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Earth System Explorers Program

Earth System Explorers Program Plan



Goddard Space Flight Center
Greenbelt, Maryland

Earth System Explorers Program Plan Signature/Approval Page

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Configuration Management Foreword

This document is an Earth System Explorers Program (ESEP)-controlled document. Changes to this document require prior approval of the ESEP Configuration Control Board chairperson.

Proposed changes are to be submitted to the ESEP Configuration Management Office, along with supportive material justifying the proposed change.

Questions or comments concerning this document should be addressed to:

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Change History Log

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1 PROGRAM OVERVIEW

1.1 Introduction

The Earth System Explorers Program (ESEP) is a new program recommended by the National Academies of Sciences, Engineering, and Medicine 2017 *Decadal Survey for Earth Science and Applications from Space*, (<https://www.nationalacademies.org/our-work-decadal-survey-for-earth-science-and-applications-from-space>). The program features competitively selected, principal investigator (PI)-led, cost-capped, risk classification C, Medium-Class Explorer (MIDEX) missions, addressing one or more Earth System Explorer target observables, which are also defined in the decadal survey.

1.2 Program Goals and Objectives

ESEP aligns with the strategies described in Sections 1.1, 1.4, 2.1, 2.3, 2.4, and 4.1 of the 2017 Decadal Survey. ESEP also aligns with Strategic Goal 1 in the 2022 NASA Strategic Plan, “Expand human knowledge through new scientific discoveries,” and Strategic Objective 1.1, “Understand the Earth system and its climate.” Further, ESEP aligns with Priority 1: Exploration and Scientific Discovery, Strategies 1.3 and 1.4, and all strategies under Priority 2: Innovation in the Science Mission Directorate’s (SMD) science plan, *Science 2020–2024: A Vision for Scientific Excellence in 2021*.

This new program is for competitive opportunities for cost-capped, medium-sized missions to augment existing capabilities (including the Designated Observables). ESEP PI-led missions are designed to accomplish high-quality Earth system science investigations addressing one or more of the following ESE Targeted Observables (TO) highlighted in Table 3.3 of the 2017 Decadal Survey:

1. Greenhouse Gases
2. Ice Elevation
3. Ocean Surface Winds and Currents
4. Ozone and Trace Gases
5. Snow Depth and Snow Water Equivalent
6. Terrestrial Ecosystem Structure
7. Atmospheric Winds

These seven candidate Targeted Observables are generally not prioritized by importance. The Decadal Survey states that “the Earth System Explorers program element is recommended in part because the science priorities identified are of sufficiently similar importance that the key discriminators on what should go forward are those that will emerge through competition addressing cost, scope, technical performance, technical readiness, and programmatic capabilities.” In addition to the competition factors suggested by the Decadal Survey, NASA Earth Science Division (ESD) may include factors such as Administration priorities and the availability of international capabilities in focusing the specific announcements. For the first announcement of opportunity (AO), proposed missions can target one or more of the observables listed above; however, at least one of the estimated four selected proposals will prioritize Greenhouse Gases as one of its Targeted Observables.

ESEP will complete scientific investigations of modest and focused programmatic scope and can be developed relatively quickly and executed on-orbit for an initial mission of 3 years or less. NASA Earth Science defines science to include research, applied research, and applications. This program line opens Earth system science to the benefits of innovation and to new, but flight-ready, technology alternatives including novel spacecraft bus concepts, miniaturized instrumentation, small satellites, and constellations.

NASA applies insights from Earth science to benefit the economy, health, quality of life, and environment around the globe. The Earth System Explorers program can help achieve this objective and increase the overall value and benefits of a mission by considering innovative and practical applications for the collected data as part of the overall mission concept.

Furthermore, it is expected that the data and science results will be an integrated part of NASA's Earth System Observatory (ESO). Depending on the TO, the science investigation may benefit from using data and/or results of the other ESO missions and enable or strengthen integrated system science.

In July 2022, NASA's Program and Project Management Board (PPMB) endorsed ESEP for formulation; the NASA Associate Administrator (AA) subsequently approved the ESEP implementation approach. ESEP has since successfully completed its combined System Requirements Review and System Definition Review in March 2023. Solicitations through an AO competitive selection ensure the most current and best strategic science is accomplished through ESEP.

1.3 Program Architecture

ESEP is an uncoupled, multi-project program of missions aimed at meeting the program objectives wherein each mission has unique science capability. ESEP meets all requirements from NASA Procedural Requirement (NPR) 7120.5F, NASA Space Flight Program and Project Management Requirements, for an uncoupled program.

ESEP emphasizes missions that can be accomplished under the control of a PI drawn from the scientific community and seeks to constrain total mission life-cycle costs. ESEP missions are cost-capped at \$310 million (\$Fiscal Year [FY]24, not including the launch vehicle cost or Headquarters-held unallocated future expense), and category 2, as defined in NPR 7120.5F.

ESEP interfaces with other organizations both inside and outside of NASA through its projects. Access to space is acquired through existing contracts held by the Launch Services Program (LSP) in the Space Operations Mission Directorate (SOMD) or otherwise provided for by the Science Mission Directorate (SMD). LSP interfaces between the program/project office and the launch service provider. Acquisitions for operations services are consistent with NASA policy.

Project Level 1 requirements are developed by the PI and documented in a program level requirements appendix (PLRA). Each project has one PLRA. The PLRAs are reviewed and approved by the SMD AA at Key Decision Point (KDP)-C. Each approved PLRA is attached to Appendix B of this document and maintained under ESEP office configuration management (CM) control. Any subsequent changes to the PLRAs require the approval of the SMD AA.

Individual projects may require external agreements with respect to other U.S. Agencies and foreign participation with the project. These external agreements for individual projects are generated, negotiated, and approved by NASA Headquarters when necessary, and are referenced in the PLRAs included in the ESE Program Plan.

Products and data resulting from ESEP and its missions are made available for public access consistent with the SMD's open data policy, International Traffic in Arms Regulations, and Export Administration Regulations.

ESEP missions are highly responsive to new knowledge, new technologies, and updated scientific priorities through the strategy of launching medium-sized missions that can be conceived and executed in a relatively short development cycle.

ESEP provides a Medium-Class Explorers (MIDEX) mission class in support of science investigations. The mission class was designed to increase the number of flight opportunities in response to recommendations from the 2017 Decadal Survey. All ESEP missions are initiated by selection through a competitive AO process.

MIDEX is defined as PI-managed missions that can be developed in approximately 60 months. MIDEX investigations use standard launch services utilizing a domestic launch vehicle certified as Category 2 per NASA Policy Directive (NPD) 8610.7D, Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions.

1.4 Stakeholder Definition

The data as well as derived data products will be distributed via a suitable Distributed Active Archive Center (DAAC). This way all data and derived data products will be publicly available and free of charge. Proposers are also encouraged to address the cross-benefits of science and applications in their development of retrieval algorithms and data products.

This approach ensures (a) broadest accessibility and (b) allows a wide range of stakeholders to utilize the data and products. Those are the science community, other federal and regional agencies, as well as the interested public.

1.5 Program Authority, Management Approach, and Governance Structure

SMD and ESEP follow NPD 7120.4, NASA Engineering and Program/Project Management, and NPR 7120.5F for the uncoupled program and flight project management. ESEP implements these procedures through the processes described in NASA's SMD Management Handbook.

ESEP is an uncoupled, multi-project program. The ESE program manager resides at Goddard within the Flight Projects Directorate's Earth Science Projects Division (ESPD), reporting institutionally to the Center Director (CD) and, programmatically, through the ESD AD for flight programs, ESD division director, then to the AA for SMD at NASA Headquarters. The Agency Program Management Council (APMC) is the governing council for program-level KDPs, except when delegated to the SMD DPMC by NASA's AA, as for KDP-I. The SMD PMC (DPMC) is the governing council for all project-level KDPs. The SMD AA is the decision authority (DA) for ESEP projects, including making all final decisions to proceed from one phase to the next.

For ESEP projects implemented with a NASA Center performing project management functions, the implementing Center holds institutional and technical authority; evaluates cost, schedule, and technical content; ensures that the project is receiving necessary Center resources; and ensures compliance with Agency and Center procedures and processes. For ESEP projects not implemented by a NASA Center, Goddard holds institutional and technical authority. SMD's DPMC holds programmatic authority for all ESEP projects. The implementing CMC makes recommendations/endorsements to the DPMC at all KDPs.

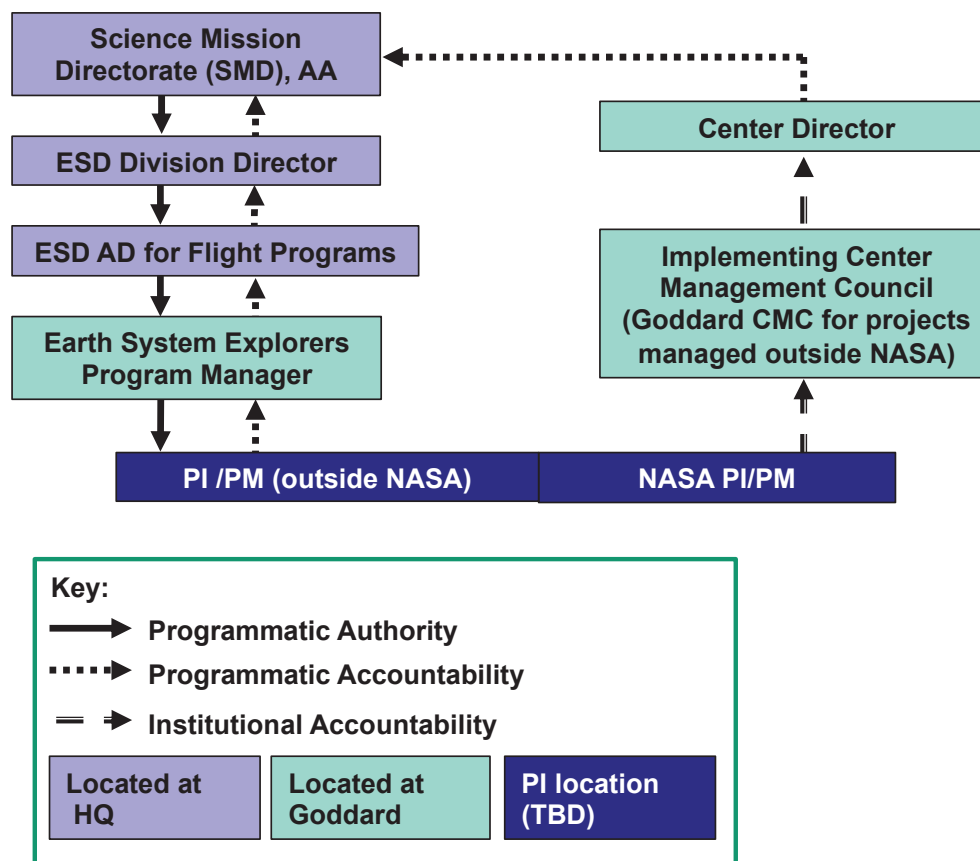


Figure 1. SMD Program Management Accountability

Figure 1 shows the lines of authority for SMD management accountability of programs and projects as well as lines of programmatic coordination.

ESEP authority is delegated from the AA/SMD, through the ESD director and associate director (AD) for flight programs, to the ESE program manager. The PI for AO-selected missions is responsible for the overall scientific and programmatic success of the mission and is accountable to the AA/SMD.

ESEP's primary role is to support the PIs toward mission success, provide comprehensive oversight of mission development progress, independently assess the health of projects, and report mission progress and issues to the ESD AD for flight programs and Goddard's Center Management Council (CMC). The program also coordinates the provision of certain services and equipment as required, such as space communication support and launch services. In addition, for ESEP missions where project management is located at a non-NASA Center, ESEP

provides technical authority (TA) support to the project. ESEP supports the NASA SMD/ESD process for procuring PI missions and then manages these missions from final award through the end of Phase D (observatory commissioning). For Phase E roles and responsibilities, see Section 1.5.

Figure 2 shows the ESEP organization chart. The ESE program manager is responsible for the oversight and management of formulation and implementation of the program and all ESEP missions. For a non-Goddard-implemented mission, the ESE program manager assigns a mission manager within the program office to oversee the mission and act as the principal point of contact to the PI. The project implementing organization assigns the project manager. For a Goddard-implemented mission, FPD assigns a project manager; in this case, there is no need for a separate Goddard mission manager. The program develops integrated budgetary requirements and recommendations for SMD, based on NASA budgetary guidelines. The program establishes operational policies for ESEP, assures appropriate independent review of assigned missions, monitors the progress of each mission, reports mission and program status to Goddard and SMD management, recommends necessary corrective and preventative actions, and provides access to Goddard and NASA expertise to support the PIs. The program operates with a small management staff. The programmatic staff approves movement and tracking of finances and supports contract actions. The program system engineer and program chief safety and mission assurance (SMA) officer (CSO) provide TA insight and advice to the program manager and identify issues for which the projects need assistance.

Oversight to support program management and TA responsibilities include weekly meetings with the project manager and/or PI. Implementing organizations also hold periodic and lower-level reviews that include program staff. Monthly status reviews are presented to SMD and the appropriate CMC. For ESEP projects where project management is performed by NASA Centers other than Goddard, TA resides at the host Center. For all other missions, TA resides at Goddard. In addition, when a Center other than Goddard is performing project management, the implementing Center's leadership team and CMC perform the review and oversight functions outlined above.

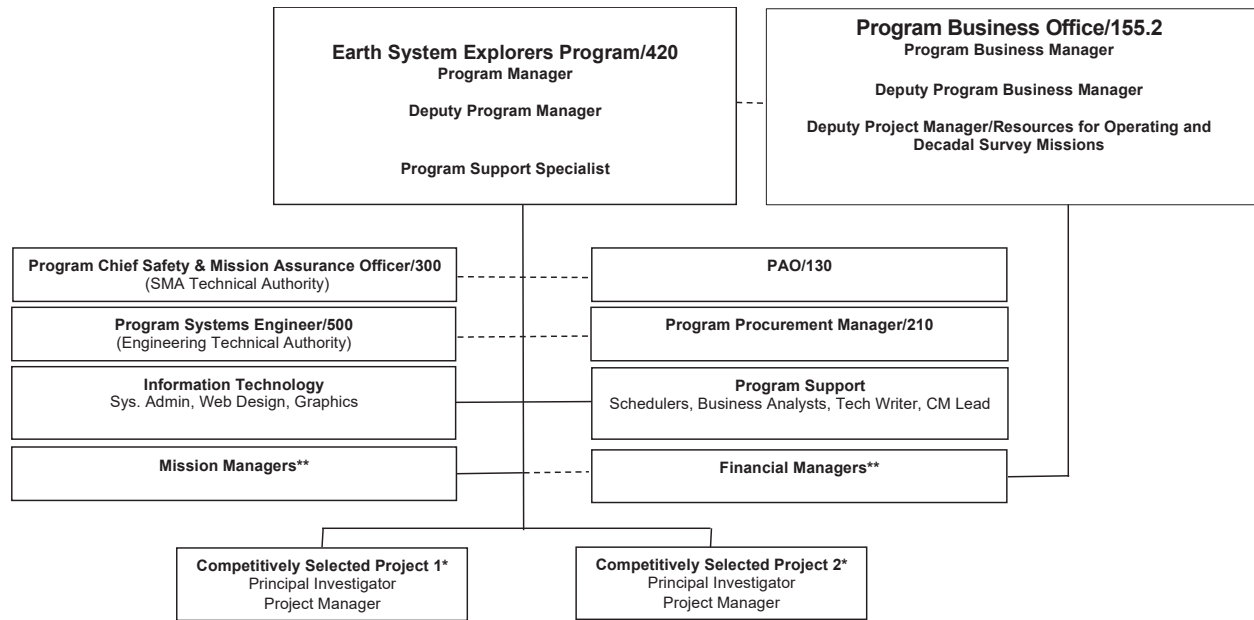


Figure 2. Earth System Explorers Program Organization Chart

ESEP supports the nominal, two-step, AO process that is led by ESD at NASA Headquarters. The program plan and ESEP mission assurance requirements (MAR) are made available to all proposers. Figure 3 shows the two-step AO process, which includes an interim downselect of two or more proposals for a 9- to 12-month Phase A study, which subsequently leads to a final selection of one or more science investigations. However, if warranted by the evaluation process, NASA reserves the right to select missions through a single-step process. ESEP supports the development of required AO products, supports the pre-proposal conference, hosts a Phase A kickoff meeting, and establishes Phase A and Phase B bridge contracts. ESEP also attends evaluation plenary sessions and site visits as observers.

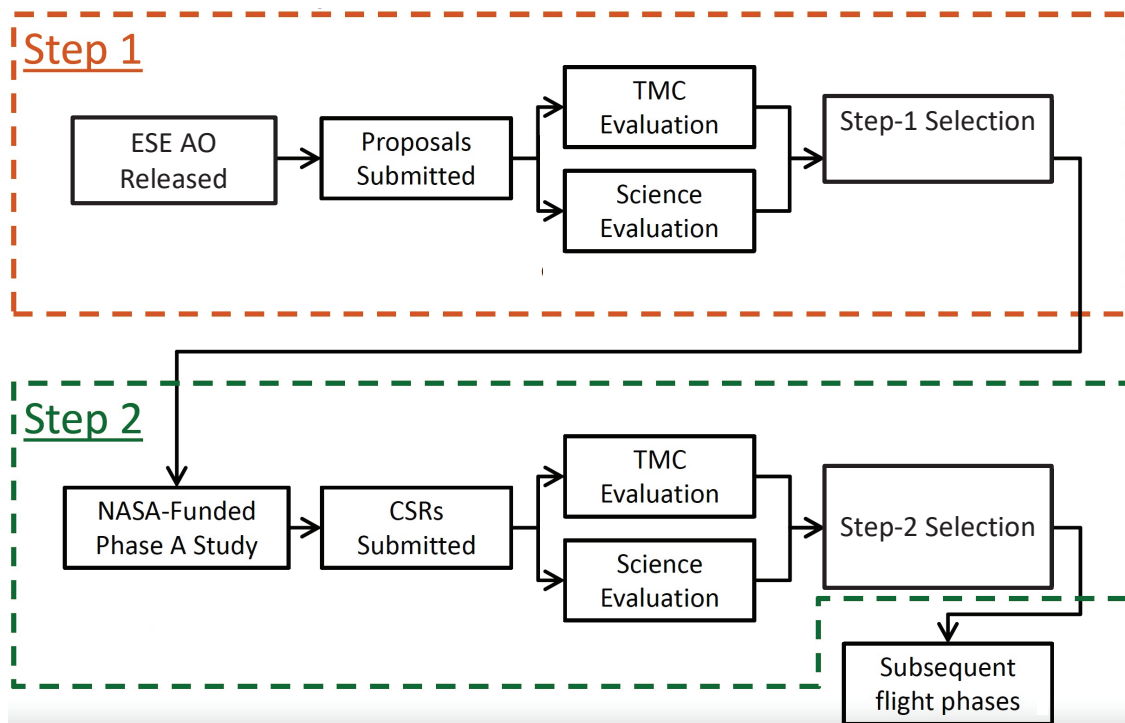


Figure 3. Two-Step Announcement of Opportunity Process led by SMD

The PI is in charge of each mission, with full responsibility for its scientific integrity, cost, schedule, technical performance and overall safety. The PI team has a large degree of freedom to accomplish its proposed objectives within the stated constraints. The project management for each mission is determined by the PI's proposal, at a NASA Center or an external organization such as a university, private laboratory, or industry. As a PI-led mission, it is expected that the PI manages the development of the mission in accordance with the best practices and standards of their parent organization and principal suppliers. The roles and responsibilities of SMD, Goddard, the program, and PI are defined in Goddard Procedural Requirement (GPR) 7120.3, Management of Principal Investigator Mode Missions, which defines how the missions are managed by the program.

It is NASA's intent to allow the successful proposers to manage their missions using the standards, practices, and processes that best support their team, provided that they are comprehensive and proven as suitable for spaceflight systems development. NASA relies heavily on the PI to develop and execute a comprehensive implementation plan for the mission. Initially, the PI's proposal provides the basis of such a plan. Early in Phase B, the PI submits a preliminary version of the project plan, following the outline established in NPR 7120.5F. The project plan forms the detailed basis upon which the project is executed. The project plan is an explicit agreement between NASA and the PI on the terms and conditions under which the PI executes the mission. At the project's Phase B to C confirmation review (KDP-C), the project plan is baselined, and the PI demonstrates minimum unencumbered cost reserves including adequate funded schedule reserve per GPR 7120.7B, Funded Schedule Margin and Budget Margin for Flight Projects. For Goddard projects, after a successful Post-Launch Assessment Review (PLAR) at the end of Phase D, mission management and operations transition to

Goddard’s Earth Science Missions Operations (ESMO), which is responsible for spacecraft maintenance and operations for Earth Science missions conducted by ESPD. For projects not managed by Goddard, the implementing Center takes full responsibility for Phase E/F management.

Table 1 and Table 2 summarize the reporting that the program and projects provide to stakeholders. ESEP will electronically transmit a copy of its reports to the designated SMD/Center reporting websites.

Table 1. Program Reporting

Program Reports to	Content	Cadence
SMD ESD	Project significant status changes and impact	Weekly
SMD ESD	Project technical progress, cost, schedule, issues/risks	Monthly
Executing CMC (Goddard for non-NASA managed missions)	Technical progress, cost, schedule, issues/risks	Monthly/KDP CMC
SMD DPMC	Independent technical/programmatic project assessments	KDP DPMC

Table 2. Project Reporting

Project Reports to	Content	Cadence
ESEP	Project significant status changes and impact	Weekly
ESEP	Project technical progress, cost, schedule, issues/risks	Monthly
SMD DPMC	Independent technical/programmatic project assessment results	KDP DPMC

1.6 Implementation Approach

ESEP follows an implementation approach consistent with the latest Program Commitment Agreement (PCA), NPR 7120.5F, and Agency requirements for AO missions. The SMD AA and Goddard CD approve this program plan, which describes how the program proposes to manage and implement the program and hold the program manager accountable. The program implementation approach is to use the NASA Headquarters issued AO process to solicit and select projects. Since ESEP is a coordinated set of uncoupled missions, the execution of the projects embodies the implementation of the program.

ESEP projects decompose their unique PLRAs to generate lower-level requirements for implementation. SMD uses the PLRA to evaluate the project’s performance during implementation and to make decisions about mission success during operations.

The mission implementation is proposed by each project in the project plan and approved by SMD AA and Goddard CD. Major project element make-or-buy and trade studies are conducted

at the project level during formulation with ESEP oversight. Each project develops its acquisition strategy in accordance with NASA and implementing Center (Goddard for ESEP projects managed outside of NASA) procurement processes to ensure cost, schedule, technical, and risk performance with appropriate insight/oversight and the use of appropriate contractual vehicles, including cost plus incentive fee, cost plus award fee, etc. Provisions for partners contributing elements to a project are controlled by the project or NASA Office of Interagency and International Relations (OIIR) agreements.

2 EARTH SYSTEM EXPLORERS PROGRAM BASELINES

2.1 Requirements Baseline

ESEP aligns with Strategic Goal 1 in the 2022 NASA Strategic Plan, “Expand human knowledge through new scientific discoveries,” and Strategic Objective 1.1, “Understand the Earth system and its climate.” ESEP also aligns with the strategies described in Sections 1.1, 1.4, 2.1, 2.3, 2.4, and 4.1 of the 2017 Decadal Survey. As stated in Section 1.2, there are seven overarching Earth science goals from the Decadal that guide the selection of ESEP projects and other programmatic decisions. ESEP objectives are also identified in Section 1.2.

Program requirements are consistent with NPRs and NPDs. In addition, ESEP will use the following guidelines to evaluate its progress at each Program Implementation Review:

1. ESEP will oversee the implementation of competitively selected missions within the confirmed and approved mission cost cap.
2. ESEP projects will use cost-effective, domestic, flight-proven expendable launch vehicle (ELVs) from NASA’s Launch Services (NLS) Catalog, unless specifically directed otherwise by NASA. SMD provides access to space and launch vehicle funding (outside PI cost cap).
3. For each project, the primary planned launch date will be within the time period specified by the associated AO.
4. In Phase B of projects selected through the AO process, ESEP will hold a formal technical readiness assessment (TRA), led by the Goddard Engineering Directorate, to assess the actual technology readiness level (TRL) of the project’s components, subsystems, and systems.

Key performance parameters (KPP) that represent measures of success for ESEP are:

1. Approving projects to proceed to implementation at KDP-C.
2. Validating that the system can achieve threshold science requirements at PLAR.
3. Completing commissioning within PI cost cap.
4. Holding pause-and-learn dialogues after every project milestone review. Collecting and developing lessons learned that are formed into best practices for future missions and across other related programs (ESMPO-G, ESSP, and Astro/Helio Explorers).

The assessment of program performance is conducted at program implementation reviews and during project reviews.

The technical performance criteria for each ESEP project are defined by the PI as Level 1 science requirements documented in the project-unique PLRA, found in the appendices to this program plan. The PLRA for each ESEP project includes a top-level mission description, science objectives, project category, governing PMC, risk classification, both baseline and threshold science requirements, and mission success criteria. These requirements are submitted at KDP-B and updated and approved at KDP-C; subsequent changes to the PLRA require approval at the original signatory level. Individual project plans describe how each ESEP project meets its unique Level 1 science requirements. Table 3 summarizes ESEP requirement sources, requirements documentation, and verification responsibility.

Table 3. ESEP Requirements Sources

Type Requirement	Origination	Where Documented	Applicable to	Compliance Verified By	Conduit to Performer				
					Solicitation	Contract SOW	NPR/NPR	PCA	Program Plan
Solicitation	Contract SOW	NPR/NPD/MAR	PCA	Program Plan		√			
Programmatic (Level 1)	HQ	Program Plan	Individual Project	HQ/ Program	-	-	-	-	√
Program High-Level	HQ	Program Plan	Program	HQ	-	-	-	√	√
Management Process	HQ	HQ NPD/ NPG	Program	HQ	-	-	√	-	-
Management Process	HQ	HQ NPD/ NPR	All Projects	Center	√	√	√	-	-
Center Management Process	Center	Center	All Projects	Center	√	√	-	-	-

2.2 Work Breakdown Structure Baseline

Table 4 shows the ESEP work breakdown structure, which meets the guidelines in NASA/SP-3404 NASA Work Breakdown Structure (WBS) Handbook. This WBS reflects the current program structure; it will be updated to include additional external elements as necessary. Future changes to the WBS will be communicated through the annual Programming, Planning, Budgeting, and Execution process.

Table 4. Earth System Explorers Program WBS

WBS Element	Name	Labor Indicator	Procurement Indicator	Travel Indicator
935634.01.02.01.01	Goddard-ESE Program	X	X	
935634.01.03.01.01	HQ-ESEPO Implementation SRB Support	X	X	X
935634.01.03.01.02	MSFC-ESEPO Implementation SRB Support	X	X	X
935634.01.03.01.03	ARC-ESEPO Implementation SRB Support	X	X	X
935634.01.03.01.04	GRC-ESEPO Implementation SRB Support	X	X	X

Note: this table will not be maintained.

All ESEP projects define the work required using a WBS in accordance with NASA/SP-3404. The WBS supports cost and schedule allocation down to a work package level. Each project will have a separate six-digit WBS (distinct from the program WBS) that is captured in the project plan.

2.3 Schedule Baseline

Individual project schedules are generated and maintained by the respective projects per the project schedule management plan. The project schedules are generated and maintained by the projects and are reviewed and updated monthly. The program monitors and analyzes project schedules and offers scheduling advice and expertise, as required. The ESEP assembles and maintains a master schedule based on top-level milestones from each project.

Figure 4 shows the top-level schedule for program and project implementation.

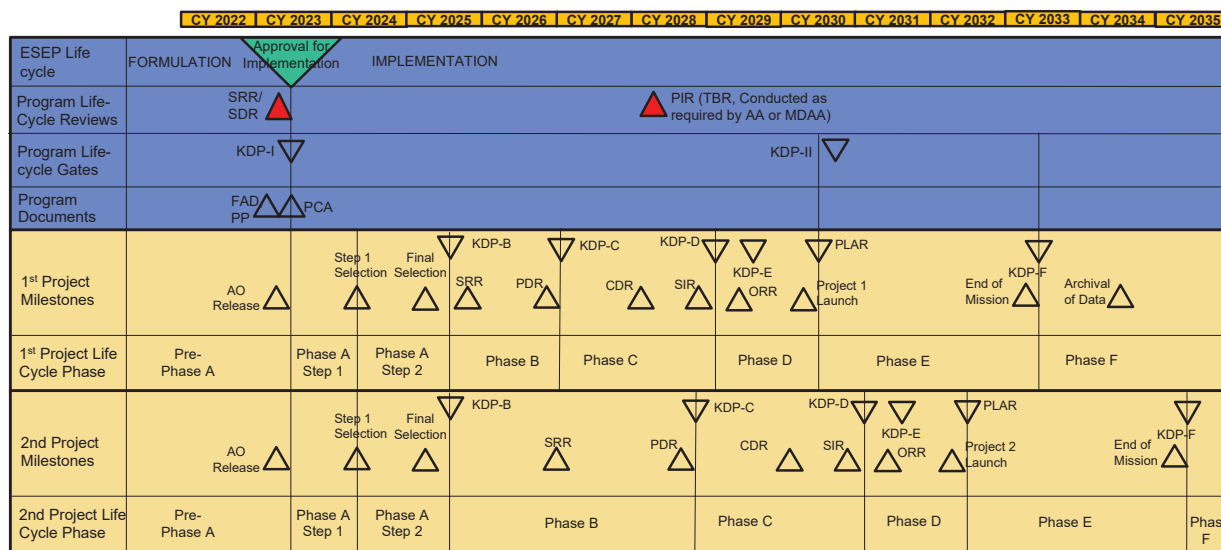


Figure 4. Top-level Schedule for Program and Project Implementation

Each AO will follow a two-step selection process. The current program scope includes the selection and implementation of two missions for launch no later than April 2030 and April 2032, respectively. In Step 1 of the initial AO, which begins in 2023, up to four mission proposals may be selected for nine-month Phase A concept studies. In Step 2 of the initial AO, which will begin in 2024, SMD will conduct a detailed review of the Phase A Concept Study Reports (CSRs) and select up to two ESE missions to proceed into Phase B and subsequent mission phases. Phasing and funding of the two initial missions will be staggered, with launch of the first mission no later than April 2030 and the second mission by April 2032. Project mission operations are expected to be completed three years after launch. ESD will direct ESEP to establish a cadence for subsequent AOs.

Subject to funding availability, the nominal schedule for the solicitation is shown in Table 5.

Table 5. AO and Project Milestones

Milestone	Date
Release of draft AO	December 2022
Release of final AO	May 2023
Pre-proposal conference	~3 weeks after final AO release
Proposals due	90 Days after AO release
Selection for competitive Phase A studies	April 2024
Concept study reports due	February 2025
Downselection	July 2025
First mission launch	NLT April 2030
Second mission launch	NLT April 2032*

* The mission selected for the second launch will have a slower ramp up with enhanced funding to enable extended Phase A (approximately one year), then ramping up in FY25.

2.4 Resource Baseline

ESEP utilizes shared infrastructure to accomplish program-level requirements. ESPD at Goddard encompasses three programs: ESMPO-G, Reimbursable Projects Program (RPP), and ESEP. Staff, information technology (IT) infrastructure, and other routine resources are shared across the programs to the greatest extent possible to maintain efficiency and consistency across ESPD.

The resource baseline assumes that two ESEP missions are managed from Phases B through D, during each decade and leverages existing ESPD staff to provide required functions. As a result, only minimal additional staff are needed to staff the ESEP. Additional resource needs include a project manager, systems engineer, and financial manager for each mission. Other than routine office space, there are no facilities requirements at the program level. Infrastructure requirements for ESEP projects, including acquisition, renovations, property/facilities, personal property, and IT resources, are identified in the individual project plans.

The cost commitment for ESEP is reflected in the most recent President's Budget (and available publicly at <http://www.nasa.gov/news/budget/index.html>). Table 6 identifies the FY24 President's Budget Request (PBR) for ESEP and its missions.

Table 6. ESEP and Mission Budget Breakdown

\$K	PY (2022)	CY (2023)	BY (2024)	BY + 1 (2025)	BY + 2 (2026)	BY + 3 (2027)	BY + 4 (2028)
Earth System Explorers	\$2,020	\$3,612	\$27,789	\$20,679	\$43,112	\$108,970	\$166,380
Earth System Explorers Future Missions (174390)	\$0	\$0	\$20,000	\$17,377	\$39,852	\$106,531	\$164,483
Earth System Explorers Program Management (935634)	\$2,020	\$3,612	\$7,789	\$3,302	\$3,260	\$2,439	\$1,897

Note: This table will not be maintained. The budget is updated annually per the Planning, Programming, Budgeting, and Execution process.

2.5 Joint Cost and Schedule Confidence Level

Cost and schedule ranges for each selected mission will be documented in a KDP-B decision memorandum. A joint cost and schedule confidence analysis is not performed to set these ranges. These ranges are based on the PI cost cap at selection and Headquarters unallocated future expense estimates.

For the mission baseline at KDP-C, a resource-loaded schedule is developed and a risk-informed probabilistic analysis that produces a joint confidence level (JCL) is performed.

3 PROGRAM CONTROL PLANS

Program control plans are described below. Project control plans are defined in PI proposals and provided as part of the project plan, which is required to be submitted for approval at KDP-C.

3.1 Technical, Schedule, and Cost Control Plan

ESEP implements regular oversight procedures to ensure program-level schedule and cost commitments are met.

Each project within ESEP develops requirement, technical, design, schedule, and cost control plans that are used to monitor status and progress. The program reports each project's technical, schedule, and cost performance trends monthly to Goddard's CMC and the SMD PMC.

Technical status for each mission within ESEP is tracked via requirements shown in the Level 1 through Level 4 requirements traceability and test verification matrices. Tracking follows processes and requirements specified in the project's systems engineering management plan and risk management plan. Design margins are established and the reserves are tracked and reported against the implementing Center's guidelines.

Schedule management for ESEP and its projects is implemented under Goddard's schedule management policy (400-PG-7120.0.2B). Integrated master schedules that show both baseline and current schedule data are generated for all ESEP projects using standard scheduling tools and appropriate schedule management methodology. The integrated master schedule identifies the project's critical path for management and control and ensures that the schedule contains all critical milestones for internal and external activities, time durations for activities, schedule reserves or slack, and interdependencies.

Cost control incorporates monthly tracking metrics such as reserve status, liens and encumbrances, reserve percentage of cost to go, obligations, and cost (plan versus actual forecast) and labor (plan versus actual) forecast. Each project is responsible for implementing a system that meets NASA requirements as stated in NPR 7120.5F for a cost, schedule, and milestone tracking system that provides sufficiently detailed data to quantitatively assess the current progress of the mission on a monthly basis and provide a forecast for accomplishing work to be completed within the management agreement. Schedule and cost status are provided as part of the monthly project review process.

Technical progress for each mission is tracked by technical performance metrics (TPM) developed per NPR 7123.1C, NASA Systems Engineering Processes and Requirements. The margins for the TPMs are measured against the guidelines defined in GSFC-STD-1000G, Goddard Space Flight Center Rules for the Design, Development, Verification, and Operation of Flight Systems, and reported monthly by each project. The program reports each mission's TPM status and trends monthly to Goddard's CMC and the SMD PMC. Other leading performance indicators that the program monitors include:

- Requirement trends (percent growth, TBD/TBR closures, number of requirement changes).

- Interface trends (percentage of interface control document (ICD) approval, TBD/TBR burn down, number of interface requirement changes).
- Verification trends (closure burn down, number of deviations/waivers approved/open).
- Review trends (RFAs and action item burn down per review).
- Problem reports/problem failure reports (number open, number closed).
- Top project risks.

Each project reports schedule and cost performance in addition to all TPMs and leading indicators at every Life Cycle Review (LCR) and KDP.

The program monitors the mission's development cost monthly and if the trend indicates there is a potential to exceed the Management Agreement (MA), the program works with the mission to develop mitigation plans to mitigate the potential breach and report the status to Goddard's CMC and the SMD PMC. If the DA directs a cancellation review, the program assists the mission in developing a presentation addressing the issues identified in the cancellation review request. The program briefs the Goddard CMC and the SMD PMC prior to the review and supports the mission at the review.

Except when explicitly identified in individual missions' project plans, ESEP uses the Système International (SI) units of measure, commonly known as the metric system.

ESEP meets the requirements of NPR 7120.5F section 3.3, Technical Authority, by implementing the Goddard Safety & Mission Assurance Technical Authority Implementation Plan (300-PG-7120.0.1-) and the Goddard Engineering Technical Authority Implementation Plan (500-PG-7120.0.1B). The fundamental aspects of TA are: (a) provide an independent view of program/project activities, (b) ensure direction to the program or project reflects the view of the Center, (c) and adjudicate requests for relief on requirements from the TA technical baseline, and (d) implement the dissenting opinion process.

For engineering TA (ETA), Goddard Directive 500-PG-7120.0.1b defines the delegation of responsibility for setting and enforcing engineering requirements from the Office of the Administrator, delegation to NASA's AA then flows to NASA's Chief Engineer to the CD and further within the Center to the Director of Engineering, who further delegates ETA to the Engineering Division Chiefs, Engineering Branch Heads, and leads to the delegation of ETA to the lead systems engineer on the program/projects. Paragraph 2.4e of the GPR states: "Program/project lead engineers are matrixed from the Engineering Directorate to the program or project and serve as the ETA for that program or project. ETA is delegated from the Director of Engineering and recorded on the listing of those designated ETA as maintained by the Director of Engineering." The ESPD lead systems engineer is designated as the program ETA for all Goddard ESPD programs on the Director of Engineering's list, including ESEP.

For SMA TA, GPR 300-PG-7120.0.1 defines a structure similar to ETA, with delegation of responsibility for setting and enforcing SMA requirements from the Office of the Administrator; delegation to NASA's AA then flows to NASA's Chief of SMA to the CD, and further within the Center to the Director of SMA, who further delegates SMA TA to the SMA division chiefs, SMA branch heads, and leads to the delegation of TA to the CSO on the program/projects. The ESPD CSO is designated as the SMA TA for all ESPD programs, including ESEP.

Earned value management (EVM) is not implemented at the program level. However, the program will lead an integrated baseline review (IBR), which will evaluate the project-developed performance measurement baseline (PMB) with support from technical and programmatic subject matter experts. The IBR will be held ahead of KDP-C to ensure that the project's work is properly linked with its cost, schedule, and risk and that the management processes are in place to conduct project-level EVM immediately after KDP-C. IBRs are required ahead of KDP-C and after significant changes to the baseline (e.g., to scope, risks, schedule, or budget).

Each project implements an EVM process under current NASA policies, NPR 7120.5F requirements, and consistent with Center/organization EVM practices. For contracts, EVM policy is defined in NASA's Federal Acquisition Regulation (FAR) Supplement (NFS) 1834.201 and requirements outlined in the NFS 1852.234-2.F.

Costs and schedules are tracked against baseline projections and reviewed monthly to ensure that performance is closely monitored, and appropriate actions taken, if necessary. The program uses the project EVM data to perform independent cost and schedule analysis.

The program uses standard tools to implement program control processes. These include the ESPD SharePoint site for artifact storage, CM, and risk management and Microsoft Project for schedule development and maintenance.

ESEP has no technical or schedule margin, or unallocated future expenses. These are managed by the projects within ESEP and the SMD PMC, respectively.

ESEP addresses waivers and deviations per the process outlined in NPR 7120.5F, section 3.5, Principles Related to Tailoring Requirements. A request for relief from a requirement (waiver or deviation) includes the rationale, a risk evaluation, and reference to all material that provides the justification supporting acceptance. The organization that established the requirement dispositions the request. The organization consults with and obtains concurrence from other stakeholders that were involved in the establishment of the requirement. The disposition is documented and becomes part of the program or project records.

Dissenting opinion is based on personal responsibility, where each individual must adhere to the Agency's shared core values of safety, integrity, teamwork, excellence, and inclusion. In exercising this personal responsibility, individuals are required and encouraged to bring dissenting opinions to the appropriate authority (e.g., the program or project manager, anyone in the ETA or SMA TA chain) in an open and timely manner and without fear of retribution. The program follows Goddard's 500-PG-7120.0.1A, section 2.5 (dissenting opinion), Engineering Technical Authority Implementation Plan.

3.2 Safety and Mission Assurance Plan

Safety and Mission Assurance is conducted in accordance with NPR 8705.4, *Risk Classification for NASA Payloads*, Class C missions. The Safety and Mission Assurance Plan (SMAP) describes the ESEP plan for conducting a Safety and Mission Assurance at the ESEP level and thus primarily documents the duties of the ESEP CSO and SMA program. The duties and responsibilities of project-level CSOs and other SMA disciplines will be explained in each of the project-level SMAPs.

The ESEP chief safety and mission assurance officer (CSO), who serves as the SMA TA, has worked closely with Goddard's SMA directorate to develop an ESEP Mission Assurance Requirements (MAR) document. This MAR has been tailored for Class C missions and is made available to proposers responding to the AO.

The program is responsible for ensuring that ESEP projects develop an approved mission assurance compliance matrix that demonstrates compliance with the ESEP MAR. The SMA processes of the project's implementing Center apply, with Goddard processes used for projects managed within Goddard. The project addresses the SMA requirements included in NASA's procurement vehicle (e.g., AO) and obtains concurrence with ESEP for any waivers to these requirements.

Project requirements flow from NASA and Goddard SMA requirements and may be tailored and/or expanded for the specific mission.

Goddard-managed projects use an existing nonconformance report/corrective action system database and the problem report/problem failure report database for the closed-loop problem reporting and resolution system. Projects managed outside of Goddard use their existing problem reporting systems.

3.3 Risk Management Plan

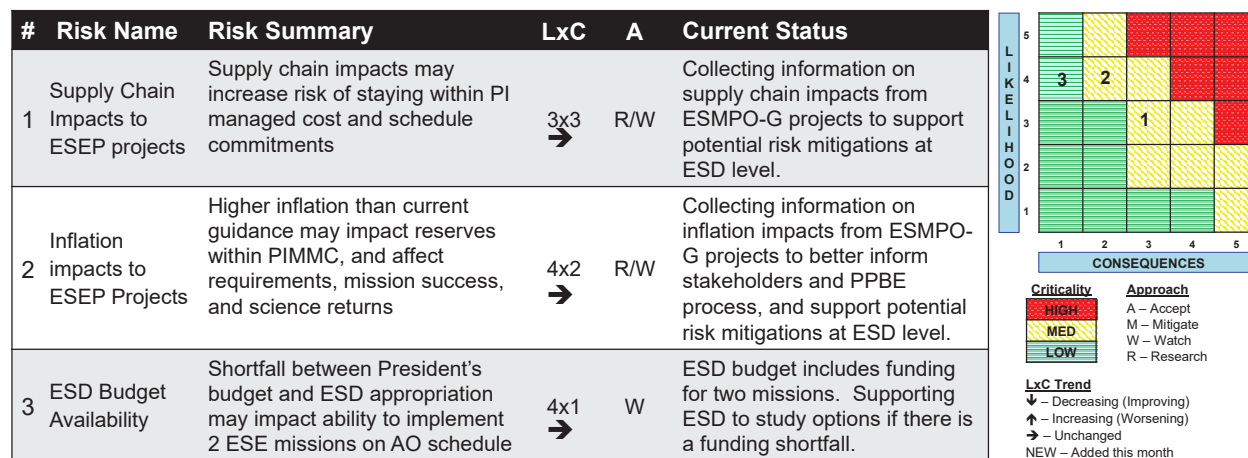
Risk management is conducted following the guidelines of GPR 7120.4, Risk Management Procedural Requirements. The ESEP risk process is documented in the Earth Science Projects Division Risk Management Plan (Document GSFC 420-01-02, Revision D). The program-level risk board meets monthly to consider new risks and update open risks. The board is chaired by the program manager and includes deputy program managers, the program systems engineering lead, and the program SMA lead.

Each ESEP project manager establishes a risk management process that identifies the safety, cost, schedule, and technical risks within the project and manages the risks. The project risk management approach is described in the project risk management plan, developed per the requirements of NPR 7120.5F, NPR 8000.4C, and GPR 7120.4 risk management procedures. The plan governs how safety, cost, schedule, and technical risks are identified, analyzed, tracked, controlled, communicated, and documented, to increase the likelihood of achieving program/project goals. The goal of risk management for ESEP projects is to identify and manage the risks to avoid occurrence or negative effects from these risks.

Each ESEP project manager presents status, including top risks, to the program leadership monthly. The program leadership then holds a risk management board at which new program risks, which can be recommended by any board member, are discussed and, if accepted, ranked and tracked. Additionally, existing program-level risk is discussed and updated as needed. Also, the project top risks are reviewed to determine whether any are relevant to other projects and, if so, will be captured as a cross-cutting risk. If a cross-cutting risk is captured at the program level, an appropriate risk statement is developed, and the risk is ranked and tracked. The program-level top risks are provided to each project and reported monthly to SMD and Goddard's CMC.

ESEP has a representative at the monthly ESD risk management board and elevates program risks to the ESD risk board in cases where the risk cannot be resolved using ESEP resources.

Figure 5 shows the current list of ESEP risks. The risks will not be updated in this document but are tracked per the ESEP Risk Management Plan and maintained in the ESEP configuration management system.



Note: This list will not be maintained.

3.4 Acquisition Strategy

There are no major acquisitions at the program level. All major acquisitions are performed at the mission directorate (mission selection through AO) or project level. Per the KDP-I chart package, an acquisition strategy meeting (ASM) is not required since the program office is not executing any procurements.

The ESEP projects and project elements are acquired through competitive procurement practices consistent with the FAR. SMD Standard AO policies and practices will be used to acquire ESEP investigations. Evaluation and selection are through peer review of science content, rigorous evaluation of technical feasibility, and cost. Future missions will be procured through peer-reviewed solicitations issued by NASA. The program supports SMD with the AO process, but is not involved with the review of proposals or the selection of missions. A firewall has been established between ESEP and GSFC to allow GSFC-based teams to submit proposals to the AO. ESPD personnel have completed training, and protocols are in place to ensure AO process integrity and avoidance of organizational conflict of interest.

The SMD AA delegates flight program authority and responsibility to the ESD director, who coordinates with the AD for flight and the program manager in developing the acquisition strategy leading to approval and selection of candidate project(s) for implementation.

Each project's acquisition strategy and processes are fully described in its acquisition plan per NPR 7120.5F and consistent with NPD 1000.5, Policy for NASA Acquisition, the results of the Agency's strategic acquisition process, and the ASM. Science investigations are provided by SMD-selected PIs through AOs under an approved agreement.

Launch vehicles are acquired through existing contracts managed by the LSP. The exception is when the Explorers mission is not a primary payload on the launch vehicle. In this latter case, arrangements for access to space are made on a case-by-case basis and documented using agreements. The launch vehicle liaison will interface with the Agency Flight Planning Board as required. Acquisitions for operations services are consistent with NASA policy. The project utilizes established host organization processes and procedures in accordance with NPR 7120.5F.

3.5 Technology Development Plan

There is no program-level technology development plan. Each project provides a technology development plan that includes the content tailored for the project as specified in NPR 7120.5F.

ESEP projects are strongly encouraged to utilize mature, low-risk technologies. These technologies are typically matured through other technology development programs (e.g., Earth Science Technology Office [ESTO] Instrument Incubator Program), substantially reducing program and project-level risk. ESEP interacts with the Office of the Chief Technologist (OCT), the Space Technology Mission Directorate (STMD), and ESTO to maintain awareness of technology investments and innovation across the Agency, as well as other government agencies, academia, and the commercial aerospace community. Through these interactions, ESEP identifies future needs and acceptable levels of risk, while ESTO, STMD, and OCT increase their knowledge of ESEP activities and strategic direction.

After a project is selected through the AO process, the program organizes a formal TRA, led by Goddard's Engineering Directorate, to assess the actual TRL of the project's components, subsystems, and systems. The program ensures that projects develop action plans to address low-TRL areas and weaknesses identified by the Technical Management and Cost review panel.

3.6 Systems Engineering Management Plan

There is no program-level system engineering management plan (SEMP), as there are no program technical requirements or cross-cutting requirements across projects. Each project within ESEP develops and maintains a project SEMP. The ESEP systems engineer ensures that the project's SEMP meet the requirements defined in NPR 7123.1C.

The test, validation, and verification requirements for hardware and software are mission unique and are addressed separately in the SEMP and/or project plan for each project. The individual plans also address software independent verification and validation.

The ESEP systems engineer monitors the technical progress of all ESEP projects and conducts periodic meetings with all of the project systems engineers to facilitate and encourage dialogue and knowledge sharing across the projects. The systems engineer identifies or conducts trade studies for areas that span multiple projects to encourage risk or cost reduction for the program.

3.7 Verification and Validation

ESEP projects shall verify performance of flight and ground elements through a combination of analysis, inspection, demonstration, similarity, and test, with particular emphasis on incremental, integrated, and concurrent testing. Projects are required to develop spacecraft to launch vehicle interface requirements documents and ICDs. The launch vehicle supplier is responsible for physical integration of the spacecraft with the launch vehicle and for verification of system

integrity. The projects shall be responsible for the end-to-end flight/ground system performance verification—preferably by test, rather than by analysis.

3.8 System Security Plan

There is no program-level System Security Plan (SSP). The ESEP IT devices are covered under the WCS End-User Devices for End-User Services (OA-9999-M-CIO-2965) SSP or the Flight Projects Directorate Moderate System (CD-9999-M-GSF-3265) SSP, which each have a current Authorization to Operate and are stored within the NASA Risk Information and Security Compliance System (RISCS).

The program is responsible for ensuring ESEP projects that implement or operate a Federal Information System (FIS) - such as a Mission Operations Center (MOC), Payload Operations Center (POC) or Science Data Operations Center (SDOC) - implement cybersecurity requirements in accordance with NPR 2810.1, Security of Information and Information Systems and the Federal Information Security Modernization Act ([FISMA](#)), including the requirements in Federal Information Processing Standards 200 ([FIPS 200](#)) and the security controls in [\[SP 800-53\]](#) (See [\[44 USC 3554\]](#) (a)(1)(A)). This requirement includes externally provided FIS from commercial vendors or universities.

The term "Federal information system" means an information system used or operated by an executive agency, by a contractor of an executive agency, or by another organization on behalf of an executive agency. [\[40 USC 11331\]](#)

"On behalf of an agency" occurs when a non-executive branch entity uses or operates an information system or maintains or collects information for the purpose of processing, storing, or transmitting Federal information, and those activities are not incidental to providing a service or product to the Government. [\[32 CFR 2002.4\]](#)

ESEP projects are required to ensure vendors that receive NASA Controlled Unclassified Information comply with NIST SP 800-171, Protecting Controlled Unclassified Information in Nonfederal Systems and Organizations. This is only for IT systems that are used to provide a service or product to NASA, not systems operating on behalf of NASA. An example is providing International Traffic in Arms Regulations–restricted computer-aided drafting data to a vendor that is building a component of a spacecraft or instrument.

3.9 Review Plan

3.9.1 Program Reviews

ESEP supports reviews consistent with NPR 7120.5F. A program level status review and program implementation review are conducted by a standing review board (SRB) or as determined by SMD, on a schedule requested by the Agency AA, the SMD AA, or the ESD director. The review entrance and success criteria are derived from NPR 7120.5F and NPR 7123.1C and can be tailored by agreement between the SRB chair, the program and SMD/ESD. This review considers all aspects of ESEP and the flow down to individual projects.

3.9.2 Program Review of Projects

ESEP conducts reviews on a periodic and as-required basis to assess project progress, evaluate risk, ensure compliance, and address issues. These reviews may include, but are not limited to, monthly project reviews, independent reviews, and weekly informal tag-ups. Monthly project reviews assess technical, schedule, and cost status, and include accomplishments, issues, risks, resources status (e.g., mass, power, schedule reserve, cost reserve), schedule changes, and cost variance analysis.

3.9.3 Review Processes for the Project Office(s)

The project office ensures that the review process, as specified in the project review plan and applicable project host organization directives, is followed and supported. GPR 8700.4, Goddard Systems Reviews, defines the purpose of each review. The following sets of reviews are included in the project's review plan.

3.9.3.1 Project Gate Reviews

Project gate reviews leading to each KDP, as defined by NPR 7120.5F, are conducted by the project SRB and defined in the project plan. These formal reviews are convened by the SMD AA and implementing CD or their designees. The review entrance and success criteria are derived from NPR 7120.5F and NPR 7123.1C and can be tailored by agreement between the project SRB chair, the project, the program, and ESD.

3.9.3.2 Engineering Peer Reviews

The organization that provides the engineering product establishes a comprehensive set of engineering peer reviews. The project office host organization selects participants who are independent of the development activity under review. Every effort is made to include technical experts from, or recommended by, ESEP. The results of the review are reported to ESEP leadership.

3.9.3.3 Anomaly Reviews

Review boards are held for anomalies that have an unknown cause and represent significant programmatic or technical risk. The boards are independent of the project and established by the project office host organization's SMA office and chief engineer with applicable membership from the ESEP office's supporting TA.

3.9.3.4 Management Reviews

The project office host organization conducts regular status reviews and provides reports to the SMD weekly reporting system (as required by SMD), and monthly and/or quarterly status reviews. The project office provides/presents an overall project assessment that includes technical, schedule, cost, and management, including significant progress; concerns/issues (including resolution plans/expected outcomes); contingency/reserves and liens status; and all significant risk threats to the implementation or mission success. ESEP has a standing seat in the project office host organization's monthly senior status review process. Each project provides a summary of its status to ESEP leadership as part of the monthly review process. ESEP, through ESPD, presents its portfolio to Goddard's CMC on a monthly basis.

3.9.3.5 Assessment Reviews

The project office host organization convenes, when necessary, assessment reviews to evaluate the readiness of the project to execute a mission-critical event (e.g., launch, encounter) or to assess the design risk of a pending implementation. The project will invite representatives of ESEP and NASA Headquarters to these reviews.

3.9.4 Termination Review Criteria

During implementation, each project develops the mission within the established performance, schedule, and cost requirements identified in the PLRA (Level 1 requirements document). If at any time during development it is determined that the project is unable to achieve the PLRA requirements, takes a descope that threatens the mission science objectives, or is anticipated to exceed the ABC in terms of cost or schedule, the project is subject to a termination review.

A termination review is not required if the SMD/AA agrees to change the requirements, the project is able to demonstrate that cost growth is above and beyond its control, or it can descope the mission concept or design in order to stay within the technical, cost, and schedule constraints. If none of these mitigations occurs, then it is appropriate to recommend a termination review. The recommendation for a termination review may come from the program or the ESD.

3.9.5 Decommissioning

Decommissioning refers to the process for ending a project that has conducted some or all of its prime mission and that may have completed one or more extended missions. This is different than mission cancellation, which refers to ending project activity before the mission is launched.

There are two means within SMD that can lead to decommissioning:

- The first is through a programmatic path, such as the outcome of a senior review or a significant budget reduction.
- The second is as a result of a condition on the spacecraft; this may be an unexpected on-orbit anomaly, or the exhausting of consumable resources.

3.10 Mission Operations Plan

There is no ESEP mission operations plan because the program is composed of uncoupled missions, each of which has a dedicated mission operations plan.

3.11 NEPA Compliance Documentation

ESEP and projects comply with NPR 8580.1A, NASA National Environmental Policy Act Management Requirements. There is no program-specific environmental management plan, as the requirement is flowed to the individual ESEP project offices. Each project office prepares an environmental management plan utilizing GPD 8500.1, Environmental Policy and Program Management, or equivalent institutional requirements.

ESEP supports the project offices in the development of these plans. Products and processes with environmental issues are identified at the earliest possible time during formulation to ensure that planning and decisions reflect environmental values, avoid delays later in the process, and

head off potential conflicts. Project environmental data management plans are submitted to the ESEP for approval.

3.12 Integrated Logistics Support Plan

The logistics requirements are identified by each project in their individual project plans. There is no program-level logistics plan. The ESEP project offices prepare logistics plans utilizing established Center/institutional processes and procedures in accordance with the project plan requirements in NPR 7120.5F and NPD 7500.1, Program and Project Logistics Policy.

3.13 Science Data Management Plan

There is no ESEP-level science data management plan, as the requirement is flowed down to the projects. In accordance with NASA policy, data are to be released as quickly as possible after a brief validation period appropriate for the mission. ESEP mission teams are responsible for collecting the scientific, engineering, and ancillary information necessary to validate and calibrate the scientific data prior to depositing it in the appropriate NASA data archive. The time required to complete the process should be the minimum necessary to provide appropriate data to the scientific community and to the general public. The PI provides this plan in the proposal. The plan describes how the project manages the scientific data generated and captured by the operational mission and describes how data are generated, processed, distributed, analyzed, and archived. The plan is submitted to ESEP for approval.

Each ESEP project develops an approach to knowledge capture and dissemination, including compliance with NPD 2200.1D, Management of NASA Scientific and Technological Information, and NPR 2200.2E, Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technological Information.

3.14 Configuration Management Plan

ESEP implements a CM process for the program per ESPD's Configuration Management Procedure (420-PG-1410.2.1F). The CM procedure describes the structure of the CM organization and tools used. It describes the methods and procedures to be used for configuration identification, configuration control, interface management, configuration traceability, and configuration status accounting and communications.

The ESEP Configuration Change Board (CCB) is chaired by the ESE program manager or designee, who has overall responsibility for all ESEP and project office activities.

ESEP follows the information management and knowledge capture requirements in NPD 2200.1D, Management of NASA Scientific and Technical Information; NPR 2200.2E Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information; NPD 1440.6I, NASA Records Management; and NPR 1441.1E, NASA Records Retention Schedules.

Each mission develops a CM plan that meets the requirements of NPR 7123.1C and GPR 1410.2, Configuration Management. It is used for configuration identification, configuration control, interface management, records traceability, and document status. It includes how important information records are created, maintained, and retained.

Each ESEP project manages information throughout its lifecycle through the use of their respective configuration management systems. ESEP maintains copies of critical project documentation in the ESPD Document Management System.

The program and each project utilize an electronic library/CM system to identify, control, and disposition program and project records under NPD 1440.6, NASA Records Management; NPD 1441.1, NASA Records Management Program Requirements; and NASA Records Retention Schedules. These systems allow control of records, including documents and drawings from inception through disposition. These systems also serve as a central hub to track and update all revisions and relay information to all approved users. Access to these systems is handled through NASA's Access Management System (NAMS).

An ESEP organizational records inventory (formerly "file plan") is updated annually to serve as an inventory of all ESEP records. All records are identified by respective Agency filing schemes, record titles, record custodians, file locations, and retention periods. The retention period is determined by the record type. Temporary records are records that the National Archives and Records Administration (NARA) has approved for either immediate disposal or for disposal after a specified time or event. Permanent records are those that NARA appraises as having sufficient value to warrant continued preservation by the Federal Government as part of the National Archives of the United States.

3.15 Security Plan

3.15.1 Security Requirements

ESEP methodology for ensuring security and technology protection uses established procedures in the GPR documents, with the assistance of Goddard's Facilities Division and Goddard Security Division. Goddard maintains building emergency plans (GPR 8710.2). Required security training materials, such as the "Cybersecurity and Sensitive Unclassified Information Awareness Training Course," are recorded and maintained in the System for Administration, Training, and Educational Resources for NASA (SATERN) learning system. The program's approach to implementing IT security requirements is in accordance with NPR 2810.1F. The content of these plans addresses the emergency notification system, types of emergency situations, occupant response procedures, and incident management responsibilities. The program identifies an individual who works with the facilities operations managers to maintain and communicate building emergency plans.

3.15.2 Emergency Response Requirements for Facilities

ESEP complies with NPR 1040.1, NASA Continuity of Operations Planning and Procedural Requirements, and GPR 8710.2D, Emergency Preparedness Plan for Greenbelt. The program identifies an individual (nominally the program support manager) who works with the facilities operations managers to maintain and communicate building emergency plans.

3.15.3 Threat Summary

Threat summaries attempt to document the threat environment that a NASA space system is most likely to encounter as it reaches operational capability. These documents contain Top Secret/Sensitive Compartmented Information and are the basis for establishing threat levels that

are used to develop survivability strategies and risk avoidance or mitigation measures. Threat summaries draw their information from intelligence community documents and address all segments of a space system, with emphasis on the space segment. Whenever possible, coordinated intelligence community documents (i.e., National Intelligence Estimates and Intelligence Community Briefs) are used as reference sources in writing the summaries. Where there is a difference of opinion between organizations about a threat, the threat summary gives a range of threat estimates and identifies each agency's position.

ESEP has no space assets or supporting infrastructures to protect from disruption, degradation, or destruction from environmental, mechanical, electronic, or hostile actions. Space assets and supporting infrastructure are developed and maintained by the missions. Projects are responsible for protection and survivability engineering throughout the entire design and development of space systems.

In response to the viable threats documented in the threat summary for a specific mission, a project protection plan is developed to document the survivability strategy(s) used by the project, to identify the valid threats and corresponding vulnerabilities to the mission, and to recommend potential countermeasures to ensure the protection of infrastructure elements that support a civil space system.

3.16 Technology Transfer Control Plan (formerly Export Control Plan)

There is no ESEP-level export control plan, as the deliverables subject to export control are provided at the project office level. Each project prepares and implements an export control plan as required, with assistance from Goddard's Export Control Office. ESEP projects comply with the export control requirements specified in NPR 2190.1C, NASA Export Control Program.

Agreements between NASA and other governments or foreign entities are established through agreements, memoranda, and arrangements such as letters of agreement (LOA), memoranda of understanding (MOU), and implementing agreements. NASA Headquarters OIIR leads the establishment of LOAs, MOUs, and implementing agreements with the support of the program and project offices. The LOAs can either be exclusively for formulation if the dollar value of the contribution is high and then followed by an MOU (or equivalent) during implementation, or an LOA can cover both formulation and implementation if the dollar value is low as determined by the OIIR. MOUs and LOAs are only established for hardware and software contributions and not for science contributions. The MOUs and LOAs go through the U.S. Department of State via OIIR so they can be used for technology assistance agreements.

When there is no contribution to NASA (for example, when a project contractor wants to purchase components from Europe), the contractor is responsible for getting Department of State approval for the import. Applications to the Department of State for licenses and technology assistance agreements for ESEP missions will be routinely routed through ESE program executives for concurrence. U.S. International Traffic in Arms Regulations and Export Administration Regulation laws still apply.

ESEP and project personnel receive U.S. International Traffic in Arms Regulations training per NPR 2190.1C. All international technical exchanges are approved by Goddard's Export Control Office.

3.17 Communications Plan

There is no ESEP-level communication plan. ESD is responsible for all ESEP and project press releases.

3.18 Knowledge Management Plan

To ensure that the Agency's knowledge is captured and accessible across all NASA Centers, with appropriate measures to safeguard Controlled Unclassified Information and comply with Federal laws and regulations, the project manager is responsible for determining lessons learned and entering them into NASA's database under NPD 7120.6A, Knowledge Policy on Programs and Projects, and NPD 7120.4E, NASA Engineering and Program/Project Management Policy, throughout the program/project lifecycle.

3.19 Human Rating Certification Package

A human rating certification package is not applicable to ESEP.

3.20 Quality Assurance Surveillance Plan

There is no ESEP-level Quality Assurance Surveillance Plan. The SMA surveillance plan is a project-level overview of the activities and approaches that the SMA team may use to ensure that the project performance requirements are met. These generally include evaluation of programmatic and engineering aspects of the project that affect risks. In accordance with NPR 8735.002C, Government contract quality assurance (QA) tasks are those performed by a representative of the Government project office that evaluate a supplier's likelihood to achieve compliance with technical specifications, quality control requirements, and other QA requirements or that verify compliance. The surveillance approach balances the impact of surveillance against the risks of mission failure, cost overruns, schedule delays, and potential breaches of safety, security, or export controls. This plan is revised as necessary over the project lifecycle based on the evaluation of performance and risks.

3.21 Orbital Collision Avoidance Plan

There is no ESEP-level Orbital Collision Avoidance Plan. The requirement is flowed down to ESEP projects. The projects' plans shall meet the requirements of NID 7120.132, Collision Avoidance for Space Environment Protection.

ESEP reviews and approves each project's Orbital Collision Avoidance Plan.

Per NPR 7120.5F, each ESEP project is required to comply with NPR 8715.6, Procedural Requirements for Limiting Orbital Debris, and NASA-STD-8719.14, Process for Limiting Orbital Debris. NPR 8715.6 requires routine conjunction assessments for all NASA orbital assets with maneuvering capability. The project management staff for each operational orbital payload will coordinate with the Conjunction Assessment Risk Analysis (CARA) Program, located at Goddard, for meeting this policy requirement and to communicate any indicated risks. Final plans, including demonstrations, need to be implemented at least three months prior to launch. A foreign partner providing operational services must sign a standard CARA nondisclosure agreement.

3.22 Human Systems Integration Plan

This plan applies only to tightly coupled and single-project programs; it is not applicable to ESEP.

4 WAIVERS OR DEVIATIONS LOG

The program maintains a waivers log consistent with the requirements of NPR 7120.5F and as documented in the Compliance Matrix (Appendix C).

5 CHANGE LOG

A change log is included on page ii to incorporate any projects added for implementation, terminated, or for documentation revisions.

Appendix A. Abbreviations and Acronyms

AA	Associate Administrator
ABC	Agency Baseline Commitment
AO	Announcement of Opportunity
APMC	Agency Program Management Council
CARA	Conjunction Assessment Risk Analysis
CCB	Configuration Change Board
CD	Center Director
CI	Configured Item
CM	Configuration Management
CMC	Center Management Council
CSO	Chief Safety and Mission Assurance Officer
DPMC	Directorate Program Management Council
ELV	Expendable Launch Vehicle
ESD	Earth Science Division
ESEP	Earth System Explorers Program
ESMO	Earth Science Mission Operations
ESMPO-G	Earth Systematic Mission Program Office at Goddard
ESTO	Earth Science Technology Office
ETA	Engineering Technical Authority
EUSO	End User Services Program Office
EVM	Earned Value Management
FAR	Federal Acquisition Regulation
GPR	Goddard Procedural Requirement
IBR	Integrated Baseline Review
ICD	Interface Control Document
IT	Information Technology
JCL	Joint Confidence Level
KDP	Key Decision Point
KPP	Key Performance Parameter
LCR	Life Cycle Review
LOA	Letter of Agreement
LSP	Launch Services Program
MA	Management Agreement
MAR	Mission Assurance Requirements
MIDEX	Medium-Class Explorers
MOU	Memorandum of Understanding
NAMS	NASA Access Management System
NARA	National Archives and Records Administration
NFS	NASA FAR Supplement
NLS	NASA Launch Services

NLT	No Later Than
NOA	New Obligation Authority
NPD	NASA Policy Directive
NPR	NASA Procedural Requirement
OCT	Office of the Chief Technologist
OIIR	Office of Interagency and International Relations
PCA	Program Commitment Agreement
PI	Principal Investigator
PLAR	Post-Launch Assessment Review
PLRA	Program Level Requirements Appendix
PMB	Performance Measurement Baseline
PMC	Program Management Council
PPMB	Program and Project Management Board
QA	Quality Assurance
RPP	Reimbursable Projects Program
SATERN	System for Administration, Training, and Educational Resources for NASA
SEMP	System Engineering Management Plan
SMA	Safety and Mission Assurance
SMD	Science Mission Directorate
SOMD	Space Operations Mission Directorate
SRB	Standing Review Board
STMD	Space Technology Mission Directorate
TA	Technical Authority
TO	Targeted Observable

Appendix B. Program Level Requirements Appendices

This section includes all PLRA appendices to the program plan. They each identify the mission, science and programmatic (funding and schedule) requirements imposed on the implementing organization for the development and operation of the project under the Explorers program.

The Explorers program maintains a detailed PLRA Matrix, which is updated as needed.

For more information, see Sections 1.1, 2.2, 2.5, and 3.1 above.

Appendix C. Compliance Matrix

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
2.1.1.2	Regardless of the structure of a program or project meeting the criteria of Section P.2, this NPR shall apply to the full scope of the program or project and all the activities under it.	NASA AA	No			A	FC		
2.1.3.1	Projects are Category 1, 2, or 3 and shall be assigned to a category based initially on: (1) the project life-cycle cost (LCC) estimate, the inclusion of significant radioactive material, and whether or not the system being developed is for human space flight; and (2) the priority level, which is related to the importance of the activity to NASA, the extent of international participation (or joint effort with other government agencies), the degree of uncertainty surrounding the application of new or untested technologies, and spacecraft/payload development risk classification.	NASA AA	No	A			FC		
2.1.3.2	For Category 1 projects, the assignment of a project to a Center or implementing organization shall be with the concurrence of the NASA AA.	NASA AA	No	A			N/A	ESEP includes only Category 2 projects.	
2.1.4.1	Programs and projects with a LCC or initial capability cost (see Section 2.4.1.3.b) greater than \$250M shall be managed by program and project managers who have been certified in compliance with Office of Management and Budget (OMB)'s promulgated Federal acquisition program/project management certification requirements.	NASA AA	No	A			FC		
2.2.1	Program and project managers shall follow their appropriate life cycle, which includes life-cycle phases; life-cycle gates and major events, including KDPs; major life-cycle reviews (LCRs); principal documents that govern the conduct of each phase; and the process of recycling through Formulation when program changes warrant such action.	NASA AA	Yes			A	FC		
2.2.2	Program and project managers shall organize the work required for each phase using a product-based WBS developed in accordance with the Program and Project Plan templates (appendices G and H).	OCFO	Yes			A	FC		
2.2.3	The documents shown on the life-cycle figures and described below shall be prepared in accordance with the templates in appendices D, E, F, G, and H.	NASA AA	Yes			A	FC		

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
2.2.4	Each program and project shall perform the LCRs and KDPs identified in its respective life-cycle figure in accordance with NPR 7123.1, applicable Center practices, and the requirements of this document.	OCE	Yes			A	T	The tailoring of NPR-7120.5F, which includes combining SRR/SDR, was endorsed by the Agency Program and Project Management Board (PPMB) and approved by the NASA Associate Administrator in July 2022.	See Center Director signature on signature page
2.2.5	Program or project managers and an independent Standing Review Board (SRB) shall conduct the System Requirements Review (SRR), System Definition Review (SDR)/ Mission Definition Review (MDR), Preliminary Design Review (PDR), Critical Design Review (CDR), System Integration Review (SIR), Operational Readiness Review (ORR), and PIR LCRs in figures 2-2, 2-3, 2-4, and 2-5.	NASA AA	No			A	T	The tailoring of NPR-7120.5F, which includes combining SRR/SDR, was endorsed by the Agency Program and Project Management Board (PPMB) and approved by the NASA Associate Administrator in July 2022.	See NASA AA signature on signature page
2.2.5.1	The Conflict of Interest (COI) procedures detailed in the NASA Standing Review Board Handbook shall be strictly adhered to.	OGC	No	A	A	A	FC		
2.2.5.2	The portion of the LCRs conducted by the SRB shall be convened by the Convening Authorities in accordance with Table 2-2.	NASA AA	No	A	A	A	FC		
2.2.5.3	The program or project manager, the SRB chair, and the Center Director (or designated Engineering Technical Authority (ETA) representative) shall mutually assess the program's or project's expected readiness for the LCR and report any disagreements to the Decision Authority for final decision.	NASA AA	No		A	A	FC		
2.2.6	In preparation for these LCRs, the program or project manager shall generate the appropriate documentation per the Appendix I tables of this document, NPR 7123.1, and Center practices, as necessary, to demonstrate that the program's or project's definition and associated plans are sufficiently mature to execute the follow-on phase(s) with acceptable technical, safety, and programmatic risk.	NASA AA	No			A	FC		
Table I-1 Uncoupled and Loosely Coupled Program Milestone Products and Control Plans Maturity Matrix									

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
Table I-1	1. FAD [Baseline at SRR] [Required per NPR 7120.5]	NASA AA	No	A		A	FC		
Table I-1	2. PCA [Baseline at KDP I] [Required per NPR 7120.5]	NASA AA	No	A			FC		
Table I-1	3. Program Plan [Baseline at SDR] [Required per NPR 7120.5]	NASA AA	No	A	A	A	FC		
Table I-1	3.a. Mission Directorate requirements and constraints [Baseline at SRR] [Required per NPR 7123.1]	OCE	Yes	A		A	FC		
Table I-1	3.b. Traceability of program-level requirements on projects to the Agency strategic goals and Mission Directorate requirements and constraints [Baseline at SDR] [Required per NPR 7123.1]	OCE	Yes	A		A	FC		
Table I-1	3.c. Documentation of driving ground rules and assumptions on the program [Baseline at SDR] [Required per NPR 7120.5]	NASA AA	Yes	A		A	FC		
Table I-1	4. Interagency and international agreements [Baseline at SDR]	NASA AA	Yes	A		A	FC	ESEP has no interagency or international agreements.	
Table I-1	5. ASM Decision Memorandum or ASM meeting summary [additional information in NPD 1000.5]	NASA AA	Yes	A		A	FC	The NASA Associate Administrator delegated decision authority of the Acquisition Strategy Meetings (ASMs) to the SMD AA, with the SMD Program Management Council (PMC) serving as the governing council. No ASM is needed as ESEP implements an Announcement of Opportunity (AO) process.	See SMD AA signature on signature page.
Table I-1	6. Risk mitigation plans and resources for significant risks [Required per NPR 7120.5]	NASA AA	Yes			A	FC		
Table I-1	7. Documented Cost and Schedule Baselines [Baseline at SDR] [Required per NPR 7120.5]	OCFO-SID	No			A	FC		

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
Table I-1	8. Documentation of Basis of Estimate (cost and schedule) [Baseline at SDR] [Required per NPR 7120.5]	OCFO-SID	No			A	FC		
Table I-1	9. Documentation of performance against plan/baseline, including status/closure of formal actions from previous KDP [Required per NPR 7120.5]	NASA AA	Yes			A	N/A	Per ESEP tailoring agreement approved by NASA AA, KDP I is the first KDP.	
Table I-1	10. Industrial Base and Supply Chain Risk Management (SCRM) Strategy and Status [Baseline at SDR] [Required per NPR 8735.2]	OSMA	No			A	N/A	ESEP will not use industrial base or a supply chain.	
Program Plan Control Plans									
Table I-1	1. Technical, Schedule, and Cost Control Plan [Baseline at SDR] [Required per NPR 7120.5]	NASA AA	Yes			A	FC		
Table I-1	2. Safety and Mission Assurance Plan [Baseline at SDR] [Required per NPRs 8705.2 and 8705.4]	OSMA	Yes			A	FC	ESEP Class C MAR developed to support AO process. Each project will develop a compliance matrix that responds to the MAR.	
Table I-1	3. Risk Management Plan [Baseline at SDR] [Required per NPR 8000.4]	OSMA	Yes			A	FC		
Table I-1	4. Acquisition Strategy [Baseline at SDR] [Required per NPD 1000.5]	NASA AA	Yes			A	FC	The NASA Associate Administrator delegated decision authority of the Acquisition Strategy Meetings (ASMs) to the SMD AA, with the SMD Program Management Council (PMC) serving as the governing council. No ASM is needed as ESEP implements an Announcement of Opportunity (AO) process.	See SMD AA signature on signature page.

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
Table I-1	6. Systems Engineering Management Plan [Baseline at SRR] [Required per NPR 7123.1]	OCE	Yes			A	N/A	N/A at program level; no technical requirements and no cross-cutting requirements across projects. All projects will develop a SEMP.	
Table I-1	7. System Security Plan [Baseline at SDR] [Required per NPR 2810.1]	OCIO	No			A	FC		
Table I-1	8. Review Plan [Baseline at SRR] [Required per NPR 7120.5]	NASA AA	Yes			A	FC		
Table I-1	9. NEPA Compliance Documentation [Baseline at SDR] [Required per NPR 8580.1]	OSI-EMD	No			A	FC	ESEP NEPA questionnaire submitted; no further actions required. Each project will develop NEPA Compliance Documentation.	
Table I-1	10. Configuration Management Plan [Baseline at SDR] [Required per NPR 7120.5; additional information in NPR 7123.1 and SAE/EIA 649]	OCE	Yes			A	FC		
Table I-1	11. Security Plan [Baseline at SDR] [Required per NPR 1040.1 and NPR 1600.1]	OPS	No			A	FC		
Table I-1	12. Technology Transfer (formerly Export) Control Plan [Baseline at SDR] [Required per NPR 2190.1]	OIIR	No			A	FC		
Table I-1	15. Quality Assurance Surveillance Plan [Baseline at SDR] [Required per NPR 8735.2 and NASA FAR Supplement part 1837.604]	OSMA	Yes			A	N/A	ESEP Class C MAR developed to support AO process. Each project will develop a quality assurance plan that responds to the MAR.	
2.2.8	Projects, single-project programs (and other programs at the discretion of the MDAA) with a life-cycle cost (LCC) or initial capability cost (see Section 2.4.1.3.b) estimated to be greater than \$250M shall perform earned value management (EVM) and comply with EIA-748, Standard for Earned Value Management Systems for all portions of work including in-house and contracted portions of the project.	OCFO-SID	No	A		A	FC	Each project will develop an EVM Plan.	
2.2.8.1	Program and project managers with programs and projects subject to EVM shall utilize the NASA EVM Capability Process for in-house work.	OCFO-SID	No			A	FC		

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
2.2.8.2	EVM system requirements for contracted work shall be applied to suppliers in accordance with the NASA Federal Acquisition Regulation Supplement, independent of phase of the \$250M threshold (https://www.hq.nasa.gov/office/procurement/regs/NFS.pdf).	OCFO-SID	No	A		A	FC		
2.2.8.3	Mission Directorates shall conduct an IBR in preparation for KDP C and for major changes that significantly impact the cost and schedule baseline.	OCFO-SID	No	A		A	FC		
2.2.8.4	EVMS surveillance shall be conducted on contracts and programs and projects with in-house work to ensure continued compliance with EIA-748, Standard for Earned Value Management Systems.	OCFO-SID	No	A		A	FC		
2.2.10	Program and project managers shall complete and maintain a Compliance Matrix (see Appendix C) for this NPR and attach it to the Formulation Agreement for projects in Formulation and/or the Program or Project Plan.	OCE	No			A	FC		
2.2.11	Single-project programs and projects shall develop a Project Protection Plan that addresses NASA-STD-1006, Space System Protection Standard in accordance with NPR 1058.1, Enterprise Protection Program.	OCE	No			A	FC	Each project will develop a PPP.	
2.3.1	Each program and project shall have a Decision Authority the Agency's responsible individual who determines whether and how the program or project proceeds through the life cycle and the key program or project cost, schedule, and content parameters that govern the remaining life-cycle activities.	NASA AA	No	A			FC		
2.3.1.1	The MDAA shall inform the NASA AA and Administrator via email on all Agency Baseline Commitments (ABCs) per the following: inform the NASA AA on ABCs for single-project programs and projects with a LCC or initial capability cost (see Section 2.4.1.3.b) greater than \$250M; and inform the NASA Administrator on ABCs for all single-project programs and projects with a LCC or initial capability cost greater than \$1B and all Category 1 projects. (See Section 2.4.1.5 for more information on ABCs.)	NASA AA	No	A			FC		
2.3.2	Each program and project shall have a governing PMC.	NASA AA	No	A			FC		

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
2.3.4	The Center Director (or designee) shall oversee programs and projects usually through the CMC, which monitors and evaluates all program and project work (regardless of category) executed at that Center.	NASA AA	No		A		FC		
2.3.5	Following each LCR, the independent SRB chair and the program or project manager shall brief the applicable management councils on the results of the LCR to support the councils' assessments.	NASA AA	No	A	A	A	FC		
2.4.1	The decisions by the Decision Authority on whether and how the program or project proceeds into the next phase shall be summarized and recorded in the Decision Memorandum signed at the conclusion of the governing PMC by all parties with supporting responsibilities, accepting their respective roles.	NASA AA	No	A			FC		
2.4.1.1	The Decision Memorandum shall describe the constraints and parameters within which the Agency, the program manager, and the project manager will operate; the extent to which changes in plans may be made without additional approval; any additional actions that came out of the KDP; and the supporting data (i.e., the cost and schedule datasheet) that provide further details.	NASA AA	No	A		A	FC		
2.4.1.2	A divergence from the Management Agreement that any party identifies as significant shall be accompanied by an amendment to the Decision Memorandum.	NASA AA	No	A		A	FC		
2.4.1.3	During Formulation, the Decision Memorandum shall establish a target LCC or initial capability cost range (and schedule range, if applicable) as well as the Management Agreement addressing the schedule and resources required to complete Formulation.	OCFO-SID	No	A		A	FC		
2.4.1.3 a	For single-project programs and projects with a LCC or initial capability cost greater than or equal to \$1B, the Decision Memorandum shall establish a high and low value for cost and schedule with the corresponding JCL value at KDP B.	OCFO-SID	No	A		A	N/A	All project LCC < \$1B.	
2.4.1.5	All single-project program managers and project managers shall document the Agency's LCC estimate or initial capability cost estimate and other parameters in the Decision Memorandum for Implementation (KDP C), and this becomes the ABC.	NASA AA	No	A		A	FC		

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
2.4.1.5.a	For all single-project programs and projects with a definite Phase E end point, the Agency's LCC estimate and other parameters shall become the ABC.	NASA AA	No	A		A	FC		
2.4.1.5.b	For single-project programs and projects that plan continuing operations and production, including integration of capability upgrades, with an unspecified Phase E end point, the initial capability cost estimate and other parameters shall become the ABC.	NASA AA	No	A		A	FC		
2.4.1.7	Tightly coupled programs shall document their LCC estimate in accordance with the scope defined in the FAD or PCA, and other parameters in their Decision Memorandum at KDP I and update it at subsequent KDPs.	OCFO-SID	No	A		A	N/A	ESEP is an uncoupled program.	
2.4.1.8	Programs or projects shall be rebaselined when: (1) the estimated development cost exceeds the ABC development cost by 30 percent or more (for projects over \$250M, also that Congress has reauthorized the project); (2) the NASA AA judges that events external to the Agency make a rebaseline appropriate; or (3) the NASA AA judges that the program or project scope defined in the ABC has been changed or the project has been interrupted.	OCFO-SID	No	A		A	FC		
2.4.2	The program or project shall document the basis of estimate (BOE) for cost estimates and planned schedules in retrievable program or project records.	OCFO-SID	No			A	FC		
2.4.3.1 a.	Single-project programs with an estimated LCC under \$1B and projects with an estimated LCC greater than \$250M and under \$1B shall provide a range of cost and a range for schedule, each range (with confidence levels identified for the low and high values of the range) established by a probabilistic analysis and based on identified resources and associated uncertainties by fiscal year.	OCFO-SID	No			A	FC		
2.4.3.1 b.	Single-project programs and projects with an estimated LCC greater than or equal to \$1B shall develop a JCL and provide a high and low value for cost and schedule with the corresponding JCL value (e.g., 50 percent, 70 percent).	OCFO-SID	No			A	N/A	All project LCC < \$1B.	
2.4.3.2	At KDP C, single-project programs (regardless of LCC) and projects with an estimated LCC greater than \$250M shall develop a cost-loaded schedule and perform a risk-informed probabilistic analysis that produces a JCL.	OCFO-SID	No			A	FC		

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
2.4.3.3	At CDR, single-project programs and projects with an estimated LCC greater than or equal to \$1B shall update their KDP C JCL and communicate the updated JCL values for the ABC and Management Agreement to the APMC for informational purposes.	OCFO-SID	No			A	N/A	All project LCC < \$1B.	
2.4.3.4	At KDP D, single-project programs and projects with an estimated LCC greater than or equal to \$1B shall update their JCL if current reported development costs have exceeded the development ABC cost by 5 percent or more and document the updated JCL values for the ABC and Management Agreement in the KDP D Decision Memorandum.	OCFO-SID	No			A	N/A	All project LCC < \$1B.	
2.4.3.5	When a single-project program (regardless of LCC) or project with an estimated LCC greater than \$250M is rebaselined, a JCL shall be calculated and evaluated as a part of the rebaselining approval process.	OCFO-SID	No	A		A	FC		
2.4.4.1	At KDP B, Mission Directorates shall plan and budget single-project programs and projects with an estimated LCC greater than or equal to \$1B based on a 70 percent JCL or as approved by the Decision Authority.	OCFO-SID	No	A			N/A	All project LCC < \$1B.	
2.4.4.2	At KDP C, Mission Directorates shall plan and budget single-project programs (regardless of LCC) and projects with an estimated LCC greater than \$250M based on a 70 percent JCL or as approved by the Decision Authority.	OCFO-SID	No	A			FC		
2.4.4.3	At KDP B and KDP C, any JCL approved by the Decision Authority at less than 70 percent shall be justified and documented in a Decision Memorandum.	OCFO-SID	No	A			FC		
2.4.4.4	At KDP C, Mission Directorates shall ensure funding for single-project programs (regardless of LCC) and projects with an estimated LCC greater than \$250M is consistent with the Management Agreement and in no case less than the equivalent of a 50 percent JCL or as approved by the Decision Authority.	OCFO-SID	No	A			FC		
2.4.4.5	At KDP C, any funding approved by the Decision Authority that is inconsistent with the Management Agreement or less than 50 percent JCL shall be justified and documented in a Decision Memorandum.	OCFO-SID	No	A			FC		

Para #	NPR 7120.5 Requirement Statement	Requirement Owner	Delegated	MD AA	CD	PM	Comply?	Justification	Approval
2.4.5	Tightly coupled, loosely coupled, and uncoupled-programs shall provide analysis of the program's risk posture to the governing PMC as each new project reaches KDP B and C or when a project's ABC is rebaselined.	OCFO-SID	No	A		A	FC		
3.3.1	Programs and projects shall follow the Technical Authority (TA) process established in this Section 3.3.	OCE	No	A	A	A	FC		
3.4.1	Programs and projects shall follow the Formal Dissent process in this Section 3.4.	NASA AA	No	A	A	A	FC		
3.5.1	Programs and projects shall follow the tailoring process in this Section 3.5.	NASA AA	No	A	A	A	FC		
3.5.5	A request for a permanent change to a prescribed requirement in an Agency or Center document that is applicable to all programs and projects shall be submitted as a "change request" to the office responsible for the requirement policy document unless formally delegated elsewhere.	NASA AA	No	A	A	A	FC		
3.6.1	Center Directors negotiating reimbursable space flight work with another agency shall propose NPR 7120.5 as the basis by which it will perform the space flight work.	NASA AA	No		A		FC		
3.7.1	Each program and project shall perform and document an assessment to determine an approach that maximizes the use of SI.	OCE	No			A	FC		

Appendix D. Applicable and Reference Documents

APPLICABLE DOCUMENTS

NPR 7120.5F, *NASA Space Flight Program and Project Management Requirements*
NPR 7123.1C, *NASA Systems Engineering Processes and Requirements*

REFERENCE DOCUMENTS

NASA POLICY DIRECTIVES

NM 7120-81, *NASA Interim Directive (NID) for NASA Procedural Requirements (NPR) 7120.5D*
NPD 1000.0, *NASA Governance and Strategic Management Handbook*
NPD 1000.5, *Policy for NASA Acquisition*
NPD 1600.2, *NASA Security Policy*
NPD 2200.1, *Management of NASA Scientific and Technical Information*
NPD 2810.1, *NASA Information Security Policy*
NPD 7120.4, *NASA Engineering and Program/Project Management Policy*
NPD 7500.1, *Program and Project Logistics Policy*
NPD 8010.3, *Notification of Intent to Decommission or Terminate Operating Space Systems and Terminate Missions*
NPD 8700.1, *NASA Policy for Safety and Mission Success*
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*
NPD 9501.3, *Earned Value Management*

NASA PROCEDURAL REQUIREMENTS

NPR 1040.1, *NASA Continuity of Operations Planning (COOP) Procedural Requirements*
NPR 1441.1, *NASA Records Retention Schedules*
NPR 1600.1, *NASA Security Program Procedural Requirements*
NPR 2190.1, *NASA Export Control Plan*.
NPR 2200.2, *Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information*
NPR 2810.1, *Security of Information Technology*
NPR 6000.1, *Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components*
NPR 7120.5, *NASA Space Flight Program and Project Management Requirements* (see also NM 7120-81)
NPR 7120.6, *Lessons Learned Process*
NPR 7120.8, *NASA Research and Technology Program and Project Management Requirements*
NPR 7123.1, *NASA Systems Engineering Processes and Requirements*
NPR 7150.2, *NASA Software Engineering Requirements*
NPR 7900.3, *Aircraft Operations Management*
NPR 8000.4, *Agency Risk Management Procedural Requirements*
NPR 8580.1, *Implementing the National Environmental Policy Act and Executive Order 12114*
NPR 8705.6, *Safety and Mission Assurance Audits, Reviews, and Assessments*

NPR 8715.3, *NASA General Safety Program Requirements*
NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debris*
NPR 8735.2, *Management of Government Quality Assurance Functions for NASA Contracts*

ADDITIONAL AGENCY DOCUMENTS

2022 NASA Strategic Plan
2018, Thriving on Our Changing Planet, A Decadal Strategy for Earth Observation from Space (Decadal Survey)
Federal Acquisition Regulation (FAR)
International Traffic In Arms Regulations (22 CFR 120-130)
NASA Earth Science Data and Information Policy
NASA FAR Supplement (NFS)
NASA Systems Engineering Handbook (NASA/SP-2007-6105, Rev1)
Science Mission Directorate Management Handbook (SMD Management Handbook), 2016.

NASA STANDARDS

NASA-STD-8719.13, *NASA Software Safety Standard*
NASA-STD-8719.14, *NASA Standard Process for Limiting Orbital Debris*
NASA-STD-8739.8, *NASA Software Assurance Standard*

NON NASA STANDARDS

ANSI/EIA 748-A, *ANSI Standard for Earned Value Management Systems*

GODDARD PROCEDURAL REQUIREMENTS AND POLICY DIRECTIVES

GPR 7120.3, Management of Principal Investigator Mode Missions
GPR 7120.7B, Funded Schedule Margin and Budget Margin for Flight Projects
GPD 500-PG-7120.0.1b Implementation of Engineering Technical Authority
GPR 300-PG-7120.0.1 Implementation of Safety and Mission Assurance Technical Authority
GPR 7120.4, Risk Management Procedural Requirements
GPR 1410.2 Configuration Management
GPR 8700.4, Goddard Systems Reviews
GPR 8710.2 Goddard Building Emergency Plans
GPR 8710.2D, Emergency Preparedness Plan
GPD 8500.1, Environmental Policy and Program Management

ESEP DOCUMENTS

420-01-13, *Earth System Explorers Program Plan*
420-PG-1410.2.1F, *ESPD Configuration Management Plan*
420-01-15, *Earth System Explorers Program Risk Management Plan*

WEBSITE REFERENCES

<https://espd.gsfc.nasa.gov/projects.html>