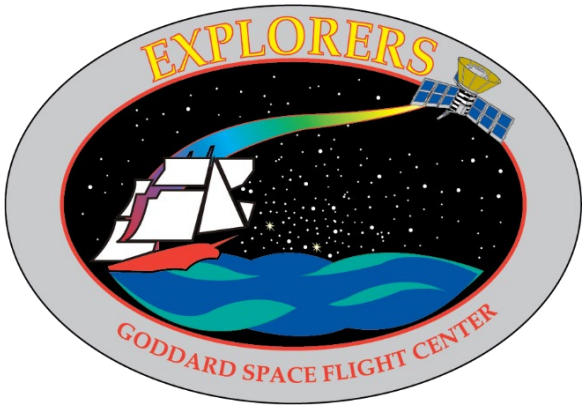
EXP-PLAN-0001, Revision C
Explorers Program

Explorers Program Plan



National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

Explorers Program Plan
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Configuration Management Foreword

This document is an Explorers Program controlled document. Changes to this document require prior approval of the Explorers Program Configuration Control Board (CCB) Chairperson.

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

Questions or comments concerning this document should be addressed to:

Explorers Configuration Management Office
Mail Stop 460
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Greenbelt, Maryland 20771

Table of Contents

List of Figures

List of Tables

1 PROGRAM OVERVIEW

1.1 Introduction

The Explorers program is the oldest continuous National Aeronautics and Space Administration (NASA) program. It is comprised of a long-standing series of space science missions that are independent, but share a common NASA oversight/insight management structure. Initiated with the Explorers 1 launch in 1958, the Explorers program has launched over 100 missions. Notable Explorers missions include the Nobel Prize yielding Cosmic Background Explorers mission and the first historically black college and university-managed space mission, the Aeronomy of Ice in the Mesosphere mission.

The program administers principal investigator (PI)-led science investigations for the Astrophysics and Heliophysics Divisions (APD and HPD) within the Science Mission Directorate (SMD). Solicitations through an announcement of opportunity (AO) competitive selection ensure the most current and best strategic science will be accomplished.

Since the early 1990s, the Explorers program has provided several mission classes in support of flight opportunities for the science program. Each mission classwas designed to increase the number of flight opportunities in response to recommendations from the scientific community. The Explorers missions are highly responsive to new knowledge, new technologies, and updated scientific priorities through the strategy of launching modest missions that can be conceived and executed in a relatively short development cycle.

This program plan encompasses the Astrophysics and Heliophysics Explorers program missions. The Astrophysics and Heliophysics Explorers programs share a program office and a common management structure. This program plan meets all requirements from NASA Procedural Requirement (NPR) 7120.5, NASA Space Flight Program and Project Management Requirements, but given the goals and objectives for each division, the plan below utilizes a different numbering paradigm to accommodate each division in response to its program commitment agreements (PCAs). Each Explorers mission develops and attaches a project plan and a program level requirements appendix (PLRA) to this program plan (see Appendix C).

The role of the Explorers program office is to support the PIs to assure mission success and to provide comprehensive oversight of mission development progress for the appropriate SMD division. The specific missions cited throughout this plan are provided as examples only, and will not be updated. Current missions will vary over time.

The goal of NASA's Explorers Program is to provide frequent flight opportunities for high quality, high value, focused Astrophysics and Heliophysics science investigations that can be accomplished under a not-to-exceed cost cap and that can be developed relatively quickly. The NASA Explorers Program accomplishes these world-class space science investigations utilizing efficient management approaches to contain mission cost through commitment to, and control of, design, development, and operations costs. The Explorers program objective of conducting a rapid series of science investigations, enables a NASA response to new knowledge, technology, and science priorities.

The Explorers program provides multiple mission classes in support of science investigations. Note: All Explorer missions (except strategic missions) are initiated by selection through AO process.

- Medium-Class Explorer (MIDEX): Principal Investigator (PI) managed mission that can be developed in approximately 48 months. MIDEX investigations are typically launched aboard a medium-class launch vehicle.

- Small-Class Explorer (SMEX): PI managed mission that can be developed in approximately 36 months. SMEX investigations are typically launched as a primary payload on a small-class launch vehicle or as a secondary payload on a larger launch vehicle.

