed and directed projects is outlined in sections 1.3.2 and 1.3.3, respectively.

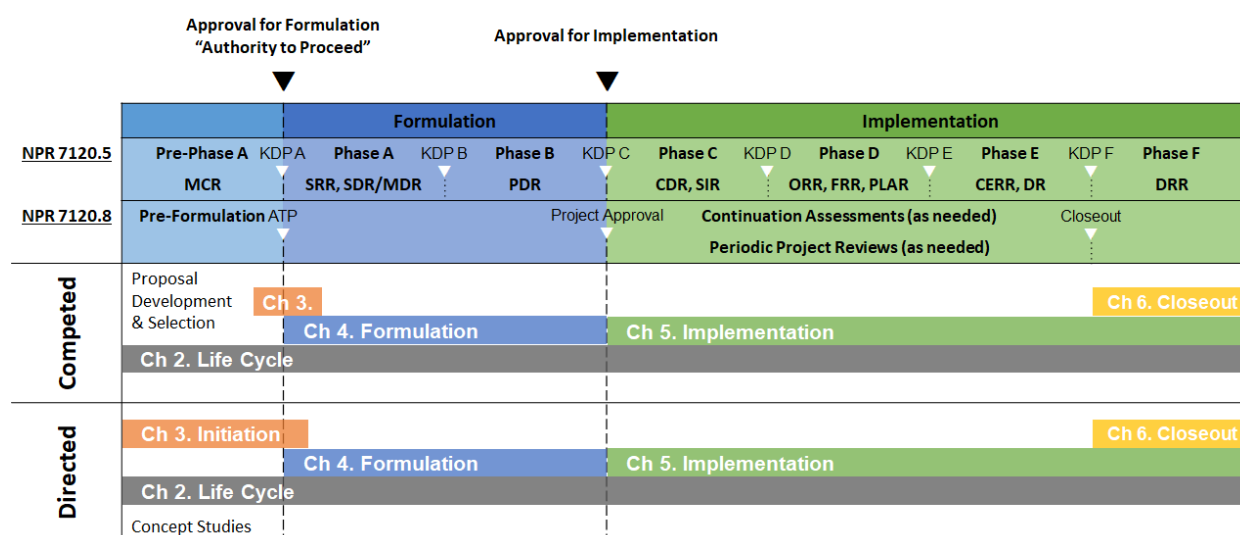


Figure 1-1. Langley Process and Requirements across the Project Life Cycle

The chapters in this document and as displayed in [Figure 1-1](#) correspond to the following periods of the project life cycle:

- Chapter 2. Life Cycle.** This Chapter covers requirements that are applied throughout the project life cycle such as: project planning and control, reporting, or reserve requirements.
- Chapter 3. Initiation.** The project initiation period includes the initial designation of Center insight, oversight, technical authority and management roles, project classification, proposal-project handoff for competed projects, New Project Briefing, preliminary formulation activities, Project Initiation Checkpoint and development, and signature of the Project Initiation Memorandum. Some initiation activities, such as role assignments and project classification, may have already occurred as part of the solicitation and proposal development process, as outlined in LAPD 7120.9, Proposal Reviews and Archiving.
- Chapter 4. Formulation.** Formulation is the period in which the project establishes high-level requirements and success criteria, prepares plans, budgets, and schedules essential to the success of the project, and establishes control systems to ensure performance to those plans and alignment with current Agency strategies. Generally, the Formulation period starts with

an Authority to Proceed (ATP). Formulation ends with the project baseline or project approval (PA), at which time the project proceeds to Implementation.

- d. **Chapter 5. Implementation.** Implementation is defined as the execution of approved plans for the development and operation of the project and the use of control systems to ensure performance to approved plans and continued alignment with the Agency's strategic goals. Implementation starts with the project baseline or project approval.
- e. **Chapter 6. Closeout.** Closeout includes final delivery of all remaining project deliverables and safe decommissioning of project assets. The Chapter also includes requirements associated with termination (unplanned closeout), although termination could occur at any point during the project life cycle.

1.3.2 Competed Projects

Competed projects, or those stemming from the development and selection of a proposal, begin the Initiation period at proposal selection. The proposal development process is a form of project planning and must ensure proposal commitments consider applicable project management requirements to be met.

LAPD 7120.9, Proposal Reviews and Archiving establishes policies and procedures for development and submission of proposals. For projects governed by NPR 7120.5, the proposal development, submission, and selection process for competed projects usually replaces Pre-Phase A activities (which include Mission Concept Review and Key Decision Point A).

1.3.3 Directed Projects

Directed projects, or those generated in a top-down process from the Agency strategic goals and through the strategic acquisition planning process, begin Initiation upon direction and guidance from a Mission Directorate Associate Administrator (MDAA).

For directed projects, the Initiation period typically begins at the beginning of a Pre-Phase A or pre-formulation period as shown in [Figure 1-1](#), and may extend into the beginning of the Formulation period.

1.3.4 Other Projects

Projects can also be initiated in many other ways. In some cases, other federal agencies fund NASA to design and develop projects; these projects are known as reimbursable projects. Projects can also come from other types of acquisition authorities such as grants, cooperative agreements, and Space Act Agreements (SAA). These projects will begin Initiation upon agreement or acquisition.

1.4 Roles and Responsibilities

Specific roles and responsibilities are defined in this section as they relate to the requirements of this document. Organizations across the Center provide resources, services, and expertise to projects and project teams. Center organization integration points are summarized in [Appendix H](#), Center Organization Integration List. Additionally, organizational categories (Product Unit Directorate, Core Resource Unit Directorate, and Mission Support Organization) and relevant councils (Center Management Council, Project Management Council) are defined with references in [Appendix A](#).

1.4.1 Center Director

The roles and responsibilities of NASA management, including Center Directors, are defined in NPD 1000.0, NASA Governance and Strategic Management Handbook and further detailed in NPD 1000.3, The NASA Organization. Additionally, NPR 7120.4, NASA Engineering and Program/Project Management Policy outlines responsibilities of Center Directors as it relates to project management. With respect to this project management process, the NASA Langley Center Director or designee:

- a. Manages Center operations to facilitate project execution
- b. Ensures proper integration, planning, and execution of the programmatic, technical authority, and institutional needs of projects assigned to the Center
- c. Resolves executive level issues with Headquarters Mission Directors, Program Offices, and Functional Offices

1.4.2 Deputy Center Director

The NASA Langley Deputy Center Director is the governing official for execution of projects covered by this document. With respect to this project management process, the Deputy Center Director:

- a. Oversees projects, monitors, and evaluates project work executed at the Center
- b. Reviews and approves Project Initiation Memorandums, Project Plans, and other project Products and Plans
- c. Reviews and approves cost estimates transmitted to stakeholders outside the Center
- d. Supports projects in the proper identification of the project's Center stakeholders
- e. Approves the project's sponsoring organization with input from the project and other Center stakeholders (e.g., PUD, CRUD management)
- f. Provides Center-level approval for the resolution of deviations/waivers to Agency and Center requirements
- g. Serves as Chair of the Center Management Council and Project Management Council

1.4.3 Center Chief Engineer

The Center Chief Engineer provides senior-level leadership for Center project engineering activities across the entire project life cycle to ensure the quality of engineering products meets mission goals and objectives; and provides engineering leadership for the Technical Authority process by ensuring policy and process implementation.

Technical Authority and associated processes are defined in NPD 1000.0, NASA Governance and Strategic Management Handbook, and LPR 7120.4, Langley Research Center Technical Authority Implementation Plan. With respect to this project management process, the Center Chief Engineer:

- a. Provides policy direction and technical authority process implementation
- b. Leads periodic reviews of the technical quality of work being performed on projects
- c. Guides the planning and facilitation of major technical reviews for projects
- d. Supports the project in determining New Project Briefing and Project Initiation Review scope, audience (stakeholders), and timing
- e. Reviews and approves Project Initiation Memorandums, Project Plans, Review Plan, and other project products and plans

- f. Supports projects in the proper identification of the project's Center stakeholders
- g. Advises Center management on the resolution of deviations/waivers to Agency and Center requirements and the resolution of formal dissents

1.4.4 Center Chief Financial Officer

The Center Chief Financial Officer (CFO) reports to the Agency Chief Financial Officer and provides the Center with primary fiscal services and accountability. The Center CFO has fiduciary responsibility for all Center financial matters and, as such, has direct accountability to the Center Director. With respect to this project management process, the Center Chief Financial Officer:

- a. Ensures the availability of Project Planning and Control (PP&C) expertise
- b. Provides valid cost-estimating tools
- c. Provides standard Center-level cost rates
- d. Reviews and approves cost estimates transmitted to stakeholders outside the Center
- e. Reviews and approves Project Initiation Memo's
- f. Provides planning, analysis, control, and reporting of fiscal resources
- g. Provides or identifies personnel and expertise to conduct independent cost/schedule estimates and assessments (ICE/ICA)

1.4.5 Sponsoring Organization & Sponsoring Organization Official

Each project will have a Sponsoring Organization. The Sponsoring Organization is the organization at Langley responsible for project insight and oversight, including ensuring proper compliance with Agency and Center requirements. The Deputy Center Director is responsible for approving the Sponsoring Organization with input from the project and other Center stakeholders (e.g., Product Unit Directorate (PUD), Core Resources Unit Directorate (CRUD management)).

For LMT A-F projects, the Sponsoring Organization is a PUD. For LMT O projects, the Sponsoring Organization may be a PUD, CRUD, or mission support organization.

The Head of the project's Sponsoring Organization designates a Sponsoring Organization Official. The Sponsoring Organization Official maintains management insight and oversight of projects, which includes ensuring proper compliance with Center and Agency requirements. With respect to this project management process, the Sponsoring Organization Official:

- a. Ensures selection of a Project Manager (or equivalent)
- b. Reviews and approves Project Initiation Memorandums, project plans, and other project products and plans
- c. Supports the project in determining New Project Briefing and Project Initiation Review scope, audience (stakeholders), and timing
- d. Reviews and approves cost estimates transmitted to customers or stakeholders outside the Center
- e. Ensures effective project management and Project Planning and Control (PP&C) for each project
- f. Determines project requirements applicability for Langley Mission Type O projects
- g. Supports the projects in representing Langley to external stakeholders
- h. Reports project status and issues to the Center Management Council

1.4.6 Project Manager (or equivalent)

The roles and responsibilities of NASA management, including Project Managers, are defined in NPD 1000.0, NASA Governance and Strategic Management Handbook. NPD 7120.4, NASA Engineering and Program/Project Management Policy outlines responsibilities of managers and engineers responsible for realizing a program, project, service, or activity. NPR 7120.5 and NPR 7120.8 provide specific responsibilities as they relate to their respective requirements and processes.

The term Project Manager is used throughout this document; however, this role may be filled by a Principal Investigator (PI) or other position that holds the responsibilities associated with a Project Manager (e.g., Sub-Project Manager, Task Lead, Responsible Manager, Project Lead). With respect to this project management process, the Project Manager:

- a. Leads the project and is responsible and accountable for the formulation and implementation of the project including project safety; technical integrity; technical, cost, and schedule performance; and mission success
- b. Is responsible and accountable for the safe conduct and successful outcome of the project in conformance with governing programmatic requirements
- c. Ensures the project meets the customer's cost, schedule, technical performance requirements, and other Agency and Center requirements
- d. Leads the planning and execution of the project
- e. Leads initiation of the project, project definition, development, approval of the Project Plan, and other project products and plans
- f. Leads initiation of the Project Initiation Memo
- g. Ensures project staffing is planned, communicated to staffing organizations, and selected to meet project needs
- h. Ensures that the project responds to the needs of the customer and other stakeholders
- i. Represents the project to external and Langley stakeholders
- j. Reports regularly to the Sponsoring Organization Official and other required Center-level reporting (e.g., pre-Center Management Council (CMC), CMC, Monthly Management Review (MMR), etc.)
- k. Responsible for roles and responsibilities as defined in NPR 7120.5 or NPR 7120.8, as applicable

1.4.7 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.

1.4.8 Project Scientist

A Project Scientist (PS) provides the scientific leadership necessary for the scientific success of a project by ensuring that the mission meets or exceeds the scientific requirements. The Project Scientist and any deputies are integral members of the project management team. For projects with a designated Project Scientist, the Project Scientist:

- a. Advises the Project Manager in all matters regarding science and science-engineering trades required to achieve the mission objectives within the resources available

- b. Provides scientific guidance and oversight of project and mission elements as agreed to by the Project Manager and Sponsoring Product Unit
- c. Leads development of science requirements and supports development of science related mission/instrument requirements, and provides recommendations to mission success criteria. The Project Scientist reviews and concurs on any requirement changes, waivers, or deviations that impact mission/instrument performance or the scientific return of the mission/instrument
- d. Serves as the primary science interface between the science community and the project; serves as a scientific spokesperson and advocate on behalf of the project including to the Principal Investigator or Science Team leaders, Langley management, and Headquarters Program Scientist, Program Executive, and other Headquarters management
- e. Oversees the implementation of the science observation program of the mission (e.g., Phase E)
- f. Participates in project meetings/reviews to confirm that scientific requirements will or will not be met
- g. Reviews and concurs to plans involving calibration, validation, mission and science operations, data analysis and archiving, and education and public outreach

1.4.9 Project Chief Engineer

The Project Chief Engineer (Project CE), this role is also known as the Chief Engineer, serves as the designated Engineering Technical Authority for the project as defined in LPR 7120.4, Langley Research Center Technical Authority Implementation Plan. Additionally, NPD 7120.4, NASA Engineering and Program/Project Management Policy outlines responsibilities of managers and engineers responsible for realizing a program, project, service, or activity. The Project CE is designated by the Center Director, or responsible Engineering Director. For projects with a designated Project CE, the duties include:

- a. Leads and manages project-related engineering activities, including systems engineering, design, requirements development, sustaining engineering, and operations
- b. Delivers a technically sound and safe product by applying and ensuring the application of institutional requirements
- c. Develops and dispositions project deviations/waivers and formal dissents
- d. Reviews and approves processes/activities such as technical readiness assessments, trend analysis, risk analysis, hazard analysis, and Failure Modes Effects Analysis (FMEA) for their projects, and documents the results of the review (peer, technical quality, life cycle, etc.) in project files
- e. Reports regularly at Center-level reporting forums and other adhoc reviews (e.g., Engineering Project Technical Review (EPTR), Engineering Review Board (ERB), peer reviews, etc.)

1.4.10 Project Systems Engineering Lead Function

The Systems Engineering Lead manages/leads all Systems Engineering and Integration (SE&I) activities and works with the Project Chief Engineer (if project role is filled) to ensure the proper application and management of discipline-specific engineering requirements and Agency standards. Depending on the project, this function may be performed under different roles/titles; however, this will be clarified in the Project Initiation Memo and the Systems Engineering Management Plan. The Systems Engineering Lead is responsible for the initiation and implementation of the project SE&I element including the technical integrity, performance, and

mission success of the overall system as well as meeting the cost and schedule commitments of the SE&I element. Additionally, NPD 7120.4, NASA Engineering and Program/Project Management Policy outlines responsibilities of managers and engineers responsible for realizing a program, project, service, or activity. With respect to this systems engineering function, the Systems Engineering Lead:

- a. Assists the project through direct involvement with working-level engineers to identify engineering requirements and develop solutions that comply with the requirements
- b. Works through and with the project-level Engineering Technical Authority to ensure the proper application and management of discipline-specific engineering requirements and Agency standards
- c. Leads the development of all systems engineering deliverables
- d. Manages all system-level interfaces, integration, and verifications
- e. Manages all integrated products, including integrated test and analysis
- f. Utilizing systems engineering processes and principles, ensures delivery of an integrated and verified system

1.4.11 Project Chief Safety and Mission Assurance Officer

The Project Chief Safety and Mission Assurance Officer (CSO) serves as the designated Safety and Mission Assurance Technical Authority for the project. For projects without a designated CSO, the Head of Mission Assurance Branch within the Safety and Mission Assurance Office serves as the designated Safety and Mission Assurance Technical Authority for the project. The Director of the Safety and Mission Assurance Office or designee appoints Project CSOs. Project CSOs report to the Director of the Safety and Mission Assurance Office or designee. The Project Chief Safety and Mission Assurance Officer:

- a. Establishes and oversees the Safety and Mission Assurance design processes, specifications, requirements, best practices, etc. necessary to fulfill mission performance requirements
- b. Ensures involvement of appropriate subject matter experts in the development and review of safety and mission assurance products by the project
- c. Leads the specification and coordination of hardware and software assurance functions for the project
- d. Responsible for reviewing program/project deviations/waivers and formal dissents; assessing technical risks or solutions to technical issues; and responsible for dispositioning deviations/waivers and formal dissents to Safety and Mission Assurance (SMA) requirements or initiating a formal dissent as appropriate

1.4.12 Project Planning and Control Lead Function

The PP&C Lead is matrixed from the OCFO to provide project financial and workforce estimates, budgets, phasing, reporting, forecasting, and any input needed for financial decisions within the project. Depending on the project's size, the project may have a PM Deputy for PP&C, a full or part-time Lead, or the PM may take on these duties as needed. With respect to this PP&C process, the PP&C Lead:

- a. Is responsible and accountable for the project financial estimates and reporting
- b. Ensures the project meets the customer's cost reporting requirements
- c. Leads the development of all financial estimates and reporting for the project

- d. Maintains configuration control and milestone versions of all project financial products
- e. Ensures project staffing is documented and reported
- f. At PM's request, represents the project on financial matters to external and Langley stakeholders
- g. Reports regularly OCFO on project financial status

Chapter 2. Life Cycle Process and Requirements

Project requirements associated with recurring processes or activities throughout the project life cycle are listed in this section. Project teams will review and monitor adherence to these requirements as the project progresses through the project life cycle. A summary list of requirements is provided in [Appendix C](#).

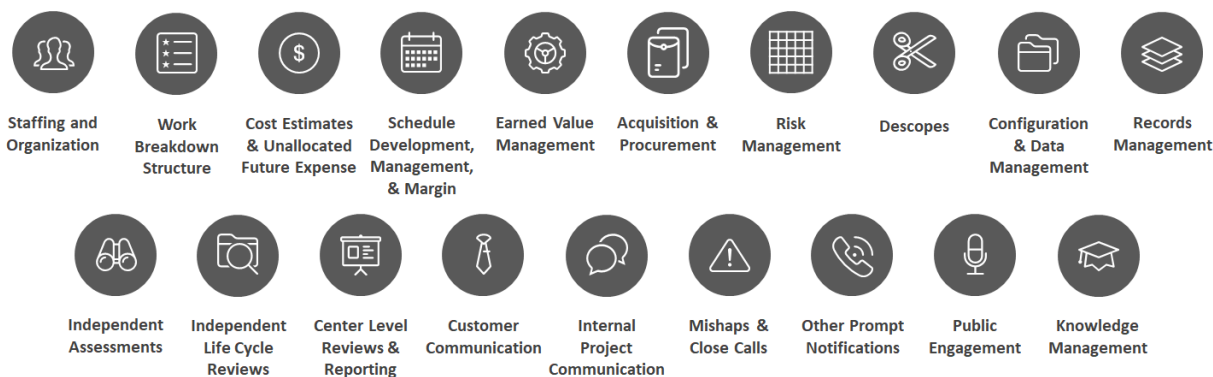


Figure 2-1. Process Elements – Life Cycle

2.1 Staffing and Organization

Project team staffing and organization is defined, developed, and negotiated with appropriate Center(s) organizations to meet the needs of the project. A project team may be geographically co-located (all team members reside at one Center), virtual (all team members distributed across multiple Centers and/or organizations), or hybrid (combined geographically co-located and virtual team members).

Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional guidance and resources for staffing.

R1. The Project Manager shall ensure an organizational structure is developed and maintained.

Rationale: These tasks serve multiple purposes in that they enable the Project Manager to develop a clear and concise instrument to plan for the staffing needs, assign roles and responsibilities, as well as provides a visual representation to facilitate communication to project team members and external stakeholders.

Allocation: Applicable to all projects LMT A-F in scope of this document.

R2. The Project Manager shall ensure key leadership roles in the project organizational structure are filled.

Rationale: The overall leadership of the project is the responsibility of the Project Manager; therefore, the Project Manager establishes the organizational structure, identifies the other leadership positions, and defines the responsibilities for each. In addition to a Project Manager (assigned in or prior to project Initiation), the key following leadership roles establish and maintain programmatic and technical responsibilities (this list is

representative only; the key leadership roles are dependent on factors such as the individual project's mission type, size, scope, direction from management, etc.).

- Project Chief Engineer (Project CE) – Per [section 1.4.9](#) of this document, the Project CE serves as the Lead of the technical team. The Project CE also serves as the Technical Authority for the project. The Center Director or responsible Engineering Director appoints the Project CE.
- Project Chief SMA Officer (CSO) – Per [section 1.4.11](#) of this document, the CSO serves as the designated Safety and Mission Assurance Technical Authority for the project. The Director of Safety and Mission Assurance or designee appoints the project CSO.
- Deputy Project Manager (DPM) – The DPM supports the Project Manager in the management and execution of the project. The DPM serves as the deputy to the Project Manager to carry out tasks delegated by the Project Manager. The DPM manages project activities and makes decisions with the authority of the Project Manager in the absence of the Project Manager. Depending on the size of the project, there may be multiple DPMs assigned and each may have a specific thrust (i.e., DPM for Technology, DPM for Implementation, DPM for PP&C, etc.), as needed by the Project Manager.
- Work Breakdown Structure (WBS) Element Leads – The WBS Element Leads are responsible for the leadership of an assigned project WBS Element. The Project Manager, in conjunction with the Project CE or equivalent, works with the head of the responsible line organizational unit to staff these positions.

Depending on the size and scope of the project, a Project CE may not be assigned. In this instantiation, the Project Manager may include a Lead Systems Engineer (LSE), Systems Engineer (SE), or Technical Lead as the lead of the technical team. The project will use the Institutional Technical Authority path as defined in LPR 7120.4, Langley Research Center Technical Authority Implementation Plan. Alternately, regardless of the size or type of the project, the CSO, if appointed, always serves as the Safety and Mission Assurance Technical Authority.

Allocation: Applicable to all projects LMT A-F in scope of this document.

R3. The Project Manager shall ensure development and implementation of a staffing plan consistent with project needs and requirements over the life of the project.

Rationale: The Project Manager works with the project leadership team to develop the staffing plan. This plan is part of the project baseline and is included in the Formulation Agreement and/or Project Plan. The staffing plan should closely follow the project WBS to ensure that all elements receive the appropriate staffing. The project team roles and staffing levels may evolve over the life of the project. For example, the Pre-Phase A/pre-Formulation activities may require a significantly different team than the one implementing Formulation and Implementation. Therefore, the staffing plan requires reassessment and updating as the project progresses through the different life-cycle phases. These updates should also include applicable destaffing plans for the later phases of the project or whenever necessary due to shifts in project scope, scale, or agreement with stakeholders.

Each Project Manager is responsible for negotiating all staffing needs, Civil Servant as well as Contractor, with the appropriate line organizational unit. Typically, Project Managers, or their designee in the project leadership team, negotiate with the head of the line organization for positions rather than specific individuals. Although specific individuals may be desired, the final decision of appointing an individual to a position lies with the head of the line organization.

Allocation: Applicable to all projects LMT A-F in scope of this document.

R4. The Project Manager shall actively communicate with line organizations and management stakeholders to facilitate team effectiveness and continuity.

Rationale: Although it is desired that personnel assignments on the project team remain static for continuity of operations, team members are matrixed from a line organization and can be subject to external factors such as attrition, needs of the line organization, Center priorities, etc. It is of paramount importance, therefore, that Project Managers maintain a clear and constant line of communication with the line organizations as well as management stakeholders to anticipate any changes to staffing. When changes are necessary, line management should clearly communicate staffing changes to the Project prior to implementation of changes, providing an opportunity for the project to provide feedback/reclama and to develop an impact assessment. Staffing levels are assessed on, at least, an annual basis through annual workforce planning activities. Another method of communication is through periodic, candid reports of team members' performance on the project, especially for mid-term and final performance reviews.

Allocation: Applicable to all projects LMT A-F in scope of this document.

2.2 Work Breakdown Structure

A Work Breakdown Structure (WBS) is a product-oriented family tree that identifies the hardware, software, services, and all other deliverables required to achieve an end project objective. The purpose of a WBS is to subdivide the project's work content into manageable segments to facilitate planning and control of cost, schedule, and technical content. A preliminary WBS is developed early in the conceptual stages of the project, as soon as program management believes the project has reached a stage of definition where it is feasible.

Ref. NASA/SP-3404, NASA Work Breakdown Structure Handbook provides project teams necessary instruction and guidance in the best practices for WBS and WBS dictionary development and use for project implementation and management control.

Ref. NASA/SP-2014-3705 NASA Space Flight Program and Project Management Handbook provides additional information and guidance regarding WBS development and considerations in context with the project life cycle.

R5. The Project Manager shall ensure a Work Breakdown Structure is developed and maintained.

Rationale: The project WBS identifies the total project work planned, which includes not only all NASA in-house work content, but also all work content to be performed by contractors, international partners, universities, or any other performing entities. Work

scope not contained in the project WBS should not be considered part of the project. The WBS divides the work content into manageable elements with increasing levels of detail. It is Langley policy to implement the standard WBS, dependent on the governing NPR (NPR 7120.5, NPR 7120.8), on all Langley-led projects unless authorized by the Sponsoring Organization Official. Projects extend the WBS and WBS dictionary to the level necessary to implement and verify the work. However, both governing NPR's require a minimum of two levels. The subdivisions of work in the project WBS need to reflect a logical, accurate, and compatible hierarchy of work. Level 1 of the project WBS is the name of the project. Level 2 and below elements correspond to the project products plus other enabling activities necessary for completing the work. The project WBS is baselined by PDR or equivalent, although breakdown to the work package level will continue as the project advances into implementation.

Allocation: Applicable to all LMT A-F projects within scope of this document.

R6. The Project Manager shall ensure a Work Breakdown Structure dictionary is developed and maintained.

Rationale: A WBS dictionary lists and defines the WBS element contents. Prepared by the project team, the WBS dictionary facilitates the identification of all work scope, as well as eliminates duplication and overlap of work assignments. To eliminate content ambiguities, use clear statements describing the effort to be completed. The level of descriptive detail needed for each element should be commensurate with the element's hierarchical position in the overall WBS structure. The lower the level of a WBS element, the greater the level of descriptive detail needed. The descriptive detail of element content should clearly identify all element interfaces.

Allocation: Applicable to all projects in scope of this document with a Langley Mission Type A-D. Projects with a Langley Missions Type E or F will work with the Sponsoring Organization Official to determine the applicability of this requirement.

2.3 Cost Estimates and Unallocated Future Expenses

A cost estimate is a documented, risk-adjusted forecast of future cost representing a specific scope of work, integrated schedule, and implementation approach. Project cost estimates are developed by the project at the lowest Work Breakdown Structure (WBS) level practicable and summed to a higher level. A cost estimate includes a Basis of Estimate (BOE), which captures the ground rules, assumptions, and drivers used in developing cost or schedule estimates, including applicable model inputs, rationale, or justification for analogies and details supporting cost or schedule estimates. Projects update cost estimates for each major review, Key Decision Point, and as part of the annual Program, Planning, Budgeting, and Execution (PPBE) process. The applicability and tailoring of a cost estimate and BOE as part of the project's baseline occurs during the project's Compliance Matrix Assessment during Formulation ([section 4.1](#)).

Unallocated Future Expense (UFE) is the portion of estimated cost required to meet a specified confidence level 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. UFE may be held by the project (project-held UFE) or held by the Mission Directorate

at NASA Headquarters (Headquarters UFE, or simply UFE). Previously, project-held UFE was referred to as project reserve, cost reserve, or budgeted reserve.

Note: An Independent Cost Estimate (ICE) is a cost estimate performed by an independent entity. An ICE uses an alternate method (e.g., parametric), alternate inputs or assumptions, basis, or risk weighting than that used by the project. An ICE is typically performed as part of an Independent Assessment (IA) or Independent Cost Assessment (ICA), in source selection preparation, or for preparation for a proposal evaluation.

Ref. NASA CEH v4.0, NASA Cost Estimating Handbook serves as a guide for cost estimating at NASA. The intended audience covers the non-estimating professional and the new cost estimator, as well as experienced analysts.

R7. The Project Manager shall obtain Deputy Center Director, Chief Financial Officer, and Sponsoring Organization Official or designees' approval and participating organizations' concurrence prior to transmitting any cost estimate outside of the Center.

Rationale: Cost estimates transmitted to stakeholders outside the Center need appropriate review before transmission to ensure Center commitments are represented accurately. For this reason, it is critical that key Center officials are aware of and approve of any commitments or potential commitments by the project. Center-level review and approval of cost estimates is typically obtained through the Sponsoring Organization. Cost estimates will be communicated with participating or impacted organizations as part of cost estimate development and update.

Allocation: Applicable to projects above \$30M. For projects \$30M and below the Sponsoring Organization Official has approval authority for cost estimates transmitted outside the Center, and will designate appropriate concurring offices. The project will work with their Sponsoring Organization Official to determine approvals and concurrences of cost estimates transmitted outside the Center.

R8. The Project Manager shall ensure project-held UFE is included in the project's cost estimate, based on estimated formulation and implementation risk, and at or above minimum project-held UFE levels throughout the project life cycle as outlined in [Table B-1](#).

Table B-1. Required minimum project-held UFE for specified projects

		7120.8 or 7120.5 w LMT E-F and LCC ≤ \$30M	7120.5 LMT A-E w LCC > \$30M	7120.5 LMT A-E w LCC > \$30M
Milestone(s)		% project-held UFE on cost to go****	% project-held UFE on cost to go in Development (through Phase D)	% project-held UFE on cost to go in Operations and Closeout (Phases E & F)***
7120.5	7120.8			
MCR, KDP-A	ATP	10%	≥ 30%	≥ 15%

SRR, SDR/MDR, KDP-B		10%	≥ 30%	≥ 15%
PDR, KDP-C,	Project Approval	10%	≥ 25%	≥ 15%
SIR, KDP-D		N/A	≥ 20%	≥ 10%
Delivery*		N/A	≥ 10%**	≥ 10%

**Examples: delivery to the launch site for mission; instrument project delivery to its flight system; ground system or other product delivery.*

***Project-held UFE requirements in Phase D at delivery apply to projects with post-delivery content in Phase D such as launch processing, launch, and checkout. Projects without post-delivery content in Phase D are not required to maintain project-held UFE post-delivery in Phase D.*

****Project-held UFE requirements in Phases E and F apply to projects with operations, sustainment, and/or closeout content. Projects without this content are not required to maintain project-held UFE following Phase D.*

*****For all projects governed by NPR 7120.8 and NPR 7120.5 projects designated LMT E-F with LCC ≤ \$30M, the UFE percentages in this table are for planning purposes only. The Project Manager will coordinate with the Sponsoring Organization to determine the appropriate level of project-held UFE.*

Rationale: For NPR 7120.5 projects designated LMT A-E with LCC > \$30M, estimated formulation and implementation risk should be translated to an appropriate project-held UFE value through analysis techniques such as assessment of similar past projects, Schedule Risk Analysis (SRA), Joint Cost and Schedule Confidence Level (JCL) analysis, and/or by comparison with independent cost estimates or independent assessments. Project customers may control the ability of the project to maintain the amount of project-held UFE. Projects that cannot meet this requirement will document rationale and obtain a waiver from the Deputy Center Director and Sponsoring Organization Official or designees.

For all projects governed by NPR 7120.8 and those governed by NPR 7120.5 with LMT E-F and LCC ≤ \$30M, the policy for project-held UFE is different across the different Sponsoring Organizations. Therefore, it is imperative that projects coordinate with their Sponsoring Organization for the appropriate levels of project-held UFE. Unless notified differently by their Sponsoring Organization, generally, projects that are in these categories should plan for a minimum of reserves as outlined in [Table B-1](#).

Definitions and calculations associated with UFE, Encumbrances, Liens, and Threats are included in [Appendix G](#).

Allocation: Applicable to projects governed by NPR 7120.5 with a Langley Mission Type A-F.

2.4 Schedule Development, Management, and Margin

Schedule management is an integral part of project management that when effectively performed, helps safeguard project success. The purpose of schedule management is to provide the framework for coordinating, communicating, time phasing, and resource planning the necessary tasks within a work effort to manage and optimize the available resources and deliver products

on time and within budget. The applicability and tailoring of project schedule plans and products, as part of the project's baseline, occurs during the project's Compliance Matrix Assessment during Formulation ([section 4.1](#)).

Schedule margin is a separately planned quantity of time (working days) above the planned work duration estimate to be used specifically to address/absorb the impacts due to risks and uncertainties. It is a risk-informed duration that is included as activities in the schedule prior to baselining. Margin is intentionally loaded in the IMS or schedule just like any other activity; however, these activities do not have any defined scope. More information about schedule margin is available in the NASA Schedule Management Handbook. Projects that cannot meet this requirement will document rationale and obtain a waiver from the Deputy Center Director and Sponsoring Organization Official or designees.

Ref. NASA/SP-2010-3403, NASA Schedule Management Handbook provides Agency guidance for meeting the scheduling requirements contained in NPR 7120.5, NPR 7120.8, and NPD 1000.5, Policy for NASA Acquisition, and describes the schedule management approach and the Agency-wide recommended best practices for carrying out this project control function.

Ref. LMS-CP-7154, LARC Project Integrated Schedule Development, provides the process for development, validation, and management of a schedule throughout a project life cycle for space flight projects. This Center Procedure may serve as a general resource for non-space flight projects (as determined by the Sponsoring Organization Official).

Ref. Defense Contract Management Agency (DCMA) 14 Point Assessment Criteria provides metrics that were developed to identify potential problem areas with a contractor's Integrated Master Schedule. In particular, these metrics provide a framework for assessment of a contractor/vendor IMS and serves as a basis for asking educated questions and performing follow-up research.

Ref. GAO-16-89G, General Accounting Office (GAO) Schedule Assessment Guide is a companion to the GAO Cost Assessment Guide. The GAO Schedule Assessment Guide develops the scheduling concepts introduced in the Cost Estimating and Assessment Guide and presents them as ten best practices associated with developing and maintaining a reliable, high-quality schedule. The GAO Schedule Assessment Guide also presents guiding principles for auditors to evaluate certain aspects of government programs.

R9. The Project Manager shall ensure funded schedule margin is included along the critical path of the project's schedule, based on estimated formulation and implementation risk, and at or above the minimum funded schedule margin levels outlined in [Table B-2](#).

Table B-2. Minimum funded schedule margin for specified projects

Beginning Milestone	Ending Milestone	Funded Schedule Margin
KDP-A (or equivalent)	KDP-D (or equivalent)	1.5 months / year
KDP-D (or equivalent)	Delivery*	2 months / year
Arrival at launch site	Launch processing complete	1 week / month**

**Examples: delivery to the launch site for mission; instrument project delivery to its flight system; ground system or other product delivery.*

***Applies to project with post-delivery content such as launch processing, launch, initial checkout, or equivalent activities.*

Rationale: Estimated formulation and implementation risk may be translated to an appropriate amount of funded schedule margin through analysis techniques such as assessment of similar past projects, Schedule Risk Analysis (SRA), and/or Joint Cost and Schedule Confidence Level (JCL) analysis. The cost of funded schedule margin includes NASA in-house staffing (Civil-servant Full Time Equivalent (FTE) and Contractor Work Year Equivalent (WYE)), prime and other contractor costs, indirect costs, and should be based on the highest labor burn rate during the schedule margin time period. For calculating funded schedule margin, one month is equal to four weeks or 20 working days.

Allocation: Applicable to NPR 7120.5 projects with a Langley Mission Type A-D or projects with a total life cycle cost greater than \$30M. NPR 7120.5 projects with a Langley Mission Type E-F \leq \$30M will work with the project's Sponsoring Organization Official to determine the applicability of this requirement or appropriate schedule margin levels, if any.

2.5 Earned Value Management

Earned Value Management (EVM) is an integrated management control system for assessing, understanding, and qualifying what a project is achieving with the project dollars. EVM integrates technical, cost, and schedule performance with risk management and allows objective assessment and quantification of current project performance. EVM predicts future performance based on trends and provides project management with objective and timely data for effective decision-making.

Projects comply with published Agency Earned Value Management System (EVMS) requirements for in-house and contracted or subcontracted work.

Ref. Mission Support Council (MSC) Approval of Budget Business Services Assessment (BSA) #6 Memo: Raise EVM Threshold to \$250M, dated December 11, 2017. This Memorandum of Record addresses the MSC's decision to raise the EVM project threshold from \$20M (as stated in NPR 7120.5) to \$250M Life Cycle Cost for in-house work.

Ref. PCD 15-05, Class Deviation to NFS 1834.2, 1834.203-70, 1852.234-1, and 1852.234-2 – Earned Value Management System (EVMS) Threshold, dated November 10, 2015. This Procurement Class Deviation (PCD) raises the dollar threshold requirement for EVMS compliance reviews from \$50 million to \$100 million for cost or fixed-price incentive contracts and subcontracts.

Ref. PS01, Subject: Request for a Deviation from the Federal Acquisition Regulation (FAR) and the NASA FAR Supplement (NFS) 1834.201 Earned Value Management System Policy for SMD Class-D Tailored/Streamlined Missions \$150M or less, dated March 23, 2018. This memo approves the request from the Science Mission Directorate (SMD) to deviate from NFS 1834.201 contracts that support SMD Mission Risk Classification D space flight projects that are tailored to the SMD Class-D Tailoring/Streamlining Policy. Specifically, applicable to cost or fixed-price incentive contracts and subcontracts with a value of at least \$20M and with an estimated Life Cycle Cost below \$150M.

Ref. EIA748, Earned Value Management Systems describes the 32 Earned Value Management System guidelines. NPR 7120.5 states that projects required to perform EVM that meet specific criteria shall perform EVM with a system that complies with these guidelines. This document can be found through Techstreet accessible at <https://standards.nasa.gov/>.

Ref. NASA/SP-2012-599, Earned Value Management Handbook (EVM) Implementation Handbook provides EVM guidance for the effective application, implementation, and utilization of EVM on NASA programs, projects, major contracts, and subcontracts in a consolidated reference document.

Ref. NASA/SP-2016-3406, Integrated Baseline Review (IBR) Handbook is a how-to guide to prepare for, conduct, and close-out an Integrated Baseline Review (IBR). It discusses the steps that should be considered, describes roles and responsibilities, tips for tailoring the IBR based on risk, cost, and need for management insight, and provides lessons learned from past IBRs.

Ref. NASA EVM Website, <https://www.nasa.gov/evm> includes tutorials, regulations and requirements, handbooks, training, reporting guidance, EVM resources, glossary, acronyms, and information about the EVM working group.

R10. The Project Manager shall obtain approval from the Center Chief Financial Officer or designee, and Sponsoring Organization Official prior to requesting variance from any Agency Earned Value Management requirements.

Rationale: Early discussion and decision regarding the applicability of Agency Earned Value Management requirements is key to allowing adequate time to prepare, setup, and implement an effective Earned Value Management System, when required. Center Chief Engineer should concur to any variance requests.

Allocation: Applicable to projects in scope of this document subject to Agency Earned Value Management requirements.

2.6 Acquisition and Procurement

The acquisition process and annual strategic resource planning form a continuous process to oversee the alignment of NASA's strategic vision, programs and projects, and resources. At the program and project level, the Acquisition Strategy Meeting (ASM) and the Procurement Strategy Meeting (PSM) support the Agency's acquisition process, which includes strategic planning as well as procurement.

Project acquisitions include procurements, in-house development, and non-procurement acquisitions. Procurements can consist of contracts, purchase orders, and contract task orders executed with industry, nonprofit organizations, and educational institutions. Non-procurement acquisitions are agreements placed with other organizations (e.g., other NASA Centers, federal agencies, state and local governments, and foreign governments and institutes).

Early discussion with the Office of Procurement is key to allowing adequate time to prepare, plan, and coordinate project procurement needs.

The project team, both programmatic and technical members, is responsible for the preparation of procurement requirements packages, including, as applicable, statements of work (SOW),

technical specifications, mission assurance requirements, and Data Requirements List and Description. This includes obtaining input from appropriate Langley organizations in the areas of safety and mission assurance, health, environmental protection, information technology, export control, and security.

Working with an Office of Procurement Contracting Officer, a member of the project team may be required to be designated as a Contracting Officer's Representative (COR). CORs attend training specified by the Office of Procurement.

The project complies with published acquisition and procurement requirements. The applicability and tailoring of an Acquisition Plan (Acquisition Approach) occurs during the project's Compliance Matrix Assessment during Formulation ([section 4.1](#)).

Ref. NPD 1000.5, Policy for NASA Acquisition provides the overall framework for ensuring that NASA's strategic vision, programs and projects, and resources remain properly aligned as well as references to other key processes and directives. This strategic acquisition process complies with NASA's obligations as a federal agency and is applicable to all of NASA's major areas of investment to ensure the efficient and effective use of the resources entrusted to the Agency.

Ref. NFS 1807.1, NASA Federal Acquisition Regulation Supplement, Acquisition Plans provides responsibilities, procedures, and requirements for Acquisition Plans.

Ref. (Langley) Work Instruction-4509, Procurement Strategy and Solicitation Development/Release provides guidance for: 1) the preparation of procurement strategy documentation and 2) development and issuance of the solicitation.

Ref. NF 1707, Special Approvals and Affirmations of Requisitions documents approval coordinations (e.g. information systems accessibility, environmental/sustainable acquisition) required at the Agency and Center level.

R11. The Project Manager shall ensure coordination with the Contracting Officer and legal counsel to identify and evaluate potential Organizational Conflicts of Interest (OCI) prior to engaging contractors.

Rationale: Projects avoid, neutralize, or mitigate potential OCIs before work begins on acquisition strategies. OCI can be categorized into three groups:

- (a) Biased ground rules, referring to situations where a company has an opportunity to skew a competition in its favor.
- (b) Unequal access to information, referring to situations where a company has access to nonpublic information that gives it an unfair advantage relative to a future competition.
- (c) Impaired objectivity, referring to situations where a company is placed in a situation of evaluating itself or a related entity, which casts doubt on its ability to provide impartial advice.

Allocation: Applicable to all projects within scope of this document with one or more contract procurements.

R12. The Project Manager shall ensure coordination and communication with the Office of Procurement and Office of the General Counsel (when appropriate) to support customer required Acquisition Strategy and/or Procurement Strategy Meetings.

Rationale: An Acquisition Strategy Meeting (ASM) is a forum where senior Agency management reviews major acquisitions in programs and projects before authorizing significant budget expenditures. The ASM is held at the Mission Directorate/Mission Support Office level, implementing the decisions that flow out of the earlier Agency acquisition strategy planning. The ASM is typically held early in Formulation, but the timing is determined by the Mission Directorate. The ASM focuses on considerations such as impacting the Agency workforce, maintaining core capabilities and make-or-buy planning, and supporting Center assignments and potential partners.

A Procurement Strategy Meeting (PSM) is 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 ASM strategic acquisition meeting to ensure the alignment of the individual procurement action with NASA's portfolio and mission.

Allocation: Applicable to all projects within scope of this document requiring an ASM or PSM.

2.7 Risk Management

Risk is the potential for shortfalls with respect to achieving explicitly established and stated objectives. As applied to projects, these objectives are translated into performance requirements, which may be related to one or more mission execution domains (safety, mission success, cost, and schedule). Risk management informs decision-making, manages, reduces, or controls the project's risk posture, and informs communication of the project's risk posture. Projects may consider use of an opportunity management process to increase project success or reduce cost and schedule. Opportunity is defined as a potential enhancement or positive impact that could improve the program's ability to meet its performance, cost, schedule, or other objectives.

The project will comply with published Agency risk management requirements. The applicability and tailoring of the project Risk Management Plan occurs during the project's Compliance Matrix Assessment during Formulation ([section 4.1](#)).

A risk management process (formality and rigor) and resulting products (e.g., risk register, analysis, reports, etc.) will vary depending on the size, scope, and complexity of the project.

Ref. NPR 8000.4, Agency Risk Management Procedural Requirements provides the requirements for risk management for the Agency, its institutions, and its programs and projects.

Ref. LMS-CP-8000.4, Master Risk Management Plan for Space Flight Projects is intended to serve as the basis for project risk management processes for projects governed by NPR 7120.5 and as a project's risk management plan in combination with a project-developed, project-specific Project Risk Management Plan Addendum. This Center Procedure may also be used in whole or

in part by small or other non-space flight projects (as determined by the Sponsoring Organization Official).

2.8 Descopes

Project descope options may be developed during Formulation and documented in the Project Plan; additional descopes may be identified or adjusted throughout the project. Executing descope option(s) typically reduces scope margin and creates a tradeoff of different types of risk (e.g., cost or schedule vs. performance).

R13. The Project Manager shall obtain Center-level concurrence (per [Table B-3](#)) in addition to any customer required approvals prior to executing a descope option.

Table B-3. Langley Concurrence for Executing Project Descope(s)

	LMT A	LMT B	LMT C	LMT D	LMT E	LMT F
Concur	Deputy Center Director, Center Chief Engineer	Deputy Center Director, Center Chief Engineer	Deputy Center Director, Center Chief Engineer	Deputy Center Director, Center Chief Engineer	Sponsoring Organization Official Center Chief Engineer or designee	Sponsoring Organization Official Center Chief Engineer or designee

Rationale: Scope margin, in general, is part of the project risk trade space, but customer-level descopes require customer approval. Regardless of the project's LMT, the project communicates and coordinates plans to execute descope option(s) with the project's Sponsoring Organization Official and obtains concurrence(s) per [Table B-3](#).

Allocation: All projects within scope of this document executing one or more descope option(s).

2.9 Configuration and Data Management

Configuration management (CM) is a technical and management process applying appropriate processes, resources, and controls to establish and maintain consistency between product configuration information and the product. This activity takes place throughout the life cycle of the project.

Data management (DM) is the collection and management of information from one or more sources and the distribution of that information to one or more audiences (including public audiences). Projects create, acquire, and manage information of many types throughout the project life cycle, including controlled documents, controlled records, and other recorded information in any format via the implementation of configuration and data management.

The project will comply with published Agency and Center configuration and data management requirements. The applicability and tailoring of the project Configuration Management Plan occurs during the project's Compliance Matrix Assessment during Formulation ([section 4.1](#)).

Per LMS-CP-8041 and LMS-CP-8042, applicable projects comply with processes documented in these Center Procedures, which ensures compliance with Agency and Center requirements for configuration and data management.

Ref. NPR 7123.1, NASA Systems Engineering Processes and Requirements outlines the process and requirements for configuration management for projects, including the development of a Configuration Management Plan.

Ref. LMS-CP-8041, Master Configuration and Data Management Plan for Flight Projects defines the configuration and data management processes, procedures, and overall tasks for Langley projects governed by NPR 7120.5. Adherence to processes within this Center Procedure ensures projects comply with Agency and Center requirements for configuration and data management. This Center Procedure serves as the Configuration and Data Management Plan (CDMP) for applicable projects or may be used as a template for the more detailed CDMPs necessary for complex projects. This Center Procedure may also be used in whole or in part by small or other non-space flight projects (as determined by the Sponsoring Organization Official).

Ref. LMS-CP-8042, Aeronautics Research Directorate Configuration and Data Management Plan defines the configuration and data management processes, procedures, and overall tasks for projects within the Aeronautics Research Directorate. This Center Procedure serves as the Configuration and Data Management Plan (CDMP) for applicable projects or may be used as a template for the more detailed CDMPs necessary for complex projects. This Center Procedure may also be used in whole or in part by small or other non-space flight projects (as determined by the Sponsoring Organization Official).

Ref. SAE EIA-649-2, Configuration Management Requirements for NASA Enterprises was written by the NASA Configuration Management Community of Practice and provides a consistent and systematic set of requirements that are used for the management of Configuration Items (CIs) delivered to, or produced by, the Agency. This document standardizes configuration management requirements specific to NASA agreements and design activities. This standard provides a template of configuration management requirements and user guidance for tailoring the requirements for each unique use case.

Ref. SAE EIA-649C, National Consensus Standard for Configuration Management has been endorsed by NASA and is intended to be used when establishing, performing, evaluating or improving configuration management processes. This standard provides the rational basis upon which to apply good judgment in both planning for and executing configuration management. An understanding of not just what to do, but why it is necessary to tailor the application of configuration management functions.

Ref. SAE GEIA-HB-649, Configuration Management Standard Implementation Guide is intended to assist the user in executing the SAE EIA-649C, National Consensus Standard for Configuration Management standard principles and functions for configuration management. It provides configuration management implementation guidance for all users (configuration management professionals and practitioners) with a variety of techniques and examples.

Ref. NPR 2190.1, NASA Export Control Program provides instructions and requirements for implementation of NPD 2190.1 NASA Export Control Program (ECP). Specifically, the NPR provides requirements, instructions, and responsibilities for all NASA employees and NASA

support contractors engaged in activities that involve the transfer of commodities, software, technical data, technology, defense services, and/or technical assistance to foreign entities. The NAI 2190.1, Export Control Operations Manual provides more detailed instruction and guidance on implementing the requirements of NPR 2190.1.

Ref. NID 1600.55, Sensitive But Unclassified (SBU) Controlled Information defines sensitive information and the processes and requirements for designating and handling Sensitive But Unclassified information.

Ref. NID 2810.135, Controlled Unclassified Information (CUI), defines sensitive information and the processes and requirements for designating and handling Controlled Unclassified information. (Previously called Sensitive But Unclassified (SBU)).

2.10 Records Management

Records are recorded information, regardless of media or format, in the custody and control of NASA or its contractors and made or acquired by NASA or its contractors as part of official duties and in the conduct of government business. Records are the evidence of the performance and fulfillment of NASA's mission and belong to the government, not to individuals. Records management is the planning, controlling, directing, organizing, training, promoting, and other managerial activities related to creating, maintaining, using, and disposing of records.

The project will comply with published Agency and Center Records Management requirements. Projects capture, retain, archive, and manage project records in accordance with LAPD 1440.7, LARC Records Management.

Ref. LAPD 1440.7, LARC Records Management implements Langley's records management requirements and procedures in accordance with NPD 1440.6, NASA Records Management, NPR 1441.1, Records Management Program Requirements, and NRRS 1441, NASA Records Retention Schedules. Specifically, LAPD includes the maintenance and preservation of records, electronic records and systems, and the responsibilities of NASA employees, contractor personnel, project manager, and project team as they relate to records management.

Ref. LMS-CP-2310, Electronic Storage and Archival System (Document and Data Management) Local technical archive document describes the process associated with active, transition, and archival with use of electronic storage and archival systems.

2.11 Independent Assessments

An Independent Assessment (IA) is an external (independent of the project) evaluation of a project's programmatic estimate and is comprised of one or more targeted assessments, such as: Independent Cost Assessment (ICA), Independent Cost Estimate (ICE), and/or Independent Schedule Assessment (ISA). An Independent Assessment informs management decisions about a project.

IA's may be required to be performed prior to project life cycle reviews (LCR) or as an ad hoc request. IA requests typically come from management stakeholders and are led by the PP&C Capability Office (PCO) and the Office of the Chief Financial Officer (OCFO). Project or SO

representatives contact the PCO to initiate an IA. Planned IAs may be documented in the Project Initiation Memorandum, Project Review Plan, or as part of the Project Plan.

Ref. LMS-OP-9000, Independent Assessment Handbook describes the Independent Assessment aspect of life cycle review readiness and proposal Red Team assessments at NASA Langley Research Center, and contains no procedural or other requirements.

Ref. LPR 7120.7, Independent Life Cycle Review Procedural Requirements details the requirements and recommended practices for planning, preparation, and conduct of project independent life cycle reviews, as well as the requirements for records, and the process for obtaining waivers or tailoring the requirements. LPR 7120.7 contains an appendix that addresses interfaces between IAs and independent life cycle reviews.

R14. The Project Manager shall coordinate with the Office of Chief Financial Officer / PP&C Capability Office to ensure an independent assessment is performed prior to each Life Cycle Review from Authority to Proceed to Critical Design Review (NPR 7120.5) or prior to Authority to Proceed and Project Approval (NPR 7120.8) (see allocation).

Rationale: During execution, projects typically go through a series of Life Cycle Reviews (LCRs), usually followed by a Key Decision Point (KDP) meeting. At a KDP the Decision Authority determines the readiness of a project to progress to the next Mission Phase of the project life cycle. An IA is performed prior to an LCR to support the Center Readiness Review. IA results assist Center Management in determining if the project is ready to proceed to their LCR. Well documented and detailed IAs build confidence the project can meet expectations, identify areas where improvement are needed, and can help identify and plan for risk before they become major issues or events. Effective internal assessments help to prepare a project team for external assessments, and verify compliance with applicable LaRC and Agency requirements.

Allocation: Applicable to projects >\$30M; deviations must be approved by the head of the sponsoring organization and Chief Financial Officer. All other projects will work with the Sponsoring Organization Official (SOO) to determine the applicability of this requirement. This requirement is not applicable to enduring projects.

R15. The Project Manager shall coordinate with the Office of Chief Financial Officer / PP&C Capability Office to ensure an independent assessment is performed following Authority to proceed when an increase to the Life Cycle Cost occurs (see allocation).

Allocation: Applicable to projects with Life Cycle Cost changes of $\geq \$10M$ or $\geq 10\%$; deviations must be approved by the head of the sponsoring organization and Chief Financial Officer. All other projects with lower Life Cycle Cost increases will work with the Sponsoring Organization Official (SOO) to determine the applicability of this requirement. This requirement is not applicable to enduring projects.

2.12 Independent Life Cycle Reviews

Independent Life Cycle Reviews (ILCRs) are a set of life cycle reviews that employ an independent team of experts to assess the progress of a project against established success criteria. Independent life cycle reviews are distinguished from ad hoc reviews, which are usually limited to a single review on a special topic and may or may not be done by a team that is independent of the project.

For projects where Langley is formally responsible for life cycle reviews, the project plans, prepares, and conducts those reviews in accordance with LPR 7120.7, Independent Life Cycle Review Procedural Requirements.

The applicability and tailoring of a project Review Plan occurs during the project's Compliance Matrix Assessment during Formulation ([section 4.1](#)).

Ref. LPR 7120.7, Independent Life Cycle Review Procedural Requirements details the requirements and recommended practices for planning, preparation, and conduct of project independent life cycle reviews, as well as the requirements for records and the process for obtaining waivers or tailoring the requirements.

2.13 Center Level Reviews and Reporting

Center leadership can serve the Center's projects well only if kept informed about each project's progress and problems. One way to communicate to Center leadership is through periodic reviews such as Pre-CMC, CMC, etc. In addition to periodic reviews, some projects also submit written status reports. Event-driven reviews (such as Center Readiness Assessment, peer/ad hoc reviews, and technical quality reviews) are those that occur when a specified event is reached or when a deliverable is ready to be delivered.

Ref. LPR 7130, Project and Task Review Procedural Requirements establishes Langley requirements for performing various periodic project and task reviews, including purpose and attendance for each of these reviews.

R16. The Project Manager shall ensure development and presentation of project status briefing(s) for each of the Langley review forums (as detailed in Table B-4).

Table B-4. Standard Langley Periodic Reviews and Reporting Cadence

Langley Review Forum and Reporting Deliverables	LMT A	LMT B	LMT C	LMT D	LMT E	LMT F
Center Management Council (CMC)	M	M	M ^R	M ^R	*R	*R
Pre-Center Management Council (Pre-CMC)	M	M	M	M	M	*
Monthly Management Review (MMR)	*	*	*	*	*	*
Engineering Project and Task Review (EPTR)	M	M	M	M	*	*
Engineering Review Board (ERB)	-	-	-	-	M	*
Written Programmatic and Technical Status (delivered to Sponsoring Organization)	W	W	W	W	*	*
Event Driven Reviews	**	**	**	**	**	**
Other Reviews and Reporting, as needed	*	*	*	*	*	*

Frequencies: **W** Weekly, **M** Monthly

^R Rollup reporting (determined by and reported by the Sponsoring Organization Official or designee) at frequency shown

*Determined by the project's Sponsoring Organization Official in consultation with the Center Chief Engineer and responsible Engineering Director

**Determined by the project's Sponsoring Organization Official per LPR 7130

Rationale: The contents and expectations of each review are outlined in LPR 7130, Project and Task Review Procedural Requirements, or at the discretion of the responsible party for each review. Rollup reporting (designated by "R" in [Table B-4](#)) is typically the responsibility of the Sponsoring Organization Official. The review and reporting cadence, as well as any changes and/or additions to the cadence, is documented in the Project Initiation Memorandum.

Allocation: Applicable to all projects LMT A-F in scope of this document.

2.14 Customer Communication

Project customer interfaces vary by project type, mission, organization, structure, etc. Customers typically assign personnel to support and report on project progress within their organizations (e.g., HQ Program Executive, Program Mission Manager, and Program Team Lead). These interfaces bring important perspectives on key activities occurring outside of the project but are related to mission success.

Each project will report to customers on a regular basis using a format and schedule negotiated with its customer. Providing key information on technical and programmatic status to HQ and Program personnel ensures project information is effectively communicated to support external stakeholder reporting and decision making.

2.15 Internal Project Communication

Projects will implement a structured cadence for effectively communicating progress and management decisions within the project team. Maintaining effective communication within the project team is essential to accomplish planned goals. Periodic meetings within the project promote informed decision making, expose interface complexities, and focus the project's efforts on the final products.

Establishing these communications early in the project will serve the project well as it moves into implementation. The work performed during implementation requires the project to operate in a more integrated environment. Status of subsystems, availability of workforce and facilities, procurement deliveries, and unknown/unknowns, all come together and impact the project plans.

2.16 Mishaps and Close Calls

A **Mishap** is defined as an unplanned event resulting in at least one of the following:

- a. Occupational injury or occupational illness to personnel caused by NASA operations.

- b. Destruction of or damage to NASA property, public or private property, including foreign property, caused by NASA operations or NASA-funded research and development projects.
- c. NASA mission failure before the scheduled completion of the planned primary mission.

A **Close Call** is defined as an event requiring first aid treatment or less, or property damage/mission failure with a direct cost of less than \$20,000. A close call has NASA mishap potential and the responsible organization will document either most likely or worst-case estimates.

The project will comply with published Agency and Center processes and requirements for reporting, investigating, and recordkeeping for mishaps and close calls.

Project specific response protocols are outlined in the project's governing Crisis Response Plan and/or Mishap Preparedness and Contingency Plan. The applicability and tailoring of project Crisis Response Plan and/or Mishap Preparedness and Contingency Plan occurs during the project's Compliance Matrix Assessment during Formulation ([section 4.1](#)). Projects may combine contents of the Crisis Response and Mishap Preparedness and Contingency Plans in a single Plan.

Ref. NPR 8621.1, NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping defines mishap and close call, and provides requirements to report, investigate, and document mishaps, close calls, and resulting corrective actions to prevent occurrence of similar work-related injury, property damage, or mission failure.

Ref. LPR 8621.1, Langley Research Center Mishap Preparedness and Contingency Plan establishes Langley's policy and procedural requirements to report, investigate, and document mishaps and close calls.

Ref. LPR 1046.1, Emergency Management Plan establishes uniform policy and guidelines for the effective mitigation of preparation for, response to, and recovery from a variety of emergency situations.

2.17 Other Prompt Notifications

Some situations or other topics do not meet the criteria for mishap or close call but still necessitate a more prompt notification and response than what could be achieved through the project's periodic review and reporting cadence. These situations and topics include a major change or request for major change to the project schedule, scope, fiscal commitments, status of facilities needed for the project; anomalies during project technical activities, other major findings; delay in the ability of the project to meet its launch or other delivery commitment; or significant public controversy resulting in opposition to the mission, or potential for significant NASA liability.

R17. The Project Manager shall ensure prompt notification to the Sponsoring Organization Official upon realization of a significant situations or topic.

Rationale: The Project Manager coordinates with the Sponsoring Organization Official as early as possible regarding additional communications to Center Management, customers, and other stakeholders.

Allocation: Applicable to all projects LMT A-F in scope of this document.

2.18 Public Engagement

Each project plans for engaging the news media on newsworthy events that are Langley's responsibility. The Office of Communications serves as the corporate, agency-wide communications function for NASA and is accountable for managing the planning, development, and implementation of communications events, activities, and products for stakeholders, including the general public.

The applicability and tailoring of a project's Communications Plan occurs during the project's Compliance Matrix Assessment during Formulation ([section 4.1](#)). Regardless, a project should have a documented engagement strategy.

Ref. NASA Office of Communication website, <https://communications.nasa.gov>, NASA Communication Policies & Guidelines includes a Communications Plan Template and other communications tools and resources for programs and projects.

Ref. LMS-CP-4122, Development and Update of Public Engagement Publications and Materials outlines the processes necessary to produce effective outreach publications, inform the public about NASA's goals and accomplishments, educate students about NASA, and satisfy media inquiries.

2.19 Knowledge Management, Lessons Learned, and Best Practices

Knowledge Management (KM) is the systematic management of information for the purposes of learning and continuous improvement. Knowledge management turns project experiences and other useful data into collective documented information that can be shared with other projects and organizations. Available knowledge from previous projects and activities (e.g., published lessons learned or best practices) can be used to improve a project's decision-making process.

The knowledge management process (evaluate, capture, and report) occurs throughout the project life cycle, with specific focus aligned with the project's Independent Life Cycle Reviews.

Ref. NPD 7120.6, Knowledge Policy for Programs and Projects describes NASA's policy to cultivate, identify, capture, retain, utilize, and share knowledge to continuously improve the performance of NASA in implementing its mission.

Lessons Learned are captured knowledge or understanding gained through experience which, if shared, would benefit the work of others. Unlike a best practice, a lesson learned describes a specific event that occurred and provides recommendations for obtaining a repeat of success or for avoiding reoccurrence of an adverse work practice or experience.

Projects and project teams capture, submit, and report on gained project knowledge, which may include traditional lessons learned as well as proposed best practices, project practices and data, metrics, statistics, templates, samples, or models.

Ref. Institutional Knowledge Management (IKM) system – Lessons Learned located at: https://oneplace.larc.nasa.gov/ikm/?id=ikm_knowledge_base, is a Langley-specific knowledge

management portal that includes a lessons learned module where lessons and other learned information can be submitted for sharing or published lessons reviewed.

Ref. NASA Lessons Learned Information System, <https://nen.nasa.gov/web/ll/>, provides access to official, reviewed lessons learned from NASA programs and projects.

Best Practices are published methods, techniques, or criteria for a specific activity or objective, which represents the demonstrated or preferred method for accomplishing that activity or objective. Best practices at Langley are published in Langley Form 209 and the Institutional Knowledge Management System.

Ref. LF 209, Langley Engineering Best Practices includes Langley-specific engineering best practices.

Ref. Institutional Knowledge Management (IKM) system – Best Practices, located at: <https://oneplace.larc.nasa.gov/ikmbp>, is a Langley-specific knowledge management portal that includes a best practices module where best practices can be submitted for approval as a published best practice.

R18. The Project Manager shall ensure the project evaluates and applies appropriate published lessons learned and best practices throughout the project life cycle.

Rationale: The outcome of the evaluation of published lessons learned, including how lessons learned and best practices have been incorporated into project plans and work, is typically reported as part of preparation for Independent Life Cycle Reviews. Published lessons learned and best practices come from a variety of sources including, but not limited to, Langley's Institutional Knowledge Management (IKM) system, NASA's Lessons Learned Information System (LLIS), case studies, and other knowledge resources. At a minimum, an evaluation of published lessons learned and best practices consists of the project team and individual project subject matter experts searching and assessing relevant discipline best practices, lessons, and other information for relevance and action. Projects may also choose to perform more formal lessons learned evaluation activities or sessions.

Allocation: Langley Mission Type A-D projects evaluate lessons learned and best practices before each Independent Life Cycle Review (ILCR). When the duration between ILCRs is greater than a year, the project should evaluate lessons learned and best practices annually. Langley Mission Type E projects evaluate lessons learned and best practices during project Formulation. Langley Mission Type F projects work with the Sponsoring Organization Official to determine the applicability of this requirement.

R19. The Project Manager shall ensure the project captures and reports project lessons learned throughout the project life cycle.

Rationale: Captured lessons learned are submitted to the Center's Institutional Knowledge Management (IKM) system. For the purposes of this requirement and the Institutional Knowledge Management system, lessons learned includes traditional lessons learned, proposed best practices, project practices or data, metrics, statistics, templates, samples, or models.

Identification and capture of lessons learned is a continuous and ongoing process. Projects capture and submit lessons learned as learned information is realized. At project Closeout, projects capture and submit any recent or not previously captured lessons learned.

Allocation: Langley Mission Type A-D projects capture and report lessons learned before each Independent Life Cycle Review (ILCR). When the duration between ILCRs is greater than a year, the project should evaluate lessons learned and best practices annually. All projects (Langley Mission Type A-F) capture and report lessons learned during project Closeout.

Chapter 3. Initiation Process and Requirements

For directed projects, Initiation starts when the customer establishes an expectation of project start, which typically occurs at the time of funding commitment; however, Initiation may begin prior with an expectation of near-term funding commitment with recommendation from the Deputy Center Director.

For competed projects, Initiation start is dependent on the proposal type.

- For single-step proposals (e.g., Earth System Science Pathfinder (ESSP) Earth Venture, Instrument Incubator Program (IIP), Convergent Aeronautics Solutions (CAS), Early Career Initiative (ECI)), Initiation typically starts with mission or project selection.
- For two-step space flight/instrument development proposals (e.g., New Frontiers, Discovery, Medium-Class Explorers (MidEx), Small Explorer (SMEX)), Initiation begins after Step 1 selection. For these proposals, Langley is usually the lead, co-lead, or has a significant development role (e.g., hardware/software delivery, subsystem/element leadership, overall mission management role that requires some level of project Initiation prior to Authority to Proceed (ATP)).
- For two-step technology development or data analysis/algorithm development proposals (e.g., ROSES Research and Analysis proposals), Initiation begins after Step 2 selection.

At Initiation, each project is assigned a Langley Mission Type. Depending on the project's Langley Mission Type classification, the project Initiation period may also include initial designation of Center insight, oversight, and management roles, an internal Proposal-Project Handoff meeting for competed projects, a New Project Briefing, preliminary formulation activities, a Project Initiation Checkpoint, and completion of a Project Initiation Memorandum.

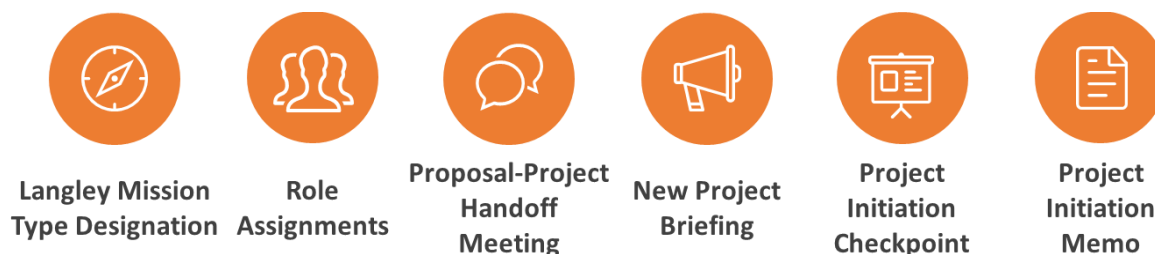


Figure 3-1. Process Elements – Initiation

3.1 Langley Mission Type Designation

- R20. The Project Manager shall propose to and obtain agreement from the Deputy Center Director or designee, Center Chief Engineer, and Sponsoring Organization Official on the project's Langley Mission Type designation prior to the New Project Briefing.**

Rationale: The Project Manager is responsible for ensuring this requirement is met. If a Project Manager has not yet been selected at this time, the expectation is that the Sponsoring Organization will take part in this early classification process.

The Langley Mission Type will be formally documented and approved in the Project Initiation Memorandum; however, since the Langley Mission Type establishes

requirements applicability for projects, early agreement to the project's Langley Mission Type is critical to guide proper Initiation and early Formulation activities. More information about Langley Mission Type classification, including the purpose and scheme, is outlined in [section 1.2.1](#).

For competed projects, the project's Langley Mission Type likely will have been determined as part of the proposal development process and formally agreed to at the proposal's Center Commitment Review (CCR) or through the Center Chief Engineer, as outlined in LAPD 7120.9, Proposals Reviews and Archiving.

Langley's online NPR Tailoring Application (<https://oneplace.larc.nasa.gov/nta>) includes a project Classifier Tool to assist projects and project stakeholders in classifying the project's Langley Mission Type.

Allocation: Applicable to all projects in scope of this document.

3.2 Role Assignments

The roles listed below and their associated responsibilities are outlined in section 1.4. Some projects may have designated engineering and Safety and Mission Assurance Technical Authority roles as outlined in LPR 7120.4, Langley Research Center Technical Authority Implementation Plan. Regardless of whether designated project technical authority positions exist on a project, project teams are still responsible for understanding and executing the Center and Agency Technical Authority processes. Additional information, considerations, and requirements associated with project staffing and organization are provided in [section 2.1](#).

R21. The head of the project's Sponsoring Organization shall designate a Sponsoring Organization Official.

Rationale: All projects will have a Sponsoring Organization. More information about Sponsoring Organizations is outlined in [section 1.4.5](#). The purpose of designating a Sponsoring Organization Official is to formalize the decision of the head of the Sponsoring Organization to designate specific insight and oversight responsibility for each project to a single point of contact. The Sponsoring Organization Official is accountable to internal stakeholders for mission success.

Allocation: Applicable to all projects in the scope of this document.

R22. The project's Sponsoring Organization Official shall ensure selection of a Project Manager or equivalent (e.g., Principal Investigator, project lead, etc.).

Rationale: Project Manager refers to the individual in charge of the planning and execution of the project. Project Managers are responsible and accountable for the safe conduct and successful outcome of their project in conformance with governing programmatic requirements. The term Project Manager is used throughout this document; however, this role may be filled by a Principal Investigator or other position that holds the responsibilities associated with a Project Manager, as defined. The Project Manager is accountable to the Sponsoring Organization.

Allocation: Applicable to all projects in the scope of this document.

3.3 Proposal-Project Handoff Meeting

R23. The Sponsoring Organization Official (for competed projects) shall organize and facilitate a Proposal-Project Handoff Meeting following receipt of selection notice.

Rationale: The purpose of the Proposal-Project Handoff Meeting is to formally transmit and review proposal materials and material from the evaluation organization with the executing Sponsoring Organization, Project Manager, and available project team. The proposal team and/or Proposal Development Office will support this meeting, including the preparation and transmission of materials for review. The Proposal-Project Handoff Meeting is an internal meeting and should not be confused with, nor take the place of, any externally required project kickoff or proposal debrief meetings.

Items associated with the proposal-project handoff include: transmission and discussion of final cost files (including exceptions and assumptions), schedule review and adjustment, final proposal, all procurement documentation (especially long-lead items), selection notice, draft Space Act or other agreements (if required), and a list of the points of contacts the proposal team worked with to pull the proposal together.

Allocation: Applicable to competed projects in scope of this document.

3.4 New Project Briefing

R24. The Project Manager shall ensure development and presentation of a New Project Briefing.

Rationale: The purpose of the New Project Briefing is to inform Center stakeholders that the project is starting and provide an overview of the project's objectives, participants, high-level cost and schedule data, and high-level project constraints. The New Project Briefing should be held as early as possible to provide stakeholders awareness that a project Initiation has begun and organization resources (staffing, office space, facilities, equipment, etc.) may be sought.

The Project Manager, in coordination with the Center Chief Engineer and Sponsoring Organization Official, will determine the appropriate scope, audience, forum, and timing for the New Project Briefing. The New Project Briefing should be held at an already established forum whenever possible. Examples of appropriate forums include but are not limited to the Center Management Council (CMC), pre-CMC, the Engineering Project and Task Review (EPTR), the Engineering Review Board (ERB), and Research Review Forum.

Allocation: Applicable to projects in scope of this document with a Langley Mission Type A-E. The content and audience for each New Project Briefing is tailorable with agreement from the Center Chief Engineer and the Sponsoring Organization Official. Projects with a Langley Mission Type F will work with the Center Chief Engineer and Sponsoring Organization Official to determine the applicability of this requirement.

3.5 Project Initiation Checkpoint

R25. The Project Manager shall conduct a Project Initiation Checkpoint to the project's Center stakeholders.

Rationale: The purpose of the Project Initiation Checkpoint is to determine how well the project did in setting up the project based on Center-provided resources, discuss the project's status in meeting Project Initiation Checkpoint Preparation Checklist items ([Table C-1](#)), and provide an opportunity to identify and communicate gaps or issues in fulfilling project needs. The Project Initiation Checkpoint, along with the Project Initiation Memorandum, completes the project Initiation period.

The Project Manager, in coordination with the Center Chief Engineer and Sponsoring Organization Official, will determine the appropriate audience, forum, and timing of the Project Initiation Checkpoint. The Project Initiation Checkpoint should be held at an already established forum whenever possible. Examples of appropriate forums include but are not limited to the Center Management Council (CMC), pre-CMC, and the Engineering Project and Task Review (EPTR). The Project Initiation Checkpoint was previously referred to as a "60-day Review."

A Project Initiation Checkpoint Preparation Checklist is provided in [Table C-1](#) which provides a list of items that the project completes in preparation for the Project Initiation Checkpoint, or otherwise address during the review. This checklist must be tailored for the individual needs of the project in coordination with the Center Chief Engineer and Sponsoring Organization Official.

Allocation: Applicable to all projects LMT A-F in scope of this document.

Table C-1. Project Initiation Checkpoint Preparation Checklist

Project Initiation Checkpoint Preparation Checklist
<ul style="list-style-type: none"> <input type="checkbox"/> Applicable Project Initiation requirements are met (section 3.0) <input type="checkbox"/> Objectives, scope, partners, stakeholders, and governance are understood <input type="checkbox"/> Funding source(s) and status are known <input type="checkbox"/> Preliminary budget profile and basis for estimate developed <input type="checkbox"/> Preliminary high-level schedule developed, including project reviews and decision gates <input type="checkbox"/> Integration needs (services, expertise, etc.) across Center organizations are known and understood; communications with relevant organizations initiated (see Appendix H) <input type="checkbox"/> Cybersecurity Assessment coordinated with the Office of the Chief Information Officer (OCIO) Cybersecurity and Privacy Branch (CSPB); accomplished with Cybersecurity "questionnaire" or discussion with OCIO <input type="checkbox"/> Staffing needs identified and communicated to applicable organizations; early staff on-board or staffing process initiated <input type="checkbox"/> Facility and equipment needs identified and communicated to applicable organizations <input type="checkbox"/> Arrangements for office space, collocation, and/or other team collaboration initiated <input type="checkbox"/> Major deliverables and receivables identified <input type="checkbox"/> Early procurements and/or long-lead items have been identified and initiated, as applicable <input type="checkbox"/> Major project risks identified including those identified by proposal evaluation team <input type="checkbox"/> Document repository identified and set up; initiation configuration control protocols in-place <input type="checkbox"/> Gaps in fulfilling resources needs and issues with project initiation identified <input type="checkbox"/> Preliminary Earned Value Management applicability coordinated with the Office of Chief Financial Officer (OCFO) and project customers <input type="checkbox"/> Project Initiation lessons learned are captured <input type="checkbox"/> Project Initiation Memorandum is ready for signature

3.6 Project Initiation Memorandum

R26. The Project Manager shall ensure completion of a Project Initiation Memorandum.

Rationale: The purpose of the Project Initiation Memorandum is to formally document and approve the project's key roles, Langley Mission Type, project summary, other project classifications, review board information, review and reporting cadence, independent cost estimate and independent assessment plans, peer and tabletop reviews, and identify approvers and signatories for project documentation. Applicable signatories are listed in the Project Initiation Memorandum templates. Langley Mission Types A-F will have the Project Initiation Memorandum ready for approval no later than the Project Initiation Checkpoint.

Project Initiation Templates are available from the Project Support Office (PSO) or as Langley Forms (LF) in the NASA Electronic Forms (NEF) system at <https://nef.nasa.gov/>: LF-577A, Project Initiation Memorandum Format 1 (primarily used and tailored for LMT A-D projects); and LF-577B, Project Initiation Memorandum Format 2 (primarily used and tailored for LMT E-F projects).

Allocation: Applicable to all projects in the scope of this document.

Chapter 4. Formulation Process and Requirements

Formulation includes 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 the project; and the establishment of control systems to ensure performance to those plans and alignment with current Agency strategies. These objectives are typically documented in the completion of project products and plans.

Generally, the Formulation period starts with an Authority to Proceed (ATP). An ATP may come in the form of a Formulation Authorization Document (FAD), proposal or mission selection, or other authorizing agreement (such as an agreement or memo from another NASA Center). The Formulation period ends with the project baseline and/or project approval (PA), at which time, the project proceeds to Implementation.

For projects governed by NPR 7120.5, Formulation is the period between Key Decision Point A (KDP-A) and Key Decision Point C (KDP-C). Management decisions from KDP-C are captured in the Management Agreement containing the approved integrated baseline that includes the technical baseline, project's risk posture, Integrated Master Schedule, and baseline Life Cycle Cost (LCC) estimate, all consistent with the program requirements and constraints on the project, the key assumptions, workforce estimates, and infrastructure requirements.

For projects governed by NPR 7120.8, Formulation is the period between KDP-ATP and project approval KDP-PA. The decision resulting from the KDP-PA review is documented in the form of a Decision Memorandum or other documentation and includes the costs, schedules, and key deliverables.

Project requirements associated with recurring processes or activities throughout the project life cycle are listed in [Chapter 2](#). Project teams will review and monitor adherence to the Life Cycle requirements as the project progresses through the project life cycle. Formulation also overlaps the Initiation period, so some Formulation activities will begin along-side Initiation activities listed in [Chapter 3](#).



Figure 4-1. Process Elements – Formulation

4.1 Compliance Matrix Assessment

A Compliance Matrix Assessment allows each project to determine and seek agreement to the applicability of common Headquarters and Program products; project technical products; project management, planning and control products; and project control plans.

Langley utilizes the online NPR Tailoring Application (NTA) (<https://oneplace.larc.nasa.gov/nta>), to guide projects through the Compliance Matrix Assessment. The NTA Compliance Matrix Assessment provides the project with the opportunity to propose Full Compliance (FC), Tailoring (T), or Non-Applicability (NA) of these products and plans. The output of the NTA Compliance Matrix Assessment is a project-specific compliance matrix.

The NTA Compliance Matrix Assessment is based on the NPR 7120.5 Compliance Matrix for projects and has been updated to include context associated with NPR 7120.8 applicability, as well as Langley-specific products and plans. Langley has extended the use of the NTA Compliance Matrix Assessment to all projects within scope of this document. [Table D-1](#) outlines the products and plans included in the NTA Compliance Matrix Assessment.

Table D-1. Compliance Matrix Assessment Products and Plans

Compliance Matrix Assessment Products and Plans

Headquarters and Program Products. Formulation Authorization Document (FAD), Program Plan, partnerships and interagency and international agreements, Acquisition Strategy Meeting minutes, National Environmental Policy Act (NEPA) compliance documentation, and a Mishap Preparedness and Contingency Plan. While not directly responsible for development of these products, the project may need to provide inputs or support development or documentation of some or all of these Headquarters and Program products.

Project Technical Products. Concept Documentation; Mission, Spacecraft, Ground, and Payload Architectures; Design Documentation; Operations Concept; Technology Readiness Assessment Documentation; Engineering Development Assessment Documentation; Heritage Assessment Documentation; Safety Data Packages; Expendable Launch Vehicle (ELV) Payload Safety Process Deliverables; Verification and Validation Report; Operations Handbook; Orbital Debris Assessment Report; End Of Mission Plans; and Mission Report.

Project Management, Planning, and Control Products. Formulation Agreement (FA), Project Plan, plans for work to be accomplished during the next implementation life cycle phase, documentation of performance against the Formulation Agreement OR against plans for work to be accomplished during implementation life cycle phase, the project baseline, and Decommissioning/Disposal Plan.

Project Plan Control Plans. Technical, Schedule, and Cost Control Plan; Safety and Mission Assurance Plan; Risk Management Plan; Acquisition Plan; Technology Development Plan; Systems Engineering Management Plan; Information Technology Plan; Software Management Plan(s); Verification and Validation Plan; Review Plan; Mission Operations Plan; Environmental Management Plan; Integrated Logistics Support Plan; Science Data Management Plan; Integration Plan; Configuration Management Plan; Security Plan; Project Protection Plan; Technology Transfer Control Plan; Knowledge Management Plan; Human Rating Certification Package; Planetary Protection Plan; Nuclear Safety Launch Approval Plan; Range Safety Risk Management Process documentation; and Communications Plan.

Langley-specific Products and Plans. Product Assurance Plan; Contamination Control Plan, Materials and Processes Plan; Photographic Documentation Plan; Crisis Response Plan.

More information about each of these products and plans is available in [Appendix D](#), the NPR Tailoring Application, and project governing requirements documents (NPR 7120.5, NPR 7120.8).

R27. The Project Manager shall ensure completion of an NPR Tailoring Application Compliance Matrix Assessment and obtain Center approval and concurrences (per [Table D-2](#)) in addition to any customer required approvals.

Table D-2. Langley Approver and Concurred for Project Compliance Matrix

	LMT A	LMT B	LMT C	LMT D	LMT E	LMT F
Approve	Deputy Center Director*	Deputy Center Director*	Deputy Center Director*	Deputy Center Director*	Center Chief Engineer (or Designee)	Center Chief Engineer (or Designee)
	Center Chief Engineer	Center Chief Engineer	Center Chief Engineer	Center Chief Engineer	SMAO Director (or Designee)	SMAO Director (or Designee)
	SMAO Director	SMAO Director	SMAO Director	SMAO Director	Head of Sponsoring Organization	Head of Sponsoring Organization
	Head of Sponsoring Organization	Head of Sponsoring Organization	Head of Sponsoring Organization	Head of Sponsoring Organization		

**Applies to any instances of tailoring as reviewed and coordinated by the Center Chief Engineer.*

Rationale: The NTA Compliance Matrix Assessment assist projects in meeting the NPR 7120.5 requirement to complete and maintain a Compliance Matrix or assists projects in meeting the NPR 7120.8 requirement to identify any additional project control plans that are appropriate for the project as well as documenting a tailoring approach.

Allocation: Applicable to LMT A-F projects in scope of this document.

4.2 Formulation Strategic Planning

Early in Formulation, projects need to address their strategies for several technical-based activities (Inheritance, Make or Buy decisions, and spares, testbeds, and models), public engagement options, and performance reporting. Strategies and decisions for these items may be captured in the Project Plan or other project documents which the Project Plan references.

A project may base its mission or products on inherited technologies, hardware, software, ground support equipment (GSE), or even processes. Incorporating inherited items into designs requires a project to perform a heritage assessment and any related risk assessments early in Formulation to ensure the long term impact is well understood and informs the project cost estimates, design options, and maintenance and operations requirements.

For many projects, Make or Buy strategies, and possibly decisions, are part of the proposal phase or developed early in Formulation and documented in the Acquisition Plan. These decisions can also arise later once a project is developing engineering units. For example, parts become unavailable or newer technologies may provide better opportunities for mission success. Documenting these strategies and decisions within the project's Acquisition Plan, whenever they arise, helps inform future projects when build options are being evaluated.

Detailed plans for the use or need of spares, testbeds, and models are developed by the project's technical team. In early project planning, strategic discussions and plans are needed on these items to inform lifecycle cost estimates, determine types of support that will be needed for the V&V and AI&T phases, planned part purchases with consideration for up-screen options for flight, and possible use in mission operations.

A project's Public Engagement Strategy will vary based on the project's LMT and is documented within the project's Communications Plan. All projects should have plans for engaging the public on its mission or products. For smaller projects, determining approaches early may prove more

beneficial given the demand for resources. Projects may have both programmatic and technical parameters or indicators that are tracked and reviewed to monitor progress and proper management of the project execution. In NPR 7120.8, these are referred to as Key Performance Parameters or Technical Challenges, and in NPR 7120.5, they are Leading Indicators. Depending on the project's LMT, selection of performance indicators may vary. In some cases, they will be defined in the Formulation Agreement or will be captured in the Project Plan. Programmatic parameters include UFE, schedule margin, and in some cases, joint confidence levels (JCL). Technical parameters include mass and power margins, software metrics, and review requests for action (RFA) closures.

4.3 Project Plan

A Project Plan is typically a standalone document which establishes the project's baseline for Implementation. The Project Plan defines at a high level the project's objectives, technical and management approach, environment within which the project operates, and commitments of the project.

R28. The Project Manager shall ensure development of a Project Plan and obtain Center approval and concurrences (per [Table D-3](#)) in addition to any customer required approvals.

Table D-3. Langley Approver and Concurred for Project Plan

	LMT A	LMT B	LMT C	LMT D	LMT E	LMT F
Langley Approve	Center Director (or designee) Project Manager	Center Director (or designee) Project Manager	Center Director (or designee) Project Manager	Center Director (or designee) Project Manager	Deputy Center Director Project Manager	Deputy Center Director Project Manager
Concur	Center Chief Engineer Sponsoring Organization Official Head of participating organizations (or designee)	Center Chief Engineer Sponsoring Organization Official Head of participating organizations (or designee)	Center Chief Engineer Sponsoring Organization Official Head of participating organizations (or designee)	Center Chief Engineer Sponsoring Organization Official Head of participating organizations (or designee)	Center Chief Engineer Sponsoring Organization Official Head of participating organizations (or designee)	Center Chief Engineer Sponsoring Organization Official Head of participating organizations (or designee)

Rationale: Both NPR 7120.5 and NPR 7120.8 require projects develop a Project Plan. Langley's requirement to develop a Project Plan reinforces NPR Project Plan requirements and identifies Langley specific Project Plan approvers. The project will ensure the Project Plan meets applicable Agency requirements (i.e., NPR 7120.5, NPR 7120.8), including Agency required approvals. Projects utilize the Project Plan template associated with their Agency governance document (NPR 7120.5, Appendix H; or NPR 7120.8, Appendix G), as applicable. Revisions to the Project Plan require the same approvals as the original release.

Allocation: Applicable to LMT A-F projects in scope of this document.

Chapter 5. Implementation Process and Requirements

Implementation includes the execution of approved plans for the development and operation of the project and the use of control systems to ensure performance to approved plans and continued alignment with the Agency's strategic goals. Projects baseline or update project documentation, per tailoring agreements and execute the Project Plan, as established in project Formulation.

Depending on the project's Langley Mission Type and goals and objectives, key accomplishments in Implementation include performing planned activities, periodic project reviews, continuation assessments, finalizing technical designs, executing planned acquisitions, hardware fabrication, assembly, testing, and verification of the full system, and establishing interfaces and plans for launch and mission operations

Project requirements associated with recurring processes or activities throughout the project life cycle are listed in [Chapter 2](#). Project teams will review and ensure adherence to the Life Cycle requirements as it progresses through the project life cycle.

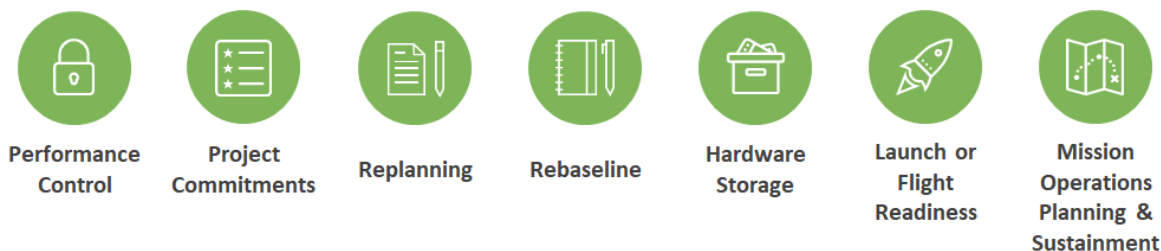


Figure 5-1. Process Elements – Implementation

5.1 Cost, Schedule, and Technical Performance Control

Projects manage cost, schedule, technical performance, and scope to support customers' continued reliance on Langley's capabilities. Projects control the work by anticipating and preventing problems and by getting deficiencies corrected before they affect cost, schedule, or quality of deliverables.

Projects use objective measures of work performance and quality to ensure mission success. Use of project control tools and trend monitoring/projections (e.g., requirements burn down, Nonconformance Reporting, and cost/schedule) provide project management, customers, and other stakeholders with information to support critical decisions and communications.

5.2 Project Commitments

Project commitments are documented in management agreements from Formulation. The life cycle reviews, KDPs, and/or Continuation Assessments (CA) performed during the Implementation phase ensure the project's progress supports the requirements defined in these management agreements. These reviews provide projects the opportunity to present and negotiate updates to commitments with customers. Management decisions made at the KDPs or CAs confirm the project's plans to proceed and are documented in a Decision Memorandum.

R29. The Project Manager shall execute control plans and processes to ensure scope, cost, schedule, and technical performance are maintained within the defined project commitment.

Rationale: Depending on the project type, governance, and customers, the “commitment” may be a formal baseline, the Project Plan, and/or planned cost (phasing) and schedule commitments, as determined by Authority to Proceed.

During Implementation, the project control plans developed in Formulation are implemented and adjusted to ensure project commitments are maintained. Projects with formal baselines work towards the commitments aligned with the project baseline. Projects without formal baselines work towards the commitments to an agreed to plan with project customer(s). Depending on the mission goals, the project may have higher technical performance risks that can impact commitments. These are often realized in Implementation. Therefore, expectations must be established and assessed during periodic lifecycle reviews.

Allocation: All LMT A-F projects in scope of this document.

5.3 Replanning

Replanning is defined as the process by which the project updates or modifies its plans. Updates or modifications to the plan may include scope, budget, schedule, and/or risk posture. A key principle of replanning is maintaining baseline commitments.

The project may also receive a request to change the scope of the project, either directly from the customer, or through other channels. The project assesses the impact of the requested changes on the cost, risk, performance, and schedule of the project and makes the impact visible to all participants in the change process.

Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook includes defined criteria for Replanning.

R30. The Project Manager shall ensure changes within the baseline, including justification and updated projections for project completion and mission success are documented and communicated.

Rationale: The extent and formality to which changes and justifications are documented is directly related to the size, scope, and criticality of the change; the documentation approach will be coordinated with the project’s Sponsoring Organization Official and customers. Center communication of replanning efforts (including planning, process, and results) occur through Center Level Reviews and Reporting ([section 2.12](#)), and/or through Other Prompt Notifications ([section 2.16](#)). Projects also communicate replanning efforts with project customers in the format and frequency which meet the expectations of the customer.

Allocation: Applicable to all projects LMT A-F in scope of this document.

5.4 Rebaseline

Rebaselining is defined as the process that results in a change to a project's Agency Baseline Commitment (NPR 7120.5) or approved baseline (NPR 7120.8). Major changes may lead a project to consider abandoning the baseline plan and creating an entirely new plan. The decision to rebaseline requires negotiation with the customer in alignment with governing Agency requirements (NPR 7120.5 or NPR 7120.8).

Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook includes defined criteria for Rebaseline.

R31. The Project Manager shall conduct a Rebaseline Review to the project's Center stakeholders and external customers prior to executing or finalizing a rebaseline.

Rationale: Projects initiate early conversations with Center stakeholders and external customers when a rebaseline is being considered or required. The Rebaseline Review is the formal assessment of the rebaseline process and recommended results. When changes in a project meet defined criteria for rebaseline, the project will develop an updated plan for the remaining work, which is traced to the last baseline plan. The impacts of changes on cost, risk, performance, and schedule must be made visible to all parties involved in the rebaselining effort. A rebaseline results in a change to a project's Agency Baseline Commitment.

Allocation: Applicable to projects with a Langley Mission Type A-D initiating a rebaseline. The Sponsoring Organization Official will determine the applicability of this requirement for projects with a Langley Mission Type E-F initiating a rebaseline.

5.5 Hardware Storage

Secured storage (which may include bonded storage) areas may be required for parts and materials used in assembly and in integration of hardware and for spare parts coming from a prime contractor after/during a contracted project. Projects establish bonded stores per LMS-CP-4892, Bonded Storage, when assembling space flight hardware to closely control safety and product quality.

Ref. LMS-CP-4892, Bonded storage provides processes to ensure control and accountability of materials, hardware, and associated equipment used to build Langley's products, thereby ensuring safety, reliability, and functionality.

In some cases, an extended storage period for parts or systems may be required. This determination may be made by customers during the latter part of Implementation. Requirements for extended storage will include, but are not limited to, selection of facilities, end of life constraints, maintenance of systems/components, and environmental factors. Storage plans should be included in the initial discussions of project planning. Strategies and plans may be included in the Project Plan or possibly a separate Storage Plan. Projects should evaluate the risk of unplanned storage, and associated contingency for hardware safety and maintenance activities, software lifespans, staffing changes, and other management concerns with respect to storage periods.

Ref. LMS-CP-4756, Handling, Preservation, Storage and Shipping of Flight Hardware and Ground Support Equipment provides processes to ensure space flight hardware and ground support equipment is handled, preserved, and shipped in a manner to preclude damage.

5.6 Launch or Flight Readiness

The options for launch or flight are dependent on mission requirements. Launch options include but may not be limited to the Launch Services Program (LSP) located at Kennedy Space Center (KSC), other government agencies/academia/industry, international partners, and/or storage for future opportunities to launch or flight. Flight options can include numerous types of vehicles. Planning for launch or flight options begins in Formulation.

Activities in Implementation include finalizing design, fabricating hardware systems, developing software systems, performing assembly, integration, and test procedures to support the selected launch or flight requirements and culminating in flight readiness reviews. For launch or flight services, projects participate in meetings with providers and stakeholders to ensure requirements are supported for launch or flight readiness.

The Communications Plan and Mishap Preparedness and Contingency Plan, if applicable, are typically refined as information on launch activities are further defined. Stakeholder participation in the launch or flight campaign increases during this phase. The project may need to support multiple events such as press release activities, news events, public affairs events, social media events, and launch site guest logistics. Launch readiness of the project and the flight status will be reported through forums identified in Center Level Reviews and Reporting ([section 2.12](#)), and/or through Center Level Notifications ([section 2.16](#)). Projects will also communicate with external customers in a format and frequency which meet the expectations of the customer.

Ref. NPD 8610.12, Orbital Space Transportation Services provides policy to encourage and facilitate a viable, healthy, and competitive U.S. commercial space transportation industry; to utilize space transportation services for NASA and NASA-sponsored payloads in concert with the risk posture of each payload; and to maximize the utilization of the lift capability of an available space transportation service to the maximum extent practicable.

5.7 Mission Operations – Planning and Sustainment

Implementation includes preparing for and executing mission operations. The project prepares and finalizes work agreements and contracts for execution in sustained mission operations. For spaceflight projects, on-orbit checkout and initial operations are performed at the end of Phase D. After the Post Launch Acceptance Review (PLAR) or other equivalent initial operations completion milestone, the sustainment of mission operations becomes the primary focus of project activities, and the management of the project transitions to the Mission Operations Team. Critical Event Readiness Review (CERRs) or other Periodic Project Reviews (PPRs) are performed. Project management processes, including cost and schedule management, configuration management, risk management, workforce planning and training, continue during mission operations through decommissioning or closeout.

- R32. The Project Manager shall ensure workforce planning and interfaces of both the mission operations and engineering technical teams fully support initial operations and transition requirements.**

Rationale: Strategic workforce plans supporting full up mission operations and support from technical engineering leads are required for a successful transition to sustained operations. Activities may include 24-hour work shifts and travel to off-site mission operation centers.

Allocation: Applicable to all projects within scope of this document performing mission operations.

- R33. The Project Manager shall ensure the scope of each operations team position, required training, and other criteria (e.g., demonstrated experience) are defined and documented, and defined training is complete before the operations functions are performed.**

Rationale: The Mission Operations Team performs rehearsals prior to mission operations to better inform the Mission Operations Plan and ensure operations team readiness. Definition of the mission operations organization ensures ease of transition, system leads, and continuity of knowledge for operations.

Allocation: Applicable to all projects within scope of this document performing mission operations.

- R34. The Project Manager or designee shall, at a minimum, report daily to Center stakeholders during the first seven days of initial operations and then weekly until the PLAR, or equivalent initial operations completion milestone.**

Rationale: The beginning of initial operations is documented in the Mission Operations Plan. Depending on project requirements, there can be multiple conditions that will need to be completed after launch by external organizations (i.e., deployment from the launch vehicle or spacecraft, installation on ISS, initial operations of other payloads) but before initial operations can begin. Activities during initial operations will include first-time in-flight use of flight system functionality and possibly irreversible events. Timely communications with Center management, customers, and other stakeholders will ensure key information on the health of the payload, operation, or spacecraft is available and up to date for management reports. Reporting cadence may need to be adjusted if off-nominal conditions occur.

Allocation: Applicable to all projects within scope of this document performing mission operations.

Project reporting and communications continue per plans. Decommissioning plans are finalized in preparation for closeout.

Chapter 6. Closeout Process and Requirements

When a project achieves its goals and objectives and/or completes the planned mission, or if a project is terminated early, closeout activities are performed, completing the project's defined life cycle. The decision to proceed with normal planned decommissioning of project hardware and the ending of the project's mission is made in conjunction with end of project Key Decision Point and associated Reviews. Depending on the mission's goals and content, closeout activities include spacecraft and other in-space asset disposal, disposition of ground systems, test beds, and spares, infusion and/or transition activities, and completion of archiving project and science data and documents.

Project requirements associated with recurring processes or activities throughout the project life cycle are listed in [Chapter 2](#). Project teams will review and ensure adherence to the life cycle requirements as the project progresses through the project life cycle.



Figure 6-1. Process Elements – Closeout

6.1 Decommissioning or Closeout

Project assets include hardware, software, documentation, and records. Projects will comply with project closeout requirements per governing documents (e.g., NPR 7120.5, NPR 7120.8) and project customers. Projects will closeout project documentation and records in alignment with records management and configuration and data management requirements, and the project's Configuration Management Plan.

R35. The Project Manager shall ensure final disposal, archiving, and dispositioning of project assets are complete per the Sponsoring Organization and project customers' expectations.

Rationale: The final steps to capture and safeguard project assets for future use or safe disposal must be performed in a timely manner. Proper completion of this phase ensures that unnecessary waste and rework by future projects will be alleviated.

Allocation: Applicable to all projects LMT A-F in scope of this document.

R36. The Project Manager shall ensure records of resources expended and workforce used since project initiation are submitted to the Langley Office of the Chief Financial Officer.

Rationale: Documenting the full life cycle cost provides needed historical information for cost basis of future proposals and assessments of future projects. This is a specific OCFO call of project data. This requirement does not negate the project requirements associated

with managing and archiving project documentation and records such as Cost Analysis Data Requirement (CADRe).

Allocation: Applicable to all projects within scope of this document.

6.2 Termination

Projects may be terminated in a variety of situations. Circumstances such as the anticipated inability of the project to meet its commitments, an unanticipated change in Agency strategic planning, or an unanticipated change in the NASA budget can result in recommendations for termination. Termination of a project is not undertaken lightly. The customer may give the project time to address deficiencies up to the next planned Key Decision Point. Depending on the life cycle phase, termination activities will vary and can include independent reviews, notifications to stakeholders, contract closeouts, reporting final project cost, decommissioning and disposal of project assets, and others as documented in decommissioning plans and the resulting Decision Memorandum associated with termination. If project termination will involve shutdown or termination of one or more contracts, the project will consult with the Office of Procurement to understand options and potential cost risks. A Decision Memorandum will include required termination actions.

Ref. NASA/SP-2014-3705 NASA Space Flight Program and Project Management Handbook, Section 5.11.1, Termination Review.

Ref. NPD 8010.3, Notification of Intent to Decommission or Terminate Operating Space Missions and Terminate Missions.

R37. The Project Manager shall ensure development of a documented Termination Plan upon notification or expectation of project termination.

Rationale: The Termination Plan captures the approach for a timely and orderly closeout, and which is needed for approval to proceed with termination activities. The Termination Plan ensures all assets (to include rights in data and rights in intellectual property) are properly documented and dispositioned, contract shutdown or termination costs/risks are addressed, all financial obligations are closed out, and stakeholder requirements are addressed. Activities for the termination of a project include many already planned decommissioning or closeout activities for the normal end of a project. Consideration will need to be given for the current state of hardware development or research, financial obligations and commitments, and stakeholder requirements.

Allocation: Applicable to all projects in scope of this document notified of project termination.

Appendix A. Definitions

Acquisition. The process for obtaining, or advancing the development of, the systems, research, services, construction, and supplies to fulfill the Agency's mission and other activities, which advance the Agency's statutory objectives.

- Ref. NPD 1000.5, Policy for NASA Acquisition provides the overall policy framework for NASA's strategic acquisition process with appropriate references to other key processes and directives.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook describes acquisition in context to the NASA project life cycle.

Acquisition Plan (Acquisition Approach). The integrated acquisition strategy that enables a program or project to meet its mission objectives and provides the best value to NASA.

- The Acquisition Plan (NPR 7120.5 terminology) or Acquisition Approach (NPR 7120.8 terminology) is a Project Plan Control Plan, which is typically documented in the Project Plan, but may be a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Acquisition Strategy Meeting (and minutes). A decision-making forum where senior Agency management reviews and approves program and project acquisition strategies. The Acquisition Strategy Meeting focuses on considerations such as impacts to the Agency workforce, maintaining core capabilities, make-or-buy decisions, supporting Center assignments, potential partnerships, and risk.

- This is a Headquarters and Program-level activity (product). The project may use the results and minutes of the Acquisition Strategy Meeting as input to the Project Plan, as part of the project's implementation approach.
- Ref. NPD 1000.5, Policy for NASA Acquisition provides the overall policy framework for NASA's strategic acquisition process with appropriate references to other key processes and directives.
- Ref. NAII 1000.1, Pre-Acquisition Strategy Meeting Guide provides an overview and guidance in executing a pre-Acquisition Strategy Meeting.
- Ref. NAII 1000.2, Acquisition Strategy Meeting Guide provides an overview and guidance in executing an Acquisition Strategy Meeting.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, describes the Acquisition Strategy Meeting as input for the project's implementation approach.

- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements describes the Acquisition Strategy Meeting in context with strategic acquisition planning.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about the Acquisition Strategy Meeting in context to the NASA project life cycle.

Agency Baseline Commitment. Establishes and documents an integrated set of project requirements, cost, schedule, technical content, and an agreed-to JCL (when required) that forms the basis for NASA's commitment to the external entities of OMB and Congress.

- For projects governed by NPR 7120.5, the Agency Baseline Commitment (ABC) is established at "Approval for Implementation," or KDP C. The ABC and other key parameters are documented in the Decision Memorandum.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook

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.

Announcement of Opportunity. An AO is one form of a NASA Broad Agency Announcement (BAA) which is a form of public/private competition. NASA solicits, accepts, and evaluates proposals submitted by all categories of proposers in response to an AO, including academia, industry, not-for-profits, government laboratories, Federally Funded Research and Development Centers (FFRDC), NASA Centers, and the Jet Propulsion Laboratory. NASA typically uses a one-step or a two-step AO process. In a one-step AO process, proposals for new projects are evaluated competitively and selected for Formulation in a single step. In two-step competitions, several proposals for new projects may be selected in Step 1 and given time to mature their concepts in a funded concept study before the Step 2 down-selection.

- Ref. NASA FAR Supplement (NFS) Part 1872, Acquisition of Flight Investigations includes regulatory coverage of Announcement of Opportunities.

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

Approval (for Implementation). 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) is documented.

Architecture (Mission, Spacecraft, Ground, and Payload). An architecture is the high-level unifying structure that defines a system (e.g., mission, spacecraft, ground, payload). It provides a set of rules, guidelines, and constraints that defines a cohesive and coherent structure consisting of constituent parts, relationships, and connections that establish how those parts fit and work together. It addresses the concepts, properties, and characteristics of the system and is

represented by entities such as functions, functional flows, interfaces, relationships, resource flow items, physical elements, containers, modes, links, communication resources, etc.

- The project mission, spacecraft, ground, or payload architectures may be documented as part of the design approach documentation, requirements, Formulation Agreement, and/or Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NASA SP-2016-6105, NASA Systems Engineering Handbook describes different architectures and their context within the NASA project life cycle.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix F: Project Formulation Agreement Template provides a description and elements of these products.

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

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

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

- The applicability and tailoring of a BOE occurs during the Compliance Matrix Assessment.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook.
- Ref. NASA CEH v4.0, NASA Cost Estimating Handbook.

Budget. A financial plan that provides a formal estimate of future revenues and obligations for a definite period of time for approved programs, projects, and activities.

- Ref. NPR 9420.1, Budget Formulation includes other related financial management terms and definitions.
- Ref. NPR 9470.1, Budget Execution includes other related financial management terms and definitions.

Capitalization Determination Form. The purpose of this form is to determine the appropriate accounting treatment for each acquisition. This form documents the evaluation of purchases, fabrications, constructions, and modifications that may result in capital asset acquisition (acquisitions, fabrications, construction, and modifications/improvements that meet specific thresholds); this applies to personal property, real property, and internal use software.

- Project Managers are responsible for completion of this form with the assistance of the Center Property Accountant. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.

- Ref. NASA Form 1739, Capitalization Determination Form (CDF) is completed for all NASA acquisitions, fabrications, construction, and modifications/improvements that meet the specific thresholds (thresholds listed on form).
- Ref. NPR 9250.1, Property, Plant, and Equipment and Operating Materials and Supplies provides the financial management requirements for the identification, valuation, recognition, and reporting of capitalized Property, Plant, and Equipment (PP&E) and Operating Materials and Supplies (OM&S).

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.

- Primary responsibility to evaluate the cost, schedule, and technical content and assessing performance of Center projects to assure Langley is meeting its commitments.
- Ref. LAPD 1150.2, Councils, Boards, Panels, Committees, Teams, and Groups.

Commitment. An administrative reservation of budget authority in anticipation of an obligation.

Communications Plan. Describes plans to implement a diverse, broad, and integrated set of efforts and activities to communicate with, and engage target audiences, the public, and other stakeholders in, understanding the project, its objectives, elements and benefits, and how it relates to the larger NASA vision and mission.

- A Communications Plan may be documented in the Project Plan, in general project planning documentation, or as a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA Office of Communication website, <https://communications.nasa.gov>, NASA Communication Policies & Guidelines, includes a Communications Plan Template for programs and projects.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

(Compliance) Fully Compliant. A prescribed product or plan that meets associated governing requirements without tailoring. This term is used to designate and approve applicability of products and plans as part of a project's Compliance Matrix Assessment.

(Compliance) Not Applicable. A prescribed product or plan that is not relevant and/or not capable of being applied to a specific program, project, system, or component. This term is used to designate and approve applicability of products and plans as part of a project's Compliance Matrix Assessment. Projects will provide a brief justification of why the requirement is not applicable within the Compliance Matrix.

[Compliance] Tailored. A prescribed product or plan that meets or partially meets associated governing requirements with modification. This term is used to designate and approve applicability of products and plans as part of a project's Compliance Matrix Assessment.

Compliance Matrix. Documents whether and how the project complies with governing requirements and provides rationale and approvals for deviation from requirements and is part of retrievable project records.

- A Compliance Matrix Assessment allows each project to determine and seek agreement to the applicability of common Headquarters and Program products; project technical products; project management, planning and control products; and project control plans.
- Ref. An online NPR Tailoring Application (NTA), <https://oneplace.larc.nasa.gov/nta>, guides projects through the Compliance Matrix Assessment. The NTA Compliance Matrix Assessment provides the project with the opportunity to propose Full Compliance (FC), Tailoring (T), or Non-Applicability (NA) of these products and plans. The output of the NTA Compliance Matrix Assessment is a project-specific compliance matrix, which will be approved as an inclusion with a Formulation Agreement or Project Plan.

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

- The concept documentation (NPR 7120.5 terminology) or operations and logistics concepts (NPR 7120.8 terminology) is a Project Plan Control Plan, which may be standalone documentation, or described or referenced in the Formulation Agreement or Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix F: Project Formulation Agreement Template provides a description and elements of this product.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a reference to this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

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

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

Configuration Management Plan (Configuration and Data Management Plan). Describes the approach that the project team will implement for configuration management. Describes the organization, tools, methods, and procedures for configuration identification, configuration control, traceability, and accounting/auditing.

- A Configuration and Data Management Plan is typically a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7123.1, NASA Systems Engineering Processes and Requirements outlines the process and requirements for configuration management for projects, including the development of a Configuration Management Plan.
- Ref. LMS-CP-8041, Master Configuration and Data Management Plan for Flight Projects defines the configuration and data management processes, procedures, and overall tasks for Langley projects governed by NPR 7120.5.
- Ref. LMS-CP-8042, Aeronautics Research Directorate Configuration, and Data Management Plan defines the configuration and data management processes, procedures, and overall tasks for projects within the Aeronautics Research Directorate.

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 with knowledge of all the pertinent facts would believe 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.

Contamination Control Plan. For projects where contamination is determined to be a potential risk to meeting requirements, this plan describes a project's contamination control program that includes a detailed susceptibility analysis.

- A Contamination Control Plan is typically a standalone document. The project evaluates the proposed flight system to identify components that have a potential for degradation due to particulate and molecular contamination and lays out the plan for how to control the generation and migration of potential contaminants. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. LPR 5300.1, Product Assurance Requirements includes Langley-specific requirements associated with a project Contamination Control Plan.
- Ref. NASA-STD-6016, Standard Materials and Processes Requirements for Spacecraft defines the minimum requirements for materials and processes and provides a general control specification for incorporation in NASA program/project hardware procurements and technical programs.

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; 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 Standing Review Board (SRB) chair; and concurring in SRB membership. These officials receive the documented results of the review.

Core Resources Unit Directorates. One of two organizations focused on meeting Center program and project objectives (the other being Product Unit Directorates). Core Resource Unit Directorates provide engineering leadership and staff for projects and ensure technical excellence in the engineering products and services developed by projects. At the time of this document's release, the Core Resource Unit Directorates at Langley include: Engineering Directorate, Research Directorate, Systems Analysis and Concepts Directorate, and Research Services Directorate.

- Ref. LAPD 1000.1, Langley Management System Policy Manual.
- Ref. [Appendix H](#), Center Organization Integration List provides a list of organizations across Langley that should be considered for their potential for communication, collaboration, resources, services, or expertise.

Cost Analysis Data Requirement. A formal document designed to help managers understand the cost and cost risk of space flight projects. The Cost Analysis Data Requirement (CADRe) consists of a Part A "Narrative" and a Part B "Technical Data" in tabular form, both provided by the program/project or Cost Analysis Division. Also, the project team produces the project life-cycle cost estimate, schedule, and risk identification, which is appended as Part C.

Cost to go. The Life Cycle Cost remaining after Cumulative Costs and less Project-held UFE.

- Ref. [Appendix G](#), Unallocated Future Expense, Encumbrances, Liens, and Threats provides more information about this and related terms, calculations, and process.

Crisis Response Plan. Defines the range and scope of potential project crisis, response actions (including mishap reporting), timing of notifications and actions, responsibilities of key individuals, and the engineering support contact plan to aid in rapid anomaly resolution.

- The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. LMS-CP-8621, Reporting, Investigating, and Recordkeeping for Mishaps, Close Calls, and Previously Unidentified Serious Workplace Hazards provide requirements to report, investigate, and document mishaps, close calls, and previously unidentified serious workplace hazards to prevent recurrence of similar accidents.

Cumulative Costs. The portion of the Life Cycle Cost that has been expended.

- Ref. [Appendix G](#), Unallocated Future Expense, Encumbrances, Liens, and Threats provides more information about this and related terms, calculations, and process.

Customer. An individual or organization providing funding for the work, commodities, or services performed on its behalf.

- For many projects, the customer is the Mission Directorate who is funding and directing the work.

- For reimbursable projects, the customer is an entity other than NASA for which the reimbursable agreements have been signed.
- All customers are stakeholders of the project; not all stakeholders are project customers.

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

Decision Memorandum. The document that summarizes the decisions made at Key Decision Points or as necessary in between Key Decision Points. The Decision Memorandum includes the Agency Baseline Commitment (if applicable), Management Agreement cost and schedule, Unallocated Future Expense, schedule margin managed above the project, as well as life-cycle cost and schedule estimates, as required.

Design Documentation. A document or series of documents that captures and communicates to others the specific technical aspects of a design. It may include images, tabular data, graphs, CAD drawings, schematics, and other descriptive material.

- Design documentation is typically standalone material and supports peer reviews, subsystem reviews, and system reviews. The applicability and tailoring of these products occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

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

Decommissioning/Disposal Plan (archival, storage, disposal, and security approach). Documents activities necessary to close out the project. This plan helps ensure products produced by the project (e.g., spacecraft, ground systems, test beds, spares, science data, operational data, returned samples) are properly dispositioned and that all project activities (e.g., contracts, financial obligations) are properly closed out. See "[Decommissioning](#)" and "[Disposal](#)" for definitions of these terms.

- The Decommissioning/Disposal Plan (NPR 7120.5 terminology) or archival, storage, disposal, and security approach (NPR 7120.8 terminology) is typically standalone documentation. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides a description of the contents of this product, as well as additional information regarding decommissioning and disposal in context to the NASA project life cycle.

- Ref. NASA/SP-2016-6105, NASA Systems Engineering Handbook describes decommissioning and disposal processes, including general guidance and information.

Decommissioning Review. The objectives of the Decommissioning Review are to evaluate the readiness of the program and its projects to conduct closeout activities, including final delivery of all remaining program or project deliverables and safe decommissioning/disposal of space flight systems and other program or project assets.

- The Decommissioning Review may be combined with the Disposal Readiness Review (DRR) if the disposal of the spacecraft will be done immediately after the Decommissioning Review.

Development Costs. The total of all costs from the period beginning with the approval to proceed to Implementation at the beginning of Phase C through operational readiness at the end of Phase D.

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

Disbursement. Amounts paid by cash or cash equivalent (such as checks and electronic transfers) to liquidate government obligations. The terms “expenditure,” “disbursement,” and “outlay” are often used interchangeably.

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

Disposal Readiness Review. The objective of the Disposal Readiness Review is to evaluate the readiness of the project and the flight system for execution of the spacecraft disposal event.

- A Decommissioning Review may be combined with the Disposal Readiness Review if the disposal of the spacecraft will be done immediately after the Decommissioning Review.

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

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

of final costs; and disciplined baseline maintenance and incorporation of baseline revisions in a timely manner.

Encumbrance. The process by which a hold against UFE is made. The money has not necessarily been moved yet to the account of the specific WBS sub element that created the need, but the hold has been placed.

- Ref. [Appendix G](#), Unallocated Future Expense, Encumbrances, Liens, and Threats provides more information about this and related terms, calculations, and process.

End of Mission Plan. Describes the plan for limiting debris generation and limiting risk to the public and other active spacecraft during decommissioning and disposal of all operational space objects. The End of Mission Plan is a living document and is maintained throughout mission operations to ensure that operational use does not preclude a safe decommissioning and disposal.

- An End of Mission Plan is typically a standalone document but may be included or referenced in a Decommissioning/Disposal Plan. An End of Mission Plan may include other aspects of the end of mission process (final disposition of data and hardware, for example) if the project finds that it is the most convenient means of recording this information. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 8715.6, NASA Procedural Requirements for Limiting Orbital Debris and Evaluating the Meteoroid and Orbital Debris Environments is generally applicable to programs and projects responsible for NASA or NASA-sponsored objects launched into space, and defines responsibilities and requirements to ensure that NASA and its partners, providers, and contractors take steps to preserve the near-Earth space environment.
- Ref. NASA-STD-8719.14, Process for Limiting Orbital Debris serves as a companion to NPR 8715.6 and provides specific technical requirements for limiting orbital debris and methods to comply with the NASA requirements for limiting orbital debris generation.
- Ref. NASA-STD-8719.14, Process for Limiting Orbital Debris, Appendix B provides an outline for developing an End of Mission Plan.

Engineering Development Assessment (Documentation). Identifies major engineering development risks and any engineering prototyping or software model development that needs to be accomplished during formulation to reduce development risk. Provides rationale and potential impacts to project performance, cost, and schedule if development risks are not addressed. Describes the scope of the prototyping and modeling activities and the expected reduction of cost and risk by performing this work during Formulation. Includes the project's testing philosophy, including functional, environmental, and qualification testing, any life testing and protoflight test plans, and rationale.

- Documentation of an Engineering Development Assessment is typically included in the project's Formulation Agreement (NPR 7120.5). The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.

- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix F: Project Formulation Agreement Template provides a description and elements of a project Engineering Development Assessment.

Environmental Management Plan (Environmental Protection Plan). Describes 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 National Environmental Policy Act (NEPA) coordinator, describes the program's NEPA strategy at all affected Centers, including decisions regarding programmatic NEPA documents.

- The Environmental Management Plan (NPR 7120.5 terminology), Environmental Protection Plan (NPR 7120.8 terminology) or equivalent is typically documented as part of the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. LPR 8500.1, Environmental and Energy Program Manual sets forth procedural requirements and responsibilities to ensure that Langley personnel comply with Langley's environmental and energy management program.
- Ref. Langley Form, LF461, Environmental Project Planning Form guides projects in gathering the data needed for the Langley Environmental Office to review the project to ensure compliance with multiple environmental regulations; the results of this assessment can be incorporated into the Project Plan.
- Ref. NPR 8580.1, Implementing the National Environmental Policy Act and Executive Order 12114 establishes procedures and responsibilities for complying with the requirements of the National Environmental Policy Act (NEPA), the Council on Environmental Quality's (CEQ) implementing regulations, Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, and NPD 8500.1, NASA Environmental Management.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a reference to this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Expendable Launch Vehicle. A vehicle that, once launched, is not reused and typically is not retrieved.

Expendable Launch Vehicle Payload Safety Process (Documentation). Expendable Launch Vehicle Payload Safety Process documentation is the collection of deliverables associated with safety processes for projects utilizing expendable launch vehicles.

- Documentation of an ELV Payload Safety Process is typically included in the Project Plan along with standalone documentation. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 8715.7, Payload Safety Program defines the NASA Payload Safety Program, which is intended to safeguard people and assets (including flight hardware and facilities)

from hazards associated with NASA payloads during testing, processing, integration to the launch vehicle components, launch, and planned recovery of payload and samples.

- Ref. NASA-STD 8719.24, Process for Limiting Orbital Debris provides more details on payload processing for launch.

Expenditure. The actual spending of money or cash equivalent. The terms “expenditure,” “disbursement,” and “outlay” are often used interchangeably.

Extended Operations. Extended operations are operations conducted after the planned prime mission operations are complete. Extended operations require approval, as determined by the Mission Directorate. Once the extension of operations is approved, program or project documentation must be updated.

Formal Dissent. A substantive disagreement with a decision or action that is based on a sound rationale (not on unyielding opposition) that an individual judges is not in the best interest of NASA and is of sufficient importance that it warrants a timely review and decision by higher-level management, and the individual specifically requests that the dissent be recorded and resolved by the Formal Dissents process defined in LPR 7120.4.

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

Formulation Agreement. A document prepared by the project in response to the Formulation Authorization Document (FAD) to establish the technical and acquisition work that needs to be conducted during Formulation, and defines the schedule and funding requirements during Phase A and Phase B for that work.

- The Formulation Agreement is an NPR 7120.5 product and is not specifically identified in NPR 7120.8. Contents of the Formulation Agreement are typically used as an initial input to the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix F: Project Formulation Agreement Template.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Formulation Authorization Document. Authorizes the formulation of a program or project whose goals will fulfill part of the Agency's Strategic Plan and Mission Directorate strategies and establish the expectations and constraints for activity in the Formulation Phase. In addition, a Formulation Authorization Document or equivalent is used to authorize the formulation of a project.

- This is a Headquarters and Program product. The Formulation Authorization Document is issued by the Mission Directorate Associate Administrator (MDAA).

- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix E: Project Formulation Authorization Document Template.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix F: R&T Project Formulation Authorization Document Template.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Funding (budget authority). The authority provided by law to incur financial obligations that will result in expenditures. There are four basic forms of budget authority, but only two are applicable to NASA: appropriations and spending authority from offsetting collections (reimbursables and working capital funds). Budget authority is provided or delegated to programs and projects through the Agency's funds distribution process.

Heritage Assessment documentation (assessment of heritage elements). A Heritage Assessment identifies the major heritage hardware and software assumptions and associated risks and the activities and reviews planned to validate those assumptions during Formulation, including schedule and funding requirements for those activities. An assessment of heritage elements should consider the intended application and operational environment compared to how they were previously used.

- The Heritage Assessment Documentation (NPR 7120.5 terminology) is typically included in the Formulation Agreement and supporting documentation, while an Assessment of Heritage Elements (NPR 7120.8 terminology) is typically included as part of a Technology Maturity Assessment. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix F: Project Formulation Agreement Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix K: Technology Maturity Assessment Process references the assessment of heritage elements.
- Ref. NASA/SP-2016-6105, NASA Systems Engineering Handbook provides description and considerations regarding heritage products and assessments.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Human Rating Certification Package. The integration of the human into the system, preventing catastrophic events during the mission, and protecting the health and safety of humans involved in or exposed to space activities, specifically the public, crew, passengers, and ground personnel. The Human Rating Certification Package is a compilation of pertinent plans and documents, plus presentation material to help guide reviewers through the Human Rating Certification process. The package is not intended to duplicate/repackage existing documentation but rather provides a summarization of information, the details of which can be found in referenced documents or other data sources and justification/explanation/augmentation for information that isn't available in other documentation.

- Applicable to human space flight missions. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 8705.2, Human Rating Requirements for Space Systems defines and implements the processes, procedures, and requirements necessary to produce human-rated space systems that protect the safety of the crew and passengers on NASA space missions.
- Ref. NPR 8705.2, Human Rating Requirements for Space Systems, Appendix D, Human Rating Certification Package; Appendix E, Human Rating Certification Package Endorsements.
- Ref. NASA/SP-2016-6105, NASA Systems Engineering Handbook describes processes and considerations for human rated systems.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

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 goals.

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

Independent Cost Assessment. An outside, non-advocate's evaluation of a project or proposal's cost estimate and Project Plan. It includes an evaluation of the project or proposal team's plans to provide increased credibility that the project or proposal team's cost estimate captures all requirements.

Independent Cost Estimate. Provides a quantitative estimate of the project scope, using an alternate method than that used by the project. It is conducted concurrently as part of the ICA, and often involves a parametric estimate.

Independent Schedule Assessment. A component of a comprehensive Independent Assessment. The ISA can include a health check of the project or proposal Integrated Master Schedule, as well as an assessment of the underlying schedule logic, task durations, margin adequacy, and critical path validity.

Independent Life Cycle Review. A set of life cycle reviews, specified in one or more approved document(s), that employs an independent team of experts to assess the progress of a project against established success criteria. The conduct of independent life cycle reviews is governed by the approved documents. Independent life cycle reviews are distinguished from ad hoc reviews, which are usually limited to a single review on a special topic and may or may not be done by a team that is independent of the project.

- Ref. LPR 7120.7, Independent Life Cycle Review Procedural Requirements.

Information Technology. Any equipment or interconnected system or subsystem of equipment that is used in the automatic acquisition, storage, manipulation, management, movement, control,

display, switching, interchange, transmission, or reception of data or information by an executive agency. It also includes computers, ancillary equipment (including imaging peripherals, input, output, and storage devices necessary for security and surveillance), peripheral equipment designed to be controlled by the central processing unit of a computer, software, firmware and similar procedures, services (including support services), and related resources.

Information Technology Plan. Describes how the project will acquire and use information technology including IT security requirements.

- The Information Technology Plan (“IT Plan”) is a Project Plan Control Plan and is typically documented as part of the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 2810.1, Security of Information Technology prescribes roles, responsibilities, and conditions that directly or indirectly promote information security throughout the life cycle of all NASA information and information systems, and identifies information security policies, procedures, and practices.
- Ref. NPR 2800.1, Managing Information Technology establishes requirements and responsibilities for information technology (IT) Management relative to the policy set forth in NPD 2800.1.
- Ref. NPD 1440.6, NASA Records Management establishes NASA’s policy for records management.
- Ref. NPR 1441.1, NASA Records Management Program Requirements provides overall, high-level direction to NASA Centers for implementation and ongoing operation of an effective Records Management (RM) program; establishes minimum requirements for managing NASA record information throughout its life cycle; and establishes the procedural requirements for development, maintenance, and use of NASA Records Retention Schedules.
- Ref. NPD 2200.1, Management of NASA Scientific and Technical Information establishes policy for conducting the Scientific and Technical Information (STI) Program, which manages the informational results of NASA’s research and development efforts.
- Ref. NPR 2200.2, Requirements for Documentation, Approval, and Dissemination of Scientific and Technical Information identifies requirements for approving, publishing, and disseminating NASA scientific and technical information (STI) under the policy set forth in NPD 2200.1.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements provides expectations for this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Infrastructure Requirements and Plans. The facilities and environmental, aircraft, personal property, equipment, and information technology resources that are needed to support programs and projects. Utilization of the capability afforded by the infrastructure includes consideration of the maintenance and other liabilities it presents.

- Infrastructure requirements and plans are typically documented in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NASA Form 1739, Capitalization Determination Form (CDF) is completed for all NASA acquisitions, fabrications, construction, and modifications/improvements that meet the specific thresholds (thresholds listed on form).
- Ref. NPR 9250.1, Property, Plant, and Equipment and Operating Materials and Supplies provides the financial management requirements for the identification, valuation, recognition, and reporting of capitalized Property, Plant, and Equipment (PP&E) and Operating Materials and Supplies (OM&S).
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a description and elements of this product.

Integrated Cost and Schedule Risk Analysis. An extension of Schedule Risk Analysis (SRA) that incorporates project costs to go a step further and help determine the adequacy of the budget, given the project schedule and risks. The results from these analyses provide management with insight on how to prioritize resources to address driving risks.

- Ref. NASA/SP-2010-3403, NASA Schedule Management Handbook provides information and describes a process for developing an integrated cost and schedule risk analysis.

Integrated Logistics Support Plan (Logistics concepts). Describes how the project will implement a maintenance and support concept, enhancing supportability, supply support, maintenance planning, packaging, handling and transportation, training, manpower, required facilities, and logistics information systems for the life of the project.

- The Integrated Logistics Support Plan (NPR 7120.5 terminology) or logistics concepts (NPR 7120.8 terminology) are typically documented in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPD 7500.1, Program and Project Life-Cycle Logistics Support Policy provides policy for reusable or maintainable flight hardware, ground hardware, and logistics support.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Integrated Master Schedule. The complete, time-phased, logically-linked network of all project effort that is required to ensure that all objectives are met within approved commitments. The use of the word “integrated” implies the incorporation of all activities, even contractor and subcontractor efforts, necessary to complete the project.

- Ref. NASA/SP-2010-3403, NASA Schedule Management Handbook.

Integration Plan. The integration and verification strategies for a project interface with the system design and decomposition into the lower-level elements. The Integration Plan is structured to bring the elements together to assemble each subsystem and to bring all of the subsystems together to assemble the system/product.

- The Integration Plan is a Project Plan Control Plan, which is typically documented in the Project Plan, and may be included in an Integration & Test Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Joint Cost and Schedule Confidence Level. (1) The probability that cost will be equal to or less than the targeted cost and schedule will be equal to or less than the targeted schedule date. (2) A process and product that helps inform management of the likelihood of a project's programmatic success. (3) A process that combines a project's cost, schedule, and risk into a complete picture. JCL is not a specific methodology (e.g., resource-loaded schedule) or a product from a specific tool. The JCL calculation includes consideration of the risk associated with all elements, regardless of whether or not they are funded from appropriations or managed outside of the project. JCL calculations include the period from KDP C through the hand over to operations, i.e., end of the on-orbit checkout.

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

Knowledge Management. A collection of policies, processes, and practices relating to the use of intellectual and knowledge-based assets in an organization.

Knowledge Management Plan. Describes the project's approach to creating the knowledge management strategy and processes. Strategy should include practices for identifying, capturing, and transferring knowledge, and capturing and documenting lessons learned and best practices throughout the project life cycle.

- The Knowledge Management Plan is a Project Plan Control Plan and is typically documented in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPD 7120.6, Knowledge Policy for Programs and Projects describes NASA's policy to effectively manage the Agency's technical and program/project management knowledge to cultivate, identify, capture, retain, utilize, and share knowledge in order to continuously improve the performance of NASA in implementing its mission.
- Ref. NPD 7120.4, NASA Engineering and Program/Project Management Policy provides the statement of policy, principles, and responsibilities for program and project management and system and software engineering disciplines at NASA, including knowledge management.

- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product (see “Project Authority, Governance Structure, Management Structure, and Implementation Approach”).
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a description and elements of this product (see “Data and Knowledge Management and Distribution”).
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Langley Management System. A set of processes, procedures, policies, tools, and organizations that support compliance with requirements in the development of products and provision of services, enabling Langley to achieve its mission.

Lien. Events that are having or are likely to have a negative impact on project cost, schedule, or technical performance. Project acceptance of a lien may result in an encumbrance on project funds or UFE.

- Ref. Appendix G, Unallocated Future Expense, Encumbrances, Liens, and Threats provides more information about this and related terms, calculations, and process.

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

Management Agreement. Within the Decision Memorandum, the parameters and authorities over which the program or project manager has management control constitute the program or project Management Agreement. A program or project manager has the authority to manage within the Management Agreement and is accountable for compliance with the terms of the agreement.

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.

Materials and Processes Plan. Addresses items such as outgassing of materials in the crew compartments, radiation shielding of materials for crew and electronics, and radiation degradation of material thermal and mechanical properties. In selecting materials, including mechanical parts and components, projects address flammability, stress corrosion, out-gassing, and off-gassing requirements based upon payload cleanliness goals and spacecraft vehicle requirements.

- The Materials and Processes Plan (may also be called a “Materials and Processes Selection, Control, and Implementation Plan,”) is typically a standalone document. The

applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.

- Ref. NASA-STD-6016, Standard Materials and Processes Requirements for Spacecraft defines the minimum requirements for materials and processes and provides a general control specification for incorporation in NASA program/project hardware procurements and technical programs.
- Ref. MSFC-STD-506, Standard Materials and Processes Control defines the minimum requirements for materials and processes for incorporation in space flight hardware procurements, technical programs, and designated ground support equipment.
- Ref. MSFC-STD-3029, Guidelines for the Selection of Metallic Materials for Stress Corrosion Cracking Resistance in Sodium Chloride Environments defines the design criteria that shall be used for the selection of metallic materials in order to prevent failure due to stress corrosion cracking.
- Ref. NASA-STD-6001, Flammability, Odor, Offgassing, and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion establishes NASA program requirements for evaluation, testing, and selection of materials to preclude unsafe conditions related to flammability, offgassing, and fluid compatibility.
- Ref. NASA Materials and Processes (M&P) Homepage (<https://ndeaa.jpl.nasa.gov/nasa-mp/mp-hp.htm>).
- Ref. ASTM E595, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment.
- Ref. LPR 1710.12, Potentially Hazardous Materials – Hazard Communication Standard defines organizational requirements and procedures for the safe use of potentially hazardous materials, and to facilitate compliance with regulations promulgated by the Occupational Safety and Health Administration (OSHA).

Mishap Preparedness and Contingency Plan. Pre-approved documents outlining timely organizational activities and responsibilities that must be accomplished in response to emergency, catastrophic, or potential (but not likely) events encompassing injuries, loss of life, property damage, or mission failure.

- This is a Headquarters and Program product. The project may work with the Program and Mission Directorate to develop and update this product.
- Ref. NPR 8621.1, NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Record keeping provides requirements to report, investigate, and document mishaps, close calls, and specifies how to prepare for the possibility of and respond to mishaps and close calls, including the elements of a Mishap Preparedness and Contingency Plan.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Mission Directorate Associate Administrator. Official-in-Charge of a specified Mission Directorate Headquarters Office (e.g., Aeronautics Research Mission Directorate, Human Exploration and Operations Mission Directorate, Science Mission Directorate, Space Technology Mission Directorate).

Mission Operations Plan. Describes the activities required to perform the mission. Discusses how the project will implement the associated facilities, hardware, software, and procedures required to complete the mission.

- The Mission Operations Plan is a Project Plan Control Plan and is typically a standalone document with some information documented in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Mission Report. A summary of what the mission accomplished, prepared at the end of a mission. The Mission Report generally includes a summary of the mission accomplishments, science data/samples collected, and a summary of the results achieved. The Mission Report provides a valuable historical record of NASA's accomplishments and the issues that were encountered and overcome as part of the mission.

- The Mission Report may also be referred to as an End of Mission report but should not be confused with the End of Mission Plan (EOMP). A Mission Report may be delivered in the form of tabular data (e.g., Excel spreadsheet), descriptive summaries, presentations (e.g., PowerPoint), or some combination of these formats. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.

Mission Support Organizations. Organizations that provide a broad spectrum of specialized functional support essential to enabling achievement of mission objectives. At the time of this document's release, the Mission Support Offices at Langley Research Center include: Procurement, General Counsel, Diversity & Equal Opportunity, Human Capital, Chief Financial Officer, Chief Information Officer, Safety and Mission Assurance, Center Operations, and Strategic Analysis, Communications, and Business Development.

- Ref. LAPD 1000.1, Langley Management System Policy Manual.
- Ref. Appendix H, Center Organization Integration List provides a list of organizations across Langley that should be considered for their potential for communication, collaboration, resources, services, or expertise.

National Environmental Policy Act. 42 U.S.C 4321 et seq. Signed into law in 1970, established a national policy for the environment, provided for the establishment of the Council on Environmental Quality and other purposes. Requires federal agencies to assess the environmental effects of proposed major federal actions prior to making decisions.

National Environmental Policy Act Compliance (Documentation). Describes a program or project's compliance with the National Environmental Policy Act.

- "NEPA Compliance Documentation" as listed in the NTA Compliance Matrix Assessment, refers to a Program and Headquarters product. The project documents initial NEPA

compliance information in the Project Plan and will address additional NEPA compliance information in an Environmental Management Plan (Environmental Protection Plan).

- Ref. NPR 8580.1, Implementing the National Environmental Policy Act and Executive Order 12114 establishes procedures and responsibilities for complying with the requirements of the National Environmental Policy Act (NEPA), the Council on Environmental Quality's (CEQ) implementing regulations, Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, and NPD 8500.1, NASA Environmental Management.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle and describes the project's documentation of NEPA compliance in the Project Plan and Environmental Management Plan.

Nuclear Safety Launch Approval Plan. Describes potential risks associated with a planned launch of radioactive materials into space, on launch vehicles and spacecraft, and during flight.

- Applicable to any U.S. space mission involving the use of radioactive materials. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 8715.3, NASA General Safety Program Requirements specifies the procedural requirements for characterizing and reporting potential risks associated with a planned launch of radioactive materials into space, on launch vehicles and spacecraft, and during flight.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Obligation. Any act that legally binds the government to make an outlay or expenditure of funds immediately or in the future.

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

- Preliminary definition of operations concept (NPR 7120.5 terminology) is included in the Formulation Agreement and further defined in the Project Plan. An operations and logistics concept (NPR 7120.8 terminology) is typically included within the technical approach of the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.

- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Operations Handbook. Provides information essential to the operation of the spacecraft and generally includes a description of the spacecraft and the operational support infrastructure; operational procedures, including step-by-step operational procedures for activation and deactivation; malfunction detection procedures; and emergency procedures.

- An Operations Handbook is typically a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

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

Orbital Debris Assessment (Report). An Orbital Debris Assessment covers the potential for generating debris during normal operations or malfunction conditions, the potential for generating debris from a collision with debris or orbiting space systems, and post mission disposal. An Orbital Debris Assessment is organized in an Orbital Debris Assessment Report.

- Applicable to projects responsible for NASA or NASA-sponsored objects launched into space as set forth in NPR 8715.6. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 8715.6, NASA Procedural Requirements for Limiting Orbital Debris and Evaluating the Meteoroid and Orbital Debris Environments define responsibilities and requirements to ensure that NASA and its partners, providers, and contractors take steps to preserve the near-Earth space environment.
- Ref. NASA-STD-8719.14, Process for Limiting Orbital Debris serves as a companion to NPR 8715.6 and provides specific technical requirements for limiting orbital debris and methods to comply with the NASA requirements for limiting orbital debris generation.
- Ref. NASA-STD-8719.14, Process for Limiting Orbital Debris, Appendix A provides an outline for developing an Orbital Debris Assessment Report.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Partnerships and Interagency and International Agreements. Types of external relationships and the associated documentation formalizing those relationships.

- This is a Headquarters and Program product. The project team supports the Mission Directorate Associate Administrator and the NASA Headquarters Offices in identifying and planning for any partnerships and interagency and international agreements.

Photographic Documentation Plan. Addresses each of the recommended practices for practices outlined in LPR 7600.1.

- Ref. LPR 7600.1, Photographic Documentation of Hardware establishes Langley requirements for closeout photographs.

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

- Applicable to planetary spacecraft or robotic extraterrestrial missions. A Planetary Protection Plan is typically a standalone document and may be referenced in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPD 8020.7, Biological Contamination Control for Outbound and Inbound Planetary Spacecraft outlines NASA's policy to comply with planetary protection provisions in support of U.S. obligations under the 1967 Outer Space Treaty.
- Ref. NPR 8020.12, Planetary Protection Provisions for Robotic Extraterrestrial Missions sets forth NASA requirements applicable to robotic planetary flight programs. Specifically addresses the control of terrestrial microbial contamination associated with robotic space vehicles intended to land, orbit, flyby, or otherwise encounter extraterrestrial solar system bodies, and the control of contamination of the Earth and the Moon by extraterrestrial material collected and returned by robotic missions.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

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.

Procurement Strategy Meeting. A forum where management reviews and approves the approach for the Agency's major and other selected procurements.

Product Assurance. Product Assurance functions include system safety; hardware quality assurance; reliability; electrical, electronic, and electro-mechanical (EEE) parts, materials and processes; software assurance; and risk management.

Product Assurance Plan. Documents the project's mission assurance requirements such as systems safety, reliability and maintainability, quality assurance, software assurance, electronic parts, problem reporting, and risk management, and is tailored to the project's characteristics.

- The Product Assurance Plan may carry a different title (e.g., Mission Assurance Plan; Safety and Mission Assurance Plan; or Safety, Reliability and Quality Plan) based on the

rules/requirements/conventions of the project customer or sponsor. Some Project requirements and/or complexity may drive the need for a separate plan for one or more of the mission assurance topics. The Product Assurance Plan is a Langley-specific plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.

- Ref. LAPD 5300.1, Product Assurance Program sets forth policy, responsibilities, and authority for Langley Product Assurance functions for applicable projects.
- Ref. LMS-CP-4750, Develop Product Assurance Plans outlines the process for developing and approving a Product Assurance Plan.

Product Unit Directorate. One of two organizations focused on meeting Center program and project objectives (the other being Core Resources Unit Directorates). Product Unit Directorates represent the Center and its projects to customers in the Agency's Mission Directorates. At the time of this document's release, the Product Unit Directorates at Langley include: Aeronautics Research Directorate, Space Technology and Exploration Directorate, and Science Directorate.

- Ref. LAPD 1000.1, Langley Management System Policy Manual.

Program Plan. The document that establishes a program's baseline for Implementation, details how the program will be managed and executed, and serves as an agreement between the Mission Directorate Associate Administrator (MDAA), the program manager, and Center Director(s) that provide contributions to the program. A Program Plan is signed by the MDAA, Center Director(s), and program manager.

- This is a Headquarters and Program product. A Program Plan may include a list or information about projects that are official program elements.

Project Management Council. The governing council over the Center's project management guidance, standards, and requirements. The Project Management Council provides a forum to discuss and make decisions regarding Langley's project management discipline, policies, requirements, and practices.

- Ref. LAPD 1150.2, Councils, Boards, Panels, Committees, Teams, and Groups,

Project Plan. The document that establishes the project's baseline for Implementation, signed by the responsible program manager, Center Director, project manager, and the Mission Directorate Associate Administrator, if required.

- The Project Plan is further described, along with Langley's requirement associated with the Project Plan, in [section 4.3](#) of this document.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Project Protection Plan. This plan is based on the program Threat Summary, which documents the threat environment the project is most likely to encounter as it reaches operational capability and recommends potential countermeasures.

- The Project Protection Plan is a Project Plan Control Plan, which may be documented in the Project Plan or as a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. Community of Practice for Mission Resilience and Protection at <https://nen.nasa.gov/web/sap>, provides information on Threat Summary and Project Protection Plans, including a template.
- Ref. NASA-STD-1006, Space System Protection Standard establish Agency-level protection requirements to ensure NASA missions are resilient to purposeful threats.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Project Team. All participants in project Formulation and Implementation. This includes all direct reports and others that support meeting project responsibilities.

Range Safety Risk Management Process (Documentation). Documentation of processes associated with the protection of the public, workforce, and property during range flight operations.

- Range Safety Risk Management Process is typically standalone documentation. Applies to launch and entry vehicle projects, scientific balloons, sounding rockets, drones, and Unmanned Aircraft Systems. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 8715.5, Range Flight Safety Program documents the NASA roles, responsibilities, and procedural requirements related to range flight safety.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

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

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

Review Plan. Summarizes the project's approach for conducting a series of reviews including internal reviews and project life cycle reviews.

- The Review Plan is a Project Plan Control Plan, which may be documented in the Project Plan or as a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.

- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Risk. The potential for shortfalls with respect to achieving explicitly established and stated objectives.

Risk Management. A set of activities aimed at understanding, communicating, and managing risk to the achievement of objectives.

- Ref. NPR 8000.4, Agency Risk Management Procedural Requirements provides the requirements for risk management for the Agency, its institutions, and its programs and projects, including requirements associated with developing a Risk Management Plan.

Risk Management Plan. Summarizes how the program or project will implement the NASA risk management process.

- The Risk Management Plan is a Project Plan Control Plan, which may be documented in the Project Plan or as a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 8000.4, Agency Risk Management Procedural Requirements provides the requirements for risk management for the Agency, its institutions, and its programs and projects, including requirements associated with developing a Risk Management Plan.
- Ref. LMS-CP-8000.4, Master Risk Management Plan for Space Flight Projects is intended to serve as the basis for project risk management processes for space flight projects. This Center Procedure may also be used in whole or in part by small or other non-space flight projects.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Safety and Mission Assurance Plan. Addresses life-cycle Safety and Mission Assurance functions and activities including roles, responsibilities, and relationships. 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 Safety and Mission Assurance Plan is a Project Plan Control Plan, which is typically a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation. The Safety and Mission Assurance Plan may carry a different title (e.g., Mission Assurance

Plan; Product Assurance Plan; or Safety, Reliability and Quality Plan) based on the rules/requirements/conventions of the project customer or sponsor.

- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product, as well as additional document references specific to development of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.
- Additional references for development of this product: NPD 8730.5, NASA Quality Assurance Program Policy; NPD 8720.1, NASA Reliability and Maintainability (R&M) Program Policy; NPR 8715.3, NASA General Safety Program Requirements; NPR 8705.2, Human-Rating Requirements for Space Systems; NPR 8705.6, Safety and Mission Assurance (SMA) Audits, Reviews, and Assessments; NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts;; NASA-STD-8739.8, Software Assurance and Software Safety Standard; NPR 8735.1, Procedures For Exchanging Parts, Materials, and Safety Problem Data Utilizing the Government-Industry Data Exchange Program; NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts.

Safety Data Packages. The deliverables associated with various safety processes.

- Safety Data Packages are typically standalone documentation. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation. Requirements for the safety data packages can be found in the following documents:
- Ref. for Safety: NPR 8715.3, NASA General Safety Program Requirements; NPR 8715.5, Range Flight Safety Program; NPR 8715.7, Payload Safety Program; NPR 8621.1, NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping.
- Ref. for Human Rating Requirements: NPR 8705.2, Human-Rating Requirements for Space Systems.
- Ref. for Quality Assurance: NPD 8730.5, NASA Quality Assurance Program Policy; NPD 8730.2, NASA Parts Policy; NPR 8735.1, Exchange of Problem Data Using NASA Advisories and the Government-Industry Data Exchange Program (GIDEP); NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts.
- Ref. for Orbital Debris: NPR 8715.6, NASA Procedural Requirements for Limiting Orbital Debris.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Schedule Risk Analysis. A technique used to analyze the potential impact of schedule duration uncertainties and discrete risks on the Project Plan, reflected in the Integrated Master Schedule, to evaluate the likelihood that the Project Plan is achievable within the planned finish date constraints.

- Ref. NASA/SP-2010-3403, NASA Schedule Management Handbook provides information and describes a process for developing a schedule risk analysis.

Science Data Management Plan. Describes how the project will manage the scientific data generated and captured by the operational mission(s) and any samples collected and returned for analysis. It includes 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.

- The Science Data Management Plan is a Project Plan Control Plan, which may be documented in the Project Plan or as a standalone document. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPD 2200.1, Management of NASA Scientific and Technical Information, establishes policy for conducting the Scientific and Technical Information (STI) Program, which manages the informational results of NASA's research and development efforts.
- Ref. NPR 2200.2, Requirements for Documentation, Approval, and Dissemination of Scientific and Technical Information identifies requirements for approving, publishing, and disseminating NASA scientific and technical information (STI) under the policy set forth in NPD 2200.1.
- Ref. NPR 1441.1, NASA Records Management Program Requirements provides overall, high-level direction to NASA Centers for implementation and ongoing operation of an effective Records Management (RM) program; establishes minimum requirements for managing NASA record information throughout its life cycle; and establishes the procedural requirements for development, maintenance, and use of NASA Records Retention Schedules.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Security Plan. Describe the project's plans for ensuring security and technology protection, including security requirements, and emergency response requirements.

- The Security Plan may also be documented in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPD 1600.2, NASA Security Policy describes NASA's policy to ensure the continuous performance of essential functions under all conditions.
- Ref. NPR 1600.1, NASA Security Program Procedural Requirements establishes standards and specifications required to maintain consistency and uniformity for the protection of NASA assets, while considering the unique requirements, circumstances, and environments of individual NASA Centers and locations.
- Ref. NPR 1040.1, NASA Continuity of Operations (COOP) Planning Procedural Requirements provides NASA Management, Center Directors, Chief Information Officers (CIO), Program Managers, and network administrators, with a step-by-step approach to preparing a Continuity of Operations Plan (COOP), which addresses long-term losses or

disruptions of primary mission-essential operations, supporting facilities, Information Technology (IT) systems, and other essential interdependencies.

- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements references the Security Plan.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Software Management Plan. Summarizes how the project will develop and/or manage the acquisition of software required to achieve project and mission objectives. Plan should be coordinated with the Systems Engineering Management Plan.

- A Software Management Plan is a Project Plan Control Plan and is typically a standalone document with some information documented in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7150.2, NASA Software Engineering Requirements establishes the engineering requirements for software acquisition, development, maintenance, retirement, operations, and management.
- Ref. NASA-STD-8739.8, Software Assurance and Software Safety Standard defines the requirements to implement a systematic approach to Software Assurance (SA), software safety, and Independent Verification and Validation (IV&V) for software created, acquired, provided, or maintained by or for NASA.
- Ref. NASA-HDBK-2203, NASA Software Engineering Handbook is a wiki-based website that provides users and practitioners with guidance material for implementing the requirements of NPR 7150.2, NASA Software Engineering Requirements, and the implementation of the NASA Software Assurance and Software Safety requirements in NASA-STD-8739.8.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Space Act Agreements. Agreements NASA can enter into based on authorization from the Space Act. The National Aeronautics and Space Act of 1958, as amended (51 U.S.C. 20113(e)), authorizes NASA “to enter into and perform such... other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate...” This authority enables NASA to enter into Space Act Agreements (SAAs) with organizations in the public and private sector. SAA partners can be a U.S. or foreign person or entity, an academic institution, a federal, state, or local governmental unit, a foreign government, or an international organization, for profit, or not for profit.

Stakeholder. An individual or organization having an interest (or stake) in the outcome or deliverable of a program or project.

- All customers are stakeholders of the project; not all stakeholders are project customers.

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

Systems Engineering Management Plan. Describes the overall approach for systems engineering including the system design and product realization processes, as well as the technical management processes.

- A Systems Engineering Management Plan is a Project Plan Control Plan and is typically a standalone document with some information documented in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7123.1, NASA Systems Engineering Processes and Requirements describes the Systems Engineering Management Plan, including its role, functions, and content.
- Ref. LPR 7123.1, LaRC Systems Engineering Process and Requirements implements the Agency Systems Engineering Management requirements documented in NPR 7123.1.
- Ref. NASA/SP-2016-6105, NASA Systems Engineering Handbook describes the Systems Engineering Management Plan, particularly in context with the project life cycle, and includes guidance on the content of this plan per the life cycle phase.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NPR 7120.8, NASA Research & Technology Program and Project Management Requirements, Appendix G: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

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

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

Technical, Schedule, and Cost Control Plan. Describes how the project plans to control project requirements, technical design, schedule, and cost to achieve its high-level requirements.

- The Technical, Schedule, and Cost Control Plan is a Project Plan Control Plan and is typically documented in the Project Plan. Elements of the Technical, Schedule, and Cost Control Plan may also be included in other project control plans such as the Systems

Engineering Management Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.

- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Technology Development Plan. Describes the technology assessment, development, management, and acquisition strategies needed to achieve the program's mission objectives.

- A Technology Development Plan is a Project Plan Control Plan, which may be part of a Formulation Agreement or Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPD 7500.1, Program and Project Life-Cycle Logistics Support Policy provides policy for reusable or maintainable flight hardware, ground hardware, and logistics support.
- Ref. NPR 7500.2, NASA Technology Transfer Requirements provides guidance for implementing the processes, requirements, and responsibilities for Agency technology transfer activities.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix F: Project Formulation Agreement Template provides a description and elements of this product.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Technology Readiness Assessment (Technology Maturity Assessment) (Documentation).

A Technology Readiness Assessment or Technology Maturity Assessment is the process to determine a system's technological maturity based on Technology Readiness Levels (TRLs). The documentation includes the identification of specific new technologies; their criticality to the project's objectives, goals, and success criteria; and the status of each planned technology development, including Technology Readiness Levels and associated risks.

- A Technology Readiness Assessment (NPR 7120.5 terminology) documentation or Technology Maturity Assessment (NPR 7120.8 terminology) documentation is typically a collection of standalone products and reports, as needed. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7120.8, Research and Technology Program and Project Management Requirements, Appendix K, Technology Maturity Assessment outlines the process for assessing technology maturity and identifying activities that should be accomplished on the part of the project.
- Ref. NASA/SP-2016-6105, NASA Systems Engineering Handbook describes the technology assessment process and technology maturity considerations.

- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Technology Readiness Levels. Provides a scale against which to measure the maturity of a technology. TRLs range from 1, basic technology research, to 9, systems test, launch, and operations. Typically, a TRL of 6 (i.e., technology demonstrated in a relevant environment) is required for a technology to be integrated into a systems engineering process.

- Ref. NPR 7123.1, NASA Systems Engineering Processes and Requirements, Appendix E provides definition of the Technology Readiness Levels for hardware and software.
- Ref. NASA/SP-2016-6105, NASA Systems Engineering Handbook describes the technology readiness levels and technology readiness maturity processes.

Technology Transfer Control Plan. Describes how the project will implement export control requirements and is intended to serve as an aid and a guide to project managers, as well as other NASA officials and contractors, involved in an international activity.

- A Technology Transfer Control Plan is a Project Plan Control Plan, which is typically included in the Project Plan. The applicability and tailoring of this plan occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 2190.1, NASA Export Control Program provides requirements, instructions, and responsibilities for all NASA employees and NASA support contractors engaged in activities that involve the transfer of commodities, software, technical data, technology, defense services, and/or technical assistance to foreign entities
- Ref. NAI 2190.1, NASA Export Control Program Operations Manual provides more detailed instruction and guidance on implementing the requirements of NPR 2190.1.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

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.

Threat (“Cost Threat”). Events that may have a negative impact on project cost, schedule, or technical performance. Project funds or UFE are not yet allocated to its mitigation.

- Ref. [Appendix G](#), Unallocated Future Expense, Encumbrances, Liens, and Threats provides more information about this and related terms, calculations, and process.

Unallocated Future Expense. The portion of estimated cost required to meet a specified confidence level that cannot yet be allocated to the specific project Work Breakdown Structure

(WBS) sub-elements because the estimate includes probabilistic risks and specific needs that are not known until these risks are realized.

- UFE may be held either in the project's control ("project-held UFE") or held in the Headquarters/Program control ("HQ UFE").

(Unallocated Future Expense) Available Project-held UFE. The Project-held UFE remaining after encumbrances and liens. Stated differently, available project-held UFE includes the sum of the cost value of threats and unthreatened Project-held UFE.

- Ref. [Appendix G](#), Unallocated Future Expense, Encumbrances, Liens, and Threats provides more information about this and related terms, calculations, and process.

(Unallocated Future Expense) Unthreatened Project-held UFE. The remaining Project-held UFE after encumbrances, liens, and threats.

- Ref. [Appendix G](#), Unallocated Future Expense, Encumbrances, Liens, and Threats provides more information about this and related terms, calculations, and process.

Validation. The process of showing proof that the product accomplishes the intended purpose based on stakeholder expectations. May be determined by a combination of test, analysis, demonstration, and inspection. (Answers the question, "Am I building the right product?").

Verification. Proof of compliance with requirements. Verification may be determined by a combination of test, analysis, demonstration, and inspection. (Answers the question, "Did I build the product right?").

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

- A Verification and Validation Plan is a Project Plan Control Plan and is typically a standalone document with some information documented in the Project Plan. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.
- Ref. NPR 7123.1, NASA Systems Engineering Processes and Requirements includes product maturity requirements associated with the Verification and Validation Plan and describes product verification and product validation processes.
- Ref. NASA/SP-2016-6105, NASA Systems Engineering Handbook, Appendix I provides a Verification and Validation Plan Outline.
- Ref. NPR 7120.5, NASA Space Flight Program and Project Management Requirements, Appendix H: Project Plan Template provides a description and elements of this product.
- Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook provides additional information about this product in context to the NASA project life cycle.

Verification and Validation Report. A document or series of documents that captures and communicates to others the results of the project's verification and validation process, as outlined in the project's Verification and Validation Plan. In addition to the report-out of completed

verification and validation activities, the report also contains a summary of verifications that are still outstanding and the plan for closing them.

- A project's Verification and Validation Report may be delivered in the form of tabular data (e.g., Excel spreadsheet), formal individual Verification Compliance Documents (VCD), presentation file (e.g., PowerPoint), or some combination of these formats. The applicability and tailoring of this product occurs during the project Compliance Matrix Assessment that is performed in project Formulation.

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

Appendix B. **Acronyms**

ABC	Agency Baseline Commitment
AO	Announcement of Opportunity
ASM	Acquisition Strategy Meeting
ATP	Authority to Proceed
BOE	Basis of Estimate
CA	Continuation Assessment
CADRe	Cost Analysis Data Requirement
CAS	Convergent Aeronautics Solutions
CCP	Contamination Control Plan
CCR	Center Commitment Review
CDF	Capitalization Determination Form
CDM	Configuration and Data Management
CDMP	Configuration and Data Management Plan
CDR	Critical Design Review
CE	Chief Engineer
CERR	Critical Events Readiness Review
CFO	Chief Financial Officer
CID	Center Interim Directive
CIO	Chief Information Officer
CM	Configuration Management
CMC	Center Management Council
COI	Conflict of Interest
COOP	Continuity of Operations
CP	Center Procedure
CRUD	Core Resources Unit Directorates
CS	Civil Servant
CSO	Chief Safety and Mission Assurance Officer
CSPB	Cyber Security and Privacy Branch

CUI	Controlled Unclassified Information
DCMA	Defense Contract Management Agency
DM	Data Management
DPM	Deputy Project Manager
DR	Decommissioning Review
DRR	Disposal Readiness Review
ECI	Early Career Initiative
ECP	Export Control Program
EEE	Electrical, Electronic, and Electro-mechanical
ELV	Expendable Launch Vehicle
EOMP	End of Mission Plan
EPTR	Engineering Project and Task Review
ERB	Engineering Review Board
EVM	Earned Value Management
EVMS	Earned Value Management System
FA	Formulation Agreement
FAD	Formulation Authorization Document
FAR	Federal Acquisition Regulation
FC	Fully Compliant
FMEA	Failure Mode and Effects Analysis
FRR	Flight Readiness Review
FTE	Full Time Equivalent
GAO	Government Accountability Office
HQ	Headquarters
HRCP	Human Rating Certification Package
IA	Independent Assessment
IBR	Integrated Baseline Review
ICA	Independent Cost Assessment
ICE	Independent Cost Estimate

ICSRA	Integrated Cost and Schedule Risk Analysis
IIP	Instrument Incubator Program
IKM	Institutional Knowledge Management
ILCR	Independent Life Cycle Review
IMS	Integrated Master Schedule
ISA	Independent Schedule Assessment
IT	Information Technology
JCL	Joint Cost and Schedule Confidence Level
KDP	Key Decision Point
KM	Knowledge Management
LAPD	Langley Policy Directive
LaRC	Langley Research Center
LCC	Life Cycle Cost
LF	Langley Form
LL	Lessons Learned
LLIS	Lessons Learned Information System
LMS	Langley Management System
LMT	Langley Mission Type
LPR	Langley Procedural Requirement
LSE	Lead Systems Engineer
M&P	Materials and Processes
MA	Management Agreement
MCR	Mission Concept Review
MDAA	Mission Directorate Associate Administrator
MDR	Mission Definition Review
MidEx	Medium-Class Explorer
MMR	Monthly Management Review
MPCP	Mishap Preparedness and Contingency Plan
MSC	Mission Support Council

MSO	Mission Support Organizations
NA	Not Applicable
NAII	NASA Advisory Implementing Instructions
NASA	National Aeronautics and Space Administration
NCR	Nonconformance Report
NEF	NASA Electronic Forms
NEPA	National Environmental Policy Act
NF	NASA Form
NFS	NASA Federal Acquisition Regulation Supplement
NODIS	NASA Online Directives Information System
NPB	New Project Briefing
NPD	NASA Policy Directive
NPR	NASA Procedural Requirement
NRRS	NASA Records Retention Schedules
NTA	NPR Tailoring Application
NTSS	NASA Technical Standards System
OCFO	Office of the Chief Financial Officer
OCI	Organizational Conflicts of Interest
OCIO	Office of the Chief Information Officer
ODAR	Orbital Debris Assessment Report
OM&S	Operating Materials and Supplies
OP	Organizational Procedure
ORR	Operational Readiness Review
OSHA	Occupational Safety and Health Administration
OSMA	Office of Safety and Mission Assurance
PA	Product Assurance
PAP	Product Assurance Plan
PCO	PP&C Capability Office
PDR	Preliminary Design Review

PI	Principal Investigator
PIM	Project Initiation Memorandum
PIR	Project Initiation Review
PLAR	Post Launch Assessment Review
PLRA	Program Level Requirements Agreement
PM	Project Manager
PMC	Project Management Council
PP&C	Program, Planning, and Control
PP&E	Property, Plant, and Equipment
PPBE	Program, Planning, Budgeting, and Execution
PPR	Periodic Project Review
Pre-CMC	Pre-Center Management Council
PS	Project Scientist
PSM	Procurement Strategy Meeting
PSO	Project Support Office
PUD	Product Unit Directorate
R&M	Reliability and Maintainability
RMP	Risk Management Plan
SAA	Space Act Agreements
SBIR	Small Business Innovation Research
SBU	Sensitive But Unclassified
SDR	System Definition Review
SE	Systems Engineer
SEMP	Systems Engineering Management Plan
SIF	Science Innovation Fund
SIR	System Integration Review
SMA	Safety and Mission Assurance
SMD	Science Mission Directorate
SMEX	Small Explorer

SOO	Sponsoring Organization Official
SOW	Statement of Work
SRA	Schedule Risk Analysis
SRR	System Requirements Review
STD	Standard
T	Tailored
TA	Technical Authority
ToR	Terms of Reference
TRL	Technology Readiness Level(s)
TTCP	Technology Transfer Control Plan
UFE	Unallocated Future Expense
V&V	Verification and Validation
WBS	Work Breakdown Structure
WYE	Work Year Equivalent

Appendix C. Requirement Allocation Matrix

Appendix C provides a summary list of all requirements presented in this document. See listed sections for allocation for variable applicability of requirements based on LMT.

Req't Num	Requirement	Required for	Applicability determined by Sponsoring Organization Official	Section Num
Life Cycle Requirements				
R1	Develop and maintain an organization structure	LMT A-F		2.1
R2	Project leadership roles	LMT A-F		2.1
R3	Develop and implement staffing plan	LMT A-F		2.1
R4	Line organization communications for staffing	LMT A-F		2.1
R5	Develop Work Breakdown Structure	LMT A-F		2.2
R6	Develop Work Breakdown Structure Dictionary	LMT A-D	LMT E-F	2.2
R7	Specified approvals prior to transmitting cost estimate outside Center	LMT A-F >\$30M	LMT A-F ≤\$30	2.3
R8	Minimum project-held Unallocated Future Expense	NPR 7120.5 LMT A-E >\$30M	NPR 7120.8 or NPR 7120.5 projects ≤\$30M	2.3
R9	Minimum funded schedule margin	NPR 7120.5 >\$30M	NPR 7120.5 ≤\$30M	2.4
R10	Specified approvals for requesting variance from any required Agency Earned Value Management Requirements	LMT A-F (as applicable)		2.5
R11	Identify and evaluate Organizational Conflicts of Interest	LMT A-F (as applicable)		2.6
R12	Coordinate with Office of Procurement for any required Acquisition Strategy and/or Procurement Strategy Meetings	LMT A-F (as applicable)		2.6
R13	Specified concurrence to execute descope plans	LMT A-F (as applicable)		2.8
R14	Coordination for Independent Assessments from ATP to CDR (NPR 7120.5) or prior to ATP and Project approval for (NPR 7120.8)	LMT A-F >\$30M	LMT A-F ≤\$30M	2.11
R15	Required notifications when increase of Life Cycle cost occurs	LMT A-F (as applicable)		2.11
R16	Periodic and event-driven reviews cadence	LMT A-F (variable allocation)		2.13

Req't Num	Requirement	Required for	Applicability determined by Sponsoring Organization Official	Section Num
R17	Specified notifications for significant situation or topics	LMT A-F		2.17
R18	Evaluate and apply appropriate published Lessons Learned and Best Practices	LMT A-E (variable allocation)	LMT F	2.19
R19	Capture and report project Lessons Learned	LMT A-F (variable allocation)		2.19
Initiation Requirements				
R20	Propose and obtain agreement to Langley Mission Type	All projects		3.1
R21	Designate a Sponsoring Organization Official	LMT A-F,O		3.2
R22	Selection of a Project Manager (or equivalent)	LMT A-F, O		3.2
R23	Proposal-Project Handoff (meeting)	LMT A-F (as applicable)		3.3
R24	New Project Briefing (meeting)	LMT A-E	LMT F (Decision includes Center CE)	3.4
R25	Project Initiation Checkpoint (meeting)	LMT A-F		3.5
R26	Completion of Project Initiation Memorandum (product)	LMT A-F, O (variable allocation)		3.6
Formulation Requirements				
R27	Completion and specified approval of NPR Tailoring Application Compliance Matrix Assessment	LMT A-F (variable allocation)		4.1
R28	Completion and specified approval of Project Plan	LMT A-F (variable allocation)		4.3
Implementation Requirements				
R29	Maintain Cost, Schedule, Scope, and Technical Performance Commitments	LMT A-F		5.2
R30	Documentation and communication of changes to baseline plans	LMT A-F (as applicable)		5.3
R31	Rebaseline Review (meeting)	LMT A-D (as applicable)	LMT E-F (as applicable)	5.4
R32	Workforce planning to support initiation operations and transition	LMT A-F (as applicable)		5.7

Req't Num	Requirement	Required for	Applicability determined by Sponsoring Organization Official	Section Num
R33	Operations team training, criteria, documentation	LMT A-F (as applicable)		5.7
R34	Reporting during initial operations	LMT A-F (as applicable)		5.7
Closeout				
R35	Disposal, archival, and dispositioning of project assets	LMT A-F		6.1
R36	Resources and workforce records submit	LMT A-F		6.1
R37	Termination Plan	LMT A-F (as applicable)		6.2

Appendix D. Reference Documents and Forms

NASA Policy Directives (NPD) – <https://nodis3.gsfc.nasa.gov/>

NPD 1000.0, NASA Governance and Strategic Management Handbook

NPD 1000.3, The NASA Organization

NPD 1000.5, Policy for NASA Acquisition

NPD 1440.6, NASA Records Management

NPD 1600.2, NASA Security Policy

NPD 2190.1, NASA Export Control Program

NPD 2200.1, Management of NASA Scientific and Technical Information

NPD 2800.1, Managing Information Technology

NPD 7120.4, NASA Engineering and Program/Project Management Policy

NPD 7120.6, Knowledge Policy for Programs and Projects

NPD 7500.1, Program and Project Life-Cycle Logistics Support Policy

NPD 8020.7, Biological Contamination Control for Outbound and Inbound Planetary Spacecraft

NPD 8500.1, NASA Environmental Management

NPD 8720.1, NASA Reliability and Maintainability (R&M) Program Policy

NPD 8730.2, NASA Parts Policy

NPD 8730.5, NASA Quality Assurance Program Policy

NASA Procedural Requirements (NPR) – <https://nodis3.gsfc.nasa.gov/>

NPR 1040.1, NASA Continuity of Operations (COOP) Planning Procedural Requirements

NPR 1440.6, NASA Records Management

NPR 1441.1, Records Management Program Requirements

NPR 1600.1, NASA Security Program Procedural Requirements

NPR 2190.1, NASA Export Control Program

NPR 2200.2, Requirements for Documentation, Approval, and Dissemination of Scientific and Technical Information

NPR 2800.1, Managing Information Technology

NPR 2810.1, Security of Information Technology

NPR 7120.4, NASA Engineering and Program/Project Management Policy
 NPR 7120.5, NASA Space Flight Program and Project Management Requirements
 NPR 7120.7, NASA Information Technology Program and Project Management Requirements
 NPR 7120.8, NASA Research and Technology Program and Project Management Requirements
 NPR 7120.10, Technical Standards for NASA Programs and Projects
 NPR 7123.1, NASA Systems Engineering Processes and Requirements
 NPR 7150.2, NASA Software Engineering Requirements
 NPR 7500.2, NASA Technology Transfer Requirements
 NPR 8000.4, Agency Risk Management Procedural Requirements
 NPR 8020.12, Planetary Protection Provisions for Robotic Extraterrestrial Missions
 NPR 8580.1, Implementing the National Environmental Policy Act and Executive Order 12114
 NPR 8621.1, NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping
 NPR 8705.2, Human-Rating Requirements for Space Systems
 NPR 8705.6, Safety and Mission Assurance (SMA) Audits, Reviews, and Assessments
 NPR 8715.3, NASA General Safety Program Requirements
 NPR 8715.5, Range Flight Safety Program
 NPR 8715.6, NASA Procedural Requirements for Limiting Orbital Debris and Evaluating the Meteoroid and Orbital Debris Environments
 NPR 8715.7, Payload Safety Program
 NPR 8735.1, Procedures for Exchanging Parts, Materials, and Safety Problem Data Utilizing the Government-Industry Data Exchange Program
 NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts
 NPR 9250.1, Property, Plant, and Equipment and Operating Materials and Supplies

Langley Policy Directives (LAPD) – <https://lms.larc.nasa.gov/>

LAPD 1000.1, Langley Management System (LMS) Policy Manual
 LAPD 1150.2, Councils, Boards, Panels, Committees, Teams, and Groups
 LAPD 1440.7, LARC Records Management
 LAPD 5300.1, Product Assurance Program
 LAPD 7120.9, Proposal Reviews and Archiving

Langley Procedural Requirements (LPR) – <https://lms.larc.nasa.gov/>

LPR 7120.4, Langley Research Center Technical Authority Implementation Plan

LPR 7120.7, Independent Life Cycle Review Procedural Requirements

LPR 7130, Project and Task Review Procedural Requirements

LPR 7600.1, Photographic Documentation of Hardware

LPR 8500.1, Environmental and Energy Program Manual

NASA Standards (STD) – <https://standards.nasa.gov/>

NASA-STD-1006, Space System Protection Standard

NASA-STD-8719.14, Process for Limiting Orbital Debris

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

NASA Forms (NF) – <https://nef.nasa.gov/>

NASA Form 1739, Capitalization Determination Form (CDF)

Langley Forms (LF) – <https://nef.nasa.gov/>

LF209, Langley Engineering Best Practices

LF461, Environmental Project Planning Form

LF-577A, Project Initiation Memorandum Format 1

LF-577B, Project Initiation Memorandum Format 2

Other NASA Level Documents – https://nodis3.gsfc.nasa.gov/OPD/OPD_list.cfm

NASA Advisory Implementing Instructions (NAII)

NAII 1000.1, Pre-Acquisition Strategy Meeting (Pre-ASM) Guide

NAII 1000.2, Acquisition Strategy Meeting (ASM) Guide

NAII 2190.1, NASA Export Control Program Operations Manual

NASA Records Retention Schedules (NRRS)

NRRS 1441.1, NASA Records Retention Schedules

NASA Federal Acquisition Regulation Supplement (NFS) – <https://www.acquisition.gov/nfs>

NFS Part 1872, Acquisition of Flight Investigations

NFS Part 1834.2, Earned Value Management System

Langley Center Procedures (CP) – <https://lms.larc.nasa.gov/>

LMS-CP-1440.8, Records Management

LMS-CP-2310, Electronic Storage and Archival System (Document and Data Management)

LMS-CP-4750, Develop Product Assurance Plan

LMS-CP-7154, LARC Project Integrated Schedule Development

LMS-CP-8000.4, Master Risk Management Plan for Space Flight Projects

LMS-CP-8041, Master Configuration and Data Management Plan for Flight Projects

LMS-CP-8042, Aeronautics Research Directorate Configuration and Data Management Plan

Langley Organizational Procedure (OP) – <https://lms.larc.nasa.gov/>

LMS-OP-9000, Independent Assessment Handbook

NASA Handbooks

NASA CEH v4.0, NASA Cost Estimating Handbook

NASA-HDBK-2203, NASA Software Engineering Handbook

NASA/SP-2010-3403, NASA Schedule Management Handbook

NASA/SP-3404, NASA Work Breakdown Structure (WBS) Handbook

NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook

NASA/SP-2016-3406, Integrated Baseline Review (IBR) Handbook

NASA/SP-XXXX-599, Earned Value Management Handbook (EVM) Implementation Handbook

NASA/SP-2016-6105, NASA Systems Engineering Handbook

Other Standards – <https://standards.nasa.gov/>

SAE EIA-649C, National Consensus Standard for Configuration Management

SAE EIA-649-2, Configuration Management Requirements for NASA Enterprises

SAE GEIA-HB-649, Configuration Management Standard Implementation Guide
SAE EIA-748, Earned Value Management Systems

Websites

Institutional Knowledge Management (IKM) System – <https://oneplace.larc.nasa.gov/ikm>

Langley Forms (LF) – <https://nef.nasa.gov/>

Langley Management System (LMS) – <https://lms.larc.nasa.gov/>

NASA Earned Value Management (EVM) – <https://www.nasa.gov/evm>

NASA Electronic Forms (NEF) – <https://nef.nasa.gov/>

NASA Engineering Network – <https://nen.nasa.gov/>

NASA Engineering Network: Mission Resilience and Protection – <https://nen.nasa.gov/web/sap>

NASA Langley Office of Procurement –
<https://nasa.sharepoint.com/sites/LaRCProcurementCustomerOutreach>

NASA Lessons Learned Information System – <https://nen.nasa.gov/web/ll/>

NASA Office of Communication – <https://communications.nasa.gov>

NASA Online Directives Information System (NODIS) – https://nodis3.gsfc.nasa.gov/main_lib.cfm

NASA Technical Standards System (NTSS) – <https://standards.nasa.gov/>

One NASA Cost Engineering (ONCE) Database – <https://oncedata.hq.nasa.gov/>

NASA Cybersecurity and Privacy Branch – <https://itsecurity.larc.nasa.gov/>

Appendix E. Langley Mission Type

Appendix E provides a guideline for Langley Mission Type criteria. See [Section 1.2.1](#) for additional information.

Criteria	Type A	Type B	Type C	Type D	Type E	Type F
Priority	High	High	Medium	Low	Low	Very Low
Acceptable Risk	Very Low	Low	Medium	High	High	High
National Significance	Very High	High	Medium	Med to Low	Low	Very Low
Complexity	Very high to high	High to medium	Medium to low	Medium to low	Low	Low to Very Low
Mission Lifetime	Long > 5 years	Medium 2-5 years	Short < 2 years	Short < 2 years	N/A	N/A
Life Cycle Cost	High > ~\$1B	High to Med ~\$500M to \$1B	Med to Low ~\$100M to \$500M	Low ~\$50M to \$100M	~\$10M to \$50M	~\$1M to \$10M
Launch Constraints	Critical	Medium	Few	Few to none	Few to none	N/A
Alternative Research or Re-Flight Opportunities	None	Few	Some	Significant	Significant	Significant
Achievement of Mission Success Criteria	All practical measures are taken to achieve minimum risk to mission success. The highest assurance standards are used.	Stringent assurance standards with only minor compromises in application to maintain a low risk to mission success.	Medium risk of not achieving mission success may be acceptable. Reduced assurance standards are permitted.	Medium or significant risk of not achieving mission success is permitted. Minimal assurance standards are permitted.	Significant risk of not achieving mission success is permitted. Minimal assurance standards are permitted.	Significant risk of not achieving mission success is permitted. Minimal assurance standards are permitted.

Appendix F. Programmatic Analysis Techniques

Programmatic analysis techniques, such as Joint Cost and Schedule Confidence Level (JCL), Schedule Risk Analysis (SRA), and Integrated Cost and Schedule Risk Analysis (ICSRA), are used for a variety of reasons. Projects may provide input to or perform these types of analysis to meet customer requirements. Projects and organizations may also elect for the project to perform these types of analysis to support planning, re-planning, independent assessment, life cycle reviews, or other decision-making or evaluation activities.

F.1 Joint Cost and Schedule Confidence Level.

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

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

F.2 Schedule Risk Analysis.

A technique used to analyze the potential impact of schedule duration uncertainties and discrete risks on the Project Plan, reflected in the Integrated Master Schedule, to evaluate the likelihood that the Project Plan is achievable within the planned finish date constraints.

F.3 Integrated Cost and Schedule Risk Analysis.

An extension of Schedule Risk Analysis (SRA) that incorporates project costs to go a step further and help determine the adequacy of the budget, given the project schedule and risks. The results from these analyses provide management with insight on how to prioritize resources to address driving risks.

F.4 Resources for Programmatic Analysis

Ref. NASA/SP-2010-3403, NASA Schedule Management Handbook

Ref. NASA/SP-2014-3705, NASA Space Flight Program and Project Management Handbook

Ref. One NASA Cost Engineering Database (ONCE), <https://oncedata.hq.nasa.gov/>

Appendix G. Unallocated Future Expense, Encumbrances, Liens, and Threats

Appendix G provides general guidelines for topics associated with Unallocated Future Expense (UFE), Encumbrances, Liens, and Threats. Given the varying applications of these concepts across Mission Directorate Stakeholders and local Product Unit Directorate requirements, all projects should work with the Mission Directorate and Sponsoring Organization Official and to determine the appropriate allocations and processes for defining project-held or other UFE and associated processes to obligate any available funding. Sponsoring Organizations may also implement thresholds for defining threats and liens and their relationship to the risk management process.

G.1 Unallocated Future Expense (UFE)

The portion of estimated cost required to meet the specified confidence level that cannot yet be allocated to the specific WBS sub elements because the estimate includes the scope of probabilistic risk and specific needs that are not known until these risks are realized.

UFE may be held by the project (“project-held UFE”) or retained by a Mission Directorate at NASA Headquarters (“Headquarters UFE” or simply “UFE”). Previously, project-held UFE was referred to as project reserve, cost reserve, budgeted reserve, or margin.

Ref. NASA/SP-2016-3424 [Document Repository - Program, Planning, and Control - NASA Engineering Network](#), PP&C Handbook, includes more information about UFE and how it is associated to confidence levels and associated analysis.

G.2 Threat

Events that may have a negative impact on project cost, schedule, or technical performance. Project funds or UFE are not yet allocated to its mitigation.

A threat represents the tracked cost value of a risk impact, specifically as it impacts the project’s UFE. The tracking of threats against Project-held UFE is an administrative activity used to understand and communicate the potential use of Available Project-held UFE, and how much of the Available Project-held UFE may remain for unknown unknowns.

A threat may be tracked as its probability-adjusted value or full-value. Definitions and considerations for both methods are listed below.

- Threat (probability-adjusted): The estimated total cost value of a risk impact, if realized, multiplied by the probability of the risk occurring.

A consideration when using the probability-adjusted method is that the project would expect to incur full value or near full value if the risk is realized, so a percentage of the full value is not an accurate representation of the actual impact of a risk realized.

- Threat (full-value): The estimated total cost value of a risk impact, if realized.

A consideration when using the full-value method is that it is not realistic to assume that the project will realize all risks, therefore the full-value method will almost always over-estimate the actual cost incurred from total risks realized.

G.3 Lien

Events that are having or are likely to have a negative impact on project cost, schedule, or technical performance. Project acceptance of a lien may result in an encumbrance on project funds or UFE.

Liens include instances where the Project Manager chooses to set aside project-held UFE funds to mitigate a risk, financially prepare for near certain risk impact, or begin to address issues or unplanned costs not stemming from a realized risk. Many, but not all, liens are associated with risks (either to address a realized risk impact or to fund a risk mitigation), as needs for use of project-held UFE may arise without early awareness or risk identification. A lien is tracked as the full-value of the cost (100%), although a lien value may be increased, reduced, or eliminated prior to becoming an encumbrance.

A cost value would be considered a lien as early as the intent to commit funds (“planned commitment”), meaning the project does not need to wait until a formal commitment process is completed to consider the cost value a lien.

Commitment: An administrative reservation of budget authority in anticipation of an obligation. (NPR 9470.1)

G.4 Encumbrance

The process by which a hold against UFE is made. The money has not necessarily been moved yet to the account of the specific WBS sub element that created the need, but the hold has been placed.

An encumbrance represents the project's acceptance of a lien and the monetary amount associated with it.

Obligation: Any act that legally binds the government to make an outlay or expenditure of funds immediately or in the future. (NPR 9470.1)

Expenditure: The actual spending of money or cash equivalent. (NPR 9470.1)

Disbursement: Amounts paid by cash or cash equivalent (such as checks and electronic transfers) to liquidate government obligations. (NPR 9470.1)

The terms “expenditure,” “disbursement,” and “outlay” are often used interchangeably.

G.5 LaRC General Guideline

Projects will define their approach to managing threats and liens. Generally, threats and resulting liens are associated with a risk.

1. Threats are generally risks with a likelihood 2 or 3 and consequence of 2, 3, 4, or 5 with potential cost impacts.
2. Liens are generally risks with a likelihood of 4 or 5, with potential cost impacts (liens are usually realized, at least in part).
3. Encumbrances are issues/risks that are fully realized and have a final cost impact.

G.5 Unthreatened Project-held UFE

The remaining Project-held UFE after encumbrances, liens, and threats.

G.6 Available Project-held UFE

The Project-held UFE remaining after encumbrances and liens. Stated differently, Available Project-held UFE includes the sum of the cost value of threats and unthreatened Project-held UFE. (see "[Illustration of Terminology](#)" diagram below)

G.7 Life Cycle Cost (LCC)

The total of the direct, indirect, recurring, nonrecurring, and other related expenses both incurred and estimated to be incurred in the design, development, verification, production, deployment, prime mission operation, maintenance, support, and disposal of a project, including closeout, but not extended operations.

Also defined as the total cost of ownership over the project or system's planned life cycle from Formulation (excluding Pre-Phase A) through Implementation (excluding extended operations). The life cycle cost includes the cost of the launch vehicle (if applicable). (NPR 7120.5)

G.8 Cumulative Costs

The portion of the Life Cycle Cost that has been expended.

Expenditure: The actual spending of money or cash equivalent. (NPR 9470.1)

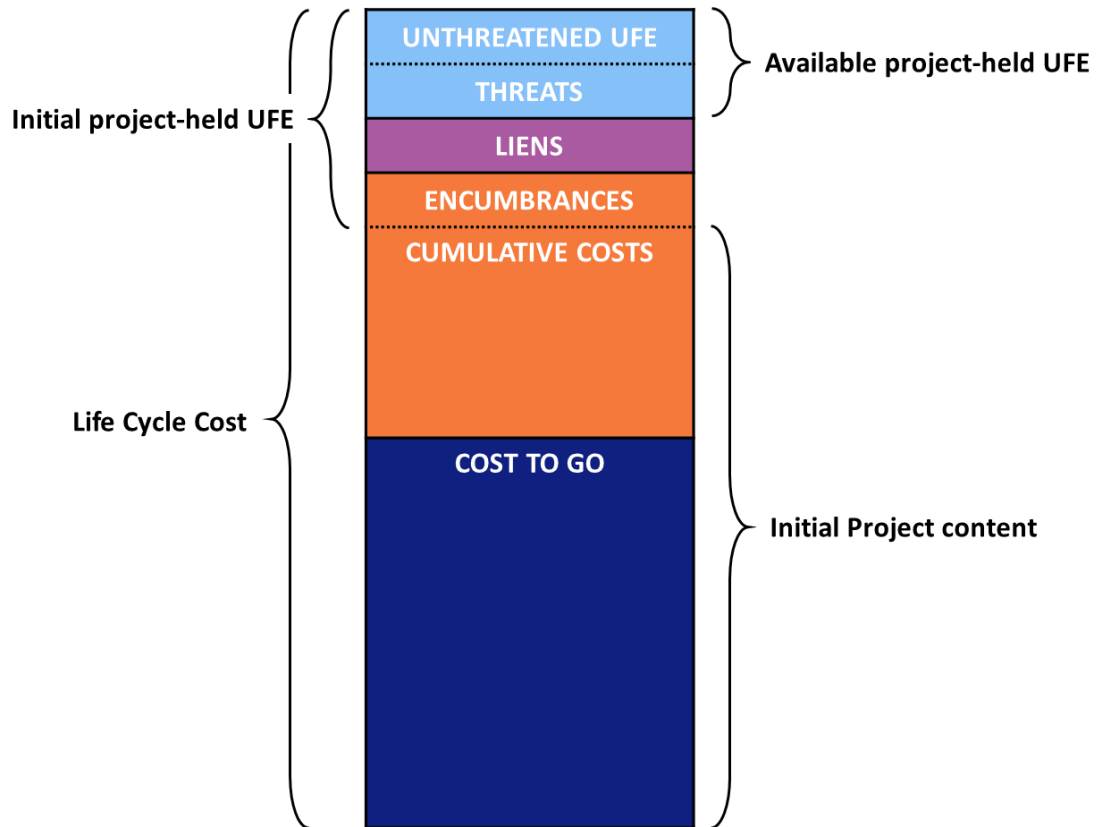
G.9 Cost to Go

The Life Cycle Cost remaining after Cumulative Costs and less Project-held UFE.

G.10 Percentage (%) of Available Project-held UFE on Cost to Go

Calculated by dividing the available project-held UFE by the remaining cost to go. The percentage (%) of available project-held UFE on cost to go is used to understand, track, communicate, and trend the Available Project-held UFE relative to the remaining cost to go.

G.11 Illustration of Terminology



Appendix H. Center Organization Integration List

To support the Product Unit Directorates (Aeronautics, Science, and Space Technology and Exploration) and other managing organizations in successful execution of projects, this list includes a description of other organizational resources available at Langley.

Early communication and coordination across Center organizations is critical to ensuring the Project has access to necessary resources, and access to relevant and appropriate knowledge and expertise. Understanding the Center's operating model and the organizations responsible for specific project resources and expertise is an important step towards planning and executing a successful project.

The Center Organization Integration List provides a list of organizations across Langley that should be considered for their potential for communication, collaboration, resources, services, or expertise. Below each organization title is a list of potential Center organization integration topics, services, or expertise available; some organizations are sectioned by branch or sub organization.

H.1 Office of Director

- a. Office of Chief Engineer: senior-level leadership for Center program and project engineering activities; technical authority process; engineering standards; best practices; lessons learned.
- b. Project Support Office: consultation, mentors, documentation, templates, tools, techniques, and examples on the practice of project formulation, management and project execution (e.g., life cycle phase schedules and review examples, templates for reviews, review preparation). Projects can request support for writing documents or quality checks on data or products, provides preliminary tailoring guidance for projects.

H.2 Office of Procurement

- a. Procurement strategies, policy, and planning, contract negotiation, obligation of procurement dollars and dollar threshold approvals, contract administration, statutory and regulatory compliance, and Contracting Officer's Representative (COR) training, organizational conflict of interest (OCI).

H.3 Office of General Counsel

- a. Legal support, advice, and representation to NASA Langley, including legal advice in the areas of business law, intellectual property, employee ethics, standards of conduct, contracting, appropriation and authorization issues, personnel, Freedom of Information Act requests, environmental issues, and various other matters. Typically supports projects in close cooperation with the Office of Procurement for contracts and supports development of external agreements.

H.4 Office of Chief Financial Officer

- a. PP&C Capability Office: Program Planning and Control (PP&C) expertise, best practices, techniques, tools, and training; PP&C process improvements and implementation; schedule management and analysis; risk management; configuration and data management; independent assessments, independent cost estimates, and independent performance assessments; and PP&C contractor support tasks.

H.5 Office of the Chief Information Officer

- a. Information Management: unique IT services such as cloud computing or applications hosting support; Center-wide information systems and services for the management and archival of NASA Langley's information and data assets and providing access to global scientific and technical information. Some of the efforts supported are Langley Google, LaRC Phone Book, the Langley Digital Repository, Technical Publications, and Document Digitization.
- b. Cyber Security: unique IT security requirements the project will need to address for flight/project components and software, general IT Security requirements, and assistance. The IT Security team deals with intrusion detection, incident response, vulnerability reduction, patch reporting, firewalls, Virtual Private Network (VPN), Two-Factor-Token-Infrastructure, Active Directory and assists with System Security Plan creation, assessment and authorization.
- c. Information Technology: Data Center, End User Services, IT Security, and Communications Teams. The OCIO Data Center (previously referred to as Centralized Web and Database Servers – CWDS) provides full-service web and database hosting to Langley customers. The End User Services team consists of Identity, Credential, and Access Management System (ICAM), NASA Operational Messaging and Directory Service (NOMAD), agency/center e-mail postmaster, desktop services, and NASA Access Management System (NAMS). The Communications team maintains the data network and phone system.
- d. Customer Relationship Management: act as "trusted advisors" and the primary LaRC OCIO point of contact to communicate Center OCIO services.

H.6 Safety and Mission Assurance

- a. Occupational health and safety, mission and quality assurance services, quality assurance support for fabrication on-site or near-site; safety and mission assurance technical authority (STA) responsibilities; measurement services for fabrication and wind-tunnel models; Standard Practice Engineer for welding and materials analysis; and quality inspection services for externally procured fasteners and billets.

H.7 Research Services Directorate

- a. Maintaining operational oversight and control of all aircraft operated on behalf of Langley, including Commercial Aircraft Services (CAS), Unmanned Air Systems (UAS) operations, and research simulation devices. Provides flight-research services to meet the needs of other Langley units, other NASA Centers, as well as other governmental agencies via formal agreement.
- b. Supports demand for mechanical engineering, environmental testing, sensor development, and data acquisition services.
- c. Provides services to acquire requisite flight test/research data, acquire atmospheric data and/or provide a flight test platform for instrument development and test, UAS systems testing, SDAB software development, verification, and validation.

H.8 Engineering Directorate

Provides systems concepts, advanced technology, and systems development to support the research and technology development objectives of the Aeronautics Research, Human

Exploration and Operations, and Science Mission Directorates. ED focuses on the following services to provide appropriate technical solutions on schedule and within budget:

- a. Requirements Development: provides systems and discipline experts for rigorous development of requirements from research and mission objectives using systems engineering methodology.
- b. Technology Development, Integration, and Maturation: provides systems engineering and discipline engineering expertise to develop and integrate lower technology readiness level (TRL) technology into demonstration testbeds and systems, thereby seeding further technology refinements as well as ideas for new technologies, based on the performance of a technology within the intended system and in the relevant physical environment.
- c. Systems Design, Development, Assembly and Integration: creates concepts, conducts trade studies, designs, develops, fabricates, integrates, and verifies (performs physical system integration, functional, and environmental testing, and preparation of the system for shipment) hardware and software for research, development, and operational systems for all Mission Directorates.
- d. Engineering Environments: provides integrated engineering environment(s) using collaborative technologies and integrated tools and methods developed in ED, Research Directorate (RD), and Systems Analysis and Concepts Directorate (SACD) to facilitate cross-Center teaming as well as teaming with personnel from other NASA Centers, industry, and academia.

H.9 Research Directorate

Provides a multiple discipline approach to advance, innovate, and transform the understanding and development utilizing computational tools, experimental facilities and methods to advance foundational research, and accelerate the development of concepts and technologies to enable NASA's missions. RD's areas of expertise are Aerosciences, Structures and Materials, and Intelligent Flight Systems.

Aerosciences: Provide the capabilities and technologies to make flight vehicles -- safe, reliable, and efficient while reducing noise and emissions. Areas of expertise:

- Vehicle Level Design, Integration and Analysis: Integrated advanced technologies with new vehicle concepts to improve performance and capabilities.
- Hypersonic Technologies: Air-breathing propulsion and impacts on propulsion airframe integration on vehicle performance.
- Aeroelasticity/Aeroservoelasticity Technologies: Understanding and controlling aeroelastic effects on air vehicles.
- Acoustic Design, Analysis and Control Technologies: Understand, predict, and control acoustics to reduce aircraft noise and vibroacoustic response.
- Flow Control Technologies: Understand and control of steady and unsteady flow phenomena to enhance vehicle performance.
- Physics-Based Modeling, Simulation, Validation and Verification: Develop rapid/accurate multidisciplinary design and analysis tools with known uncertainty.

Structures and Materials: Innovate new materials and structural concepts that enable future aviation and space exploration, and develop the foundational technologies essential for manufacturing, design, validation, and sustainment. Areas of expertise:

- Materials: Structural, Flexible, Nano, Multifunctional, Extreme Environments; Durability and Damage Tolerance; Computational Materials
- Structures: Lightweight/Multifunctional/Active Concept Development; Design and Certify Technologies; Reliability and Sustainment Technology
- Mechanisms/Manipulators: Deployment; Design Development Test and Evaluation, In-space and Surface Manipulators
- Advanced Manufacturing Technology: Integrated Design/Manufacturing Qualification: Additive Processes Development; Flight Qualification; Precision Joining and Assembly
- Flight - Qualified Structures: Design Trade Studies and Tailored Design Development Test and Evaluation for flight systems.
- Advanced Non-destructive Evaluation and Structural Health Monitoring (NDE & SHM) Technology: NDE for ground or space-based characterization & Material State Awareness

Intelligent Flight Systems: Transforming aviation and aerospace through adaptive and autonomous systems, human-machine teaming solutions, integrated flight systems, and new vehicle and operational concepts. Areas of expertise:

- Smart Systems for Vehicles: Systems for determining and managing vehicle internal state/external interaction; machine-machine teaming
- Methods to Ensure Trusted Autonomy: Methods to ensure demonstrate safe and reliable behavior of autonomous systems and operations
- Human-Machine Teaming and Interfaces: Operator/autonomous agent teaming; Operator interfaces; crew state monitoring; situational awareness
- Modeling and Control of Complex Systems: Modeling of complex system dynamics for control; Guidance Navigation and Control of novel vehicles/systems; tactical and strategic air traffic operations
- High Confidence Safety-Critical Systems: Safety assurance methods and tools; formal specification and Verification and Validation of algorithms/cyber-physical properties/security
- Intelligent Sensory Systems: Integrating sensor technologies and fusing data to enable vehicles and networks
- Flight Dynamics and Control Technologies: Predict and understand air vehicle flight-dynamic characteristics, and develop new flight-vehicle technologies

H.10 Center Operations Directorate

- a. Export Control: Review of project content for potential export control issues or concerns; proper document markings and protected from unintended disclosure, compliance with applicable export control laws and regulations; protection of personnel, property, facilities, operations, information, and activities (including International Traffic in Arms Regulations, Export Administration Regulations, Export Control Training, Commodity Classifications, Technology Transfer Control, Non-Proliferation).
- b. Logistics: Unique project logistics requirements, including property management and controls, as well as shipping, receiving, and inspection; equipment management, contract surveillance, contract property management, warehousing and storage, logistics facilities management, transportation/fleet management, shipping/receiving and mail room operations, facility rehab outfitting, material inventory and stores stock management, property management – disposal, loans, and GSA sales.
- c. Environmental: Unique environmental planning actions; expert advice and service for environmental and engineering disciplines; ensure safety, compliance, and sustainable practices are incorporated into all planning, operations, engineering, and maintenance activities.
- d. Revitalization: Space or facility requirements and assignments, space consolidation, facilities maintenance and planning; ReViTALization Program, Construction of Facilities (CoF), strategic planning for maintenance program, Center master planning, facility utilization, and real property.
- e. Protective Services: Project unique security requirements, vulnerability/threat assessments, electronic security systems, communications security, investigation/inquiries, Badge and Pass Office, information security, traffic management, workplace violence, personnel security, physical security, foreign national access management, foreign travel, VIP protection, Center access, key control.

H.11 Systems Analysis and Concepts Directorate

- a. Systems Analysis: Infuse a systems-driven approach to research and technology development. Develop tools and methods for integrating technologies, subsystems models, and analyses to ensure compatibility of methods and assure continuity of analyses at suitable fidelity levels from concept to flight. Perform preliminary design and analysis of aeronautic and space transportation system concepts, from the point of origin to the final destination and the entire life cycle.
- b. Technology Maturation: Formulate and mature original and innovative transportation architectures that enable effective space exploration and air transport through the exploitation of novel, synergistic, and high-payoff technologies. Identify, evaluate, and recommend high payoff and synergistic technologies.
- c. Requirements Development: Perform a non-advocacy role in the independent evaluation of proposed system requirements, hardware technologies, and individual vehicle and system concepts. Participate in the definition of systems level requirements through vehicle, architecture, and campaign analyses.
- d. Decision Analysis: Assist tactical decision-making throughout project life cycles through requirement sensitivity evaluations. Assess the impact of decisions and assumptions over the duration of the project life cycle including performance, affordability, risk, safety, technology, and benefit or value. Provide decision analysis/support services, including cost-benefit

analysis, prioritization facilitation, decision model development, figure of merit formulation, and process development.

- e. Strategic Planning: Assist in strategic planning through technology roadmap development.
- f. Project Support: Support experimental and operational vehicle, architecture, and campaign projects through in-depth discipline design and analysis.

H.12 Office of Strategic Analysis, Communications, and Business Development

- a. Communications Team: Provides mission support with professional skills that include public engagement, exhibit design, conference planning, communications strategy development, media relations, internal communications, and the Center Outreach Resource Center (ORC), and manages external communications such as social media, news stories, interviews, and news print/virtual articles. They also will do interview preparation training for public interactions.
- b. Legislative Affairs (OLIA): Helps facilitate conversations and enables engagement with legislative stakeholders to advocate and educate about NASA's mission work, and responds to legislative inquiries.
- c. Protocol team: Provides mission support to help facilitate engagement with VIP's and high-ranking official visits to the Center. This may include tours and events hosted by the Center or Headquarters.
- d. Strategic Business and Partnership Development team: Provide mission support to facilitate the development of new partnerships while leveraging partnering mechanisms such as Space Act Agreements, technology transfer, and the SBIR/STTR program.
- e. Strategic Analysis team: Provides integrated analysis of workforce, programs, and Center capabilities.