- Mission of Opportunity (MO): An opportunity to conduct a PI-managed space flight investigation in science, exploration, and technology of modest cost and scope to address one or more of the goals established in the 2018 NASA Strategic Plan. A MO investigation can be either a small complete mission or an investigation hosted on a non-NASA SMD space science mission of any size. The specifics of any MO are described in the relevant Program Element Appendix as an amendment to the Stand Alone Mission of Opportunity Notice for each AO. These missions are conducted on a no-exchange-of-funds basis with any non-US organization that is involved.
- Strategic Missions: Investigations directed by NASA Headquarters that entail development for flight. These investigations may be characterized as being part of non-NASA SMD Astrophysics mission of any size or a NASA mission.

2 ASTROPHYSICS

2.1 Goals and Objectives

The Astrophysics Explorers program emphasizes focused and timely science problems that are investigated with modest, fully competed missions that complement the science of larger strategic missions of the Astrophysics division. The Astrophysics Explorers program aligns with Strategic Goal 1 in the 2018 NASA Strategic Plan, "Expand human knowledge through new scientific discoveries," and Strategic Objective 1.1, "Understand the Sun, Earth, Solar System, and Universe." The Astrophysics Explorers program also aligns with the strategies described in Sections 3.2 and 4.4 of the 2014 Science Plan for NASA's SMD.

NASA's strategic objective in astrophysics is to discover how the universe works, explore how it began and evolved, and search for life on planets around other stars. Three broad scientific questions flow from this objective:

1. How does the universe work?

2. How did we get here?

3. Are we alone?

SMD addresses the above strategic objective by conducting programs of astrophysics scientific research designed to address the following science goals:

1. Probe the origin and destiny of our universe, including the nature of black holes, dark energy, dark matter, and gravity;

2. Explore the origin and evolution of the galaxies, stars, and planets that make up our universe; and

3. Discover and study planets around other stars and explore whether they could harbor life.

The Explorers program strives to:

1. Advance scientific knowledge of astrophysics processes and systems;

2. Add scientific data and other knowledge-based products to data archives for all scientists to access;

3. Publish scientific progress and results in the peer-reviewed literature to encourage, to the maximum extent possible, the fullest commercial use of the knowledge gained;

4. Implement technology advancements prepared in related programs; and

5. Announce scientific progress and results in popular media, scholastic curricula, and materials that can be used to inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.

The Astrophysics Explorers PCA provides the relationship between the Astrophysics Explorers program and the Strategic Objective 1.1 of the 2018 NASA Strategic Plan, which is listed below:

Strategic Objective 1.1: Understand The Sun, Earth, Solar System, And Universe:

> Conduct scientific studies of the Earth and Sun from space, return data and samples from other bodies in the solar system, peer out into the vast reaches of the universe, and play a catalyzing role in lunar robotic exploration by supporting innovative approaches to advancing science. These efforts are guided by national priorities and recommendations from the National Academies' decadal surveys and implemented through a balanced portfolio of programs.

There are three core contexts of NASA's first strategic objective, with the first two pertaining to Astrophysics:

Discovering the Secrets of the Universe:

> NASA's science vision is to understand the Sun and its effects on the solar system, the Earth, other planets and solar system bodies, the interplanetary environment, the space between stars in our galaxy (the interstellar medium), and the universe beyond. NASA's journey of scientific discovery will help motivate, support, and prepare for human and robotic expansion throughout the solar system and beyond.

Searching for Life Elsewhere:

> "Are we alone?" is a central research question that involves biological research and research in the habitability of locations in the solar system such as Mars, the moons of outer planets, or thousands of potentially habitable worlds around other stars. This research supports a fundamental science topic at the interface of physics, chemistry, and biology.

2.2 Program Architecture

The Explorers program is an uncoupled program of missions aimed at meeting the program objectives wherein each mission has unique science capability.

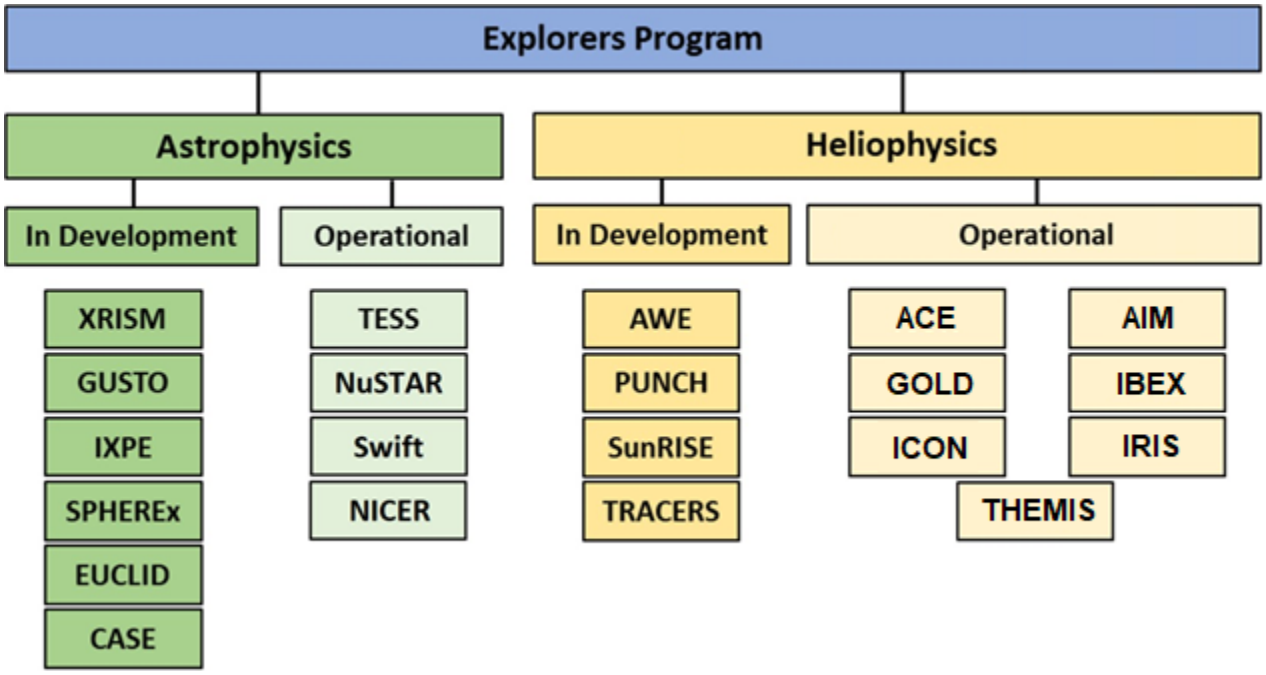

Figure 1. Elements of the Explorers Program

The Explorers program 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. Explorers program missions are Category 2 or Category 3, as defined in NASA Procedural Requirements (NPR) 7120.5, NASA Program and Project Management.

Strategic Missions are investigations directed by NASA Headquarters that entail development for flight. These investigations may be characterized as being part of non-NASA SMD Astrophysics mission of any size or a NASA mission.

Strategic Missions are not initiated through the AO process, an acquisition strategy will be approved per NPR 7120.5. The acquisition strategy is documented in the Key Decision Point (KDP)-A Decision Memorandum, as appropriate.

The Explorers program interfaces to other organizations both inside and outside of NASA through the projects. Access to space will be acquired through existing contracts held by the Launch Services Program (LSP) in the Human Exploration and Operations Mission Directorate (HEOMD) or otherwise provided for by SMD, except when provided by an international partner under an approved agreement or when procured by the PI, as allowed. In the excepted cases, arrangements for access to space will be made on a case- by-case basis and documented in user agreements. LSP interfaces between the program/project office and the launch service provider. Acquisitions for operations services will be consistent with NASA policy.

NASA and institutional contacts are unique to the PI proposals and are contained in the individual project plans and project-specific requirements appendices (PLRAs). The project-specific requirements appendices, i.e., PLRA attached to this Explorers Program Plan, defined relationships with supporting organizations. Each approved PLRA is attached to Appendix C of this document and maintained under program office configuration management control. Note: See Appendix D for optional PLRA cover sheet.

External agreements for individual projects will be generated when necessary, and are referenced in the PLRAs to the Explorers Program Plan.

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

2.3 Stakeholder Definition

The science community and NASA SMD are the immediate customers of the Explorers program. NASA Headquarters Astrophysics and Heliophysics divisions provide the program with its operating budget, programmatic guidelines, and identification of the scientific goals and objectives. The science community is the principal user of the data resulting from the selected missions.

NASA science is uniquely positioned among Federal agencies to transfer content and expertise to an informative environment to support learning across all age groups. Data is accessible through multiple channels, which allows NASA to benefit from partners actively engaged in learning communities and emerging citizen base science.

2.4 Program Authority, Management Approach, and Governance Structure

SMD and the Explorers program follow NASA Policy Directive (NPD) 7120.4, NASA Engineering and Program/Project Management, and NASA Procedural Requirement (NPR) 7120.5, NASA Program and Project Management Processes and Requirements, for both program and flight project management. SMD implements these procedures through the processes described in NASA's SMD Management Handbook.

The Explorers program is an uncoupled multi-project program. Goddard Space Flight Center (Goddard) has been designated as the managing Center for the program. The Explorers program manager resides at Goddard, reporting functionally to the Center Director and, programmatically, through the division director to the Associate Administrator (AA) for SMD at NASA Headquarters. The governing responsibility for the Explorers program is the Agency Program Management Council (PMC). The SMD PMC is the approving council for all Explorers projects, given that all Explorers projects are Category 2 or Category 3. The SMD AA is the decision authority for Explorers projects, including making all final decisions to proceed from one phase to the next.

For Explorers projects executed with a NASA Center performing the Project Management function, the Executing Center's Center Management Council (CMC) will evaluate cost, schedule, and technical content to ensure that the project is receiving the necessary Center resources to accomplish its tasks, and from a technical authority (TA) viewpoint, to ensure compliance with the PCA, program plan, formulation agreements, project plan, Center procedures and processes, as well as applicable NASA technical standards. For Explorers projects where Project Management resides outside NASA, the Goddard CMC is assigned this role. The CMC does not make programmatic decisions without the approval of SMD.

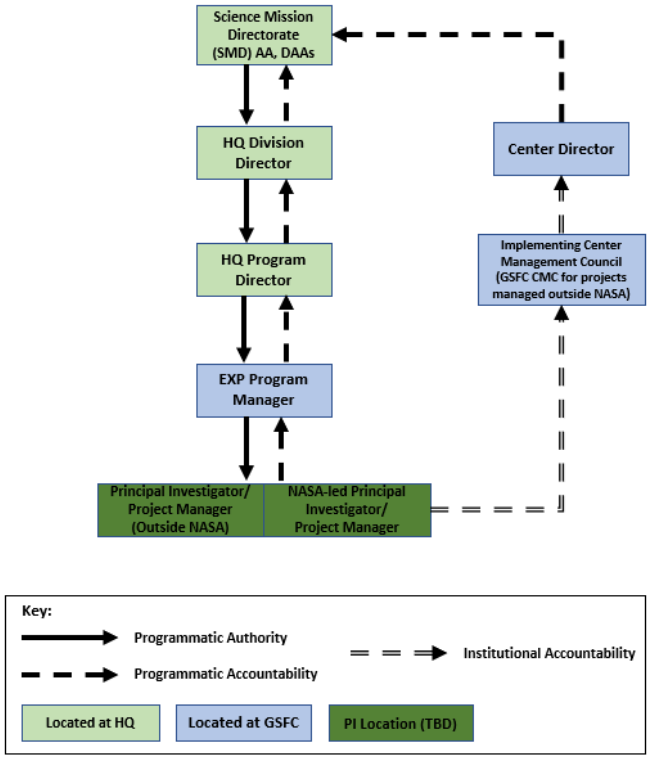

Figure 2. SMD Program Management Accountability

Figure 2 shows the lines of authority for SMD management accountability of programs and projects as well as lines of programmatic coordination.

Explorers program authority is delegated from the AA/SMD, through the division director, to the Explorers 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. The Center Director for strategic missions is responsible for the overall scientific and programmatic success of the mission and is accountable to the AA/SMD.

The Explorers program manager is responsible for the oversight and management of formulation and implementation of the program and all Explorers missions. The program manager will assign a mission manager to oversee the development of each mission and act as the principal point of contact to the PI. The program office will develop integrated budgetary requirements and recommendations for SMD, based on NASA budgetary guidelines. The program office establishes operational policies for the Explorers program, assures appropriate independent review of Explorers 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 for the support of the PIs. The program office operates with a small management staff. Risk-driven identification of technical areas may require deeper insight and closer tracking. The programmatic staff will approve movement and tracking of finances and support contract actions. The deputy program manager will coordinate the efforts of the program chief engineer and program chief safety and mission assurance officer in providing 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 will include the conduct of weekly teleconferences with the project manager and/or PI. Program staff will attend, at the implementing organization, periodic and lower level reviews as appropriate. Monthly status reviews will be presented to SMD and the CMC. For Explorers 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 executing Center's leadership team and CMC performs the review and oversight functions outlined above.

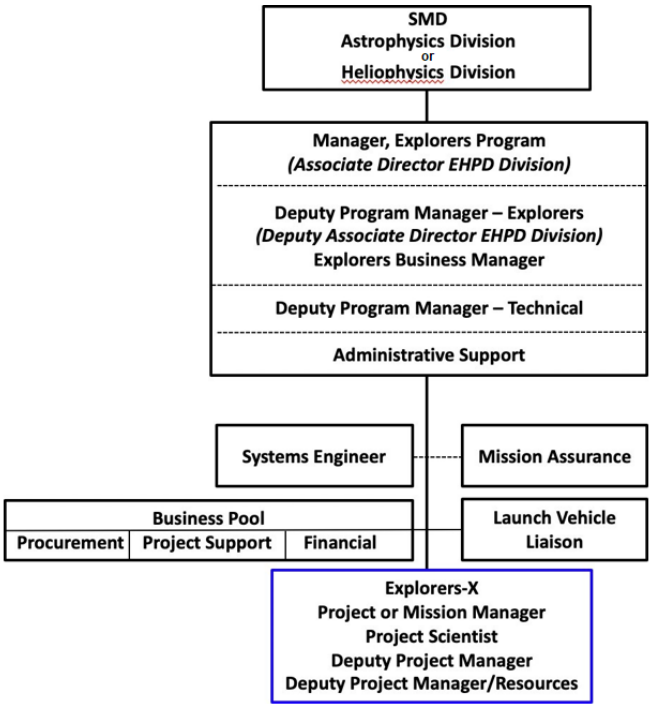

Figure 3. Explorers Program Organization Chart

The PI is in charge of each mission, with full responsibility for its scientific integrity, cost, schedule, and overall safety. The PI team will have a large degree of freedom to accomplish its proposed objectives within the stated constraints with only essential NASA oversight. 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 mission, it is expected that the PI will manage the development of the mission in accordance with the best practices and standards of his/her parent organization and principal suppliers. The roles and responsibilities of SMD, Goddard, Explorers program office, mission manager, and PI are defined in Goddard Procedural Requirement (GPR) 7120.3, Management of Principal Investigator Mode Missions, and will form the foundation of how the missions are managed by the Explorers program office.

It is NASA's intent to allow the successful proposers to manage their missions utilizing the standards, practices, and processes that they best determine supports their team, provided that they are comprehensive and proven as suitable for spaceflight systems development. NASA will rely heavily on the PI to develop and execute a comprehensive development plan for the mission.

Initially, the PI's proposal will provide the basis of such a plan. In support of confirmation review, the PI will submit a project plan that will, upon approval, be the detailed basis upon which the project will be executed. The project plan is intended to be the explicit agreement between NASA and the PI on the terms and conditions under which the PI will execute the mission. At the investigation's Phase B to C confirmation review (KDP-C), the PI will be required to demonstrate minimum unencumbered cost reserves including adequate funded schedule reserve.

The Explorers program is required to report to senior NASA management on a regular basis the status of all mission activities (Table 1)

Table 1. Explorers Reports to NASA Management

SMD (All Missions)	Technical Progress, Cost, Schedule	Monthly
Executing Center CMC (Goddard for non-NASA project managed missions)	Technical Progress, Cost, Schedule	Monthly
SMD Weekly Status Report	Electronic Weekly Progress Report	Weekly

The Explorers program office electronically transmits a copy of its reports to the designated SMD monthly report web site.

2.5 Implementation Approach

The Explorers program implements the program consistent with the latest PCA, NPR 7120.5, and Agency requirements for both AO and Strategic Missions. The SMD AA approves the program plan, which describes how the program office proposes to manage and implement the program, and holds the program manager accountable. For non-Strategic Missions, the program implementation approach is to use NASA's Headquarters issued AO process to solicit and select projects. The investigations are competed to the greatest extent possible. Since the Explorers program is a coordinated set of uncoupled missions, the execution of the missions or projects embodies the implementation of the program.

NASA projects use the PLRA to generate lower-level requirements for implementation. SMD uses the PLRA to evaluate the project's performance during implementation and for decisions on mission accomplishment.

The mission implementation is proposed by each project in the project plan and approved by SMD AA. Major project element make-or-buy and trade studies are conducted at the project level during formulation in support an SMD decision. Each project develops its acquisition strategy in accordance with NASA and Center 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 project or NASA Office of Interagency and International Relations (OIIR) agreements. The individual projects will ensure that interfaces do not increase risk to mission success.

3 ASTROPHYSICS PROGRAM BASELINES

3.1 Requirements Baseline

3.1.1 Program Requirements

1. High-level requirements are defined in NPR 7120.5. The program independently assesses the project's compliance with those requirements.

2. The Explorers program implements missions selected by SMD.

3. A Formulation Authorization Document issued by SMD for each selected project constitutes the authorization to begin formulation.

4. SMD uses the AO process to select science investigations that include science instruments, sensors, instrument suites and/or an entire (PI-led) mission.

5. The selected science investigations and the mission requirements for a project defines the project science and technical performance requirements.

6. Launch vehicles used for Explorers missions are certified vehicles consistent with the payload class defined in NPR 8705.4, Risk Classification for NASA Payloads.

7. International partnerships for space flight hardware and software are defined using international agreements arranged by OIIR.

8. Each science investigation team maintains a data archive of its instrument science and science data products for the life of the prime mission.

9. Each science investigation team provides the data obtained as part of the mission, including the engineering data and ancillary information and analysis software necessary to validate and calibrate the science data, to the public as defined in the PLRA.

10. Each science investigation team delivers the data archive from the prime mission to NASA for a deep data archive within 1 year of the completion of the prime mission.

11. Each science investigation team performs scientific analyses required for the science requirements for the mission as defined in the PLRA.

12. For each mission, the Level 1 requirements defined in the proposal by the PI shall be documented in mission-specific PLRAs to this program plan for approval by SMD at confirmation review.

3.1.2 Requirements Documentation

1. Explorers program requirements for specific Explorers projects are documented in the PLRA to this program plan.

3.1.3 Program Requirements on Projects

1. The technical performance requirements for the missions and projects are detailed in the PLRAs to the Explorers Program Plan and are baselined when each mission or project begins implementation.

2. Program requirements that flow down to the projects are identified in Center processes and directives in safety and mission assurance (SMA), risk management, schedule management, resources management and information, and configuration management (CM) as well as SMD and NASA strategic objectives and requirements.

3. Compliance verification and traceability of the requirements that flow down from the program to the projects are conducted as part of the review and signature of the project plan and during the life cycle through regular monthly status reviews (MSRs), project reviews, and assessments.

4. Changes to program requirements require approval of the program manager, Center Director, and the AA/SMD of the identified mission directorate.

5. Changes to key project personnel (PI, project manager) require approval from the Headquarters Division Director.

6. Missions have no exclusive use data analysis periods and release mission data as soon as possible after a brief validation period.

7. A requirements traceability and verification matrix, as defined in the Safety and Mission Assurance Plan, is used to confirm that the mission system has met all requirements and is ready for launch.

3.1.4 Mission Classification and Life Cycle Costs

Table 2 below defines the Astrophysics Explorers Mission categorization, the governing PMC, and the risk classification. The program level requirements including cost limits and launch dates for the missions are set forth by SMD in the PLRA.

Table 2. Astrophysics Explorers Program/Project Categorization, Governing PMC, and Risk Classification for Projects in Development or Operations

Class of Mission	Mission/TA	Category	Governing PMC	Governing CMC	Risk Classification
MIDEX	TESS/GSFC	2	SMD	GSFC	C
MIDEX	SPHEREx/JPL	2	SMD	JPL	C
SMEX	IXPE/MSFC	3	SMD	MSFC	D
MO	GUSTO/GSFC	3	SMD	GSFC	D
Strategic	Euclid/JPL	3	SMD	JPL	B
Strategic	XRISM/GSFC	3	SMD	GSFC	C
MO	CASE/JPL	3	SMD	JPL	C

Table 3 defines the key dates and time frames for the phase transitions for each project based upon the latest Astrophysics Explorers program master schedule dated January 2019. Dates and costs for projects in formulation are guidelines for planning purposes and are subject to change as the Astrophysics Explorers program matures.

Table 3. Astrophysics Explorers Key Milestones for Projects in Development*

Project	Start Formulation	Systems Requirements Review	Start Implementation	Ready for Launch	Start Prime Operations	End Prime Operations
GUSTO	3/2017	5/2018	12/2018	12/2022	1/2023	5/2023
IXPE	2/2017	9/2017	8/2018	11/2021	12/2021	12/2023
SPHEREx	5/2019	10/2019	1/2021	6/2024	7/2024	8/2026
Euclid	7/2012	4/2013	9/2013	9/2022	10/2022	9/2029
XRISM	9/2017	N/A	1/2018	2/2023	12/2022	2/2025
CASE	01/2020	02/2022	02/2022	12/2029	1/2030	10/2033

*This table will not be maintained.

3.2 Work Breakdown Structure Baseline

All applicable Explorers projects plan, budget, and execute in accordance with the Agency-wide standard work breakdown structure (WBS). Per NPR 7120.5, there are no program WBS standard requirements.

The PI will define the work required for each mission using NASA's standard WBS format and dictionary shown in NPR 7120.5. This information down to the level 2 elements will be in the proposal and updated at confirmation review.

3.3 Schedule Baseline

As an uncoupled program, the Explorers program does not utilize a program level integrated master schedule. Individual project schedules are generated and maintained by the respective projects under the project schedule management plan, as flowed down through the Explorers program schedule management plan. The project schedules are generated and maintained by the projects and are reviewed and updated monthly. The program office monitors and analyzes project schedules and offers scheduling advice and expertise, as required.

3.4 Resource Baseline

Table 4 identifies the current Astrophysics Explorers program NOA requirement. Table 5 identifies the current Astrophysics Explorers program workforce requirements. These requirements reflect the FY 2021 Planning, Programming, Budgeting, and Execution (PPBE) budget submission in May 2019. Astrophysics Explorers program office requirements are based on the shared infrastructure approach identified below.

The Explorers program utilizes a shared infrastructure to accomplish program level requirements. The Explorers and Heliophysics Projects Division (EHPD) at Goddard encompasses the Living with a Star (LWS), Solar Terrestrial Probes (STP), and Explorers programs. Staff, information technology (IT) infrastructure, and other routine resources are shared across the programs to any extent possible, to maintain efficiency and consistency across

EHPD. Other than routine office space, there are no facilities requirements at the program level. Infrastructure requirements for Astrophysics Explorers projects, including acquisition, renovations, property/facilities, personal property, and IT resources are identified in the individual project plans.

Table 4. Astrophysics Explorers Program Office Budget*

Astrophysics Explorers Program					
FY 2022 PPBE Budget Submission					
($ in millions)					
	FY 2020	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**
	NOA	NOA	NOA	NOA	NOA
Program Management	2.4	9.3	7.4	4.9	4.2
Safety & Mission Assurance	0.3	0.2	0.2	0.1	0.1
Systems Engineering	2.3	2.3	2.1	2.4	2.2
Total	**5.0**	**11.8**	**9.7**	**7.4**	**6.5**

*This table will not be maintained. The budget is updated annually per the PPBE process.

Table 5. Astrophysics Explorers Program Office Work Force*

Astrophysics Explorers Program					
FY 2022 Workforce Submission					
	FY 2020	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**
	FTE/WYE	**FTE/WYE**	**FTE/WYE**	**FTE/WYE**	**FTE/WYE**
Program Management	14.5	13.5	13.0	14.0	19.9
Safety & Mission Assurance	2.3	2.3	2.0	1.9	2.0
Systems Engineering	4.3	4.2	4.3	3.0	3.2
Total	**21.1**	**20.0**	**19.3**	**18.9**	**25.1**

* This table will not be maintained.

3.5 Joint Cost and Schedule Confidence Level

A range of cost and a range for schedule are typically provided in the KDP-B decision memo. 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.

Joint cost and schedule confidence level analyses are not required for Class D missions at KDP-C. For Class C and above missions, a resource-loaded schedule is developed and a risk-informed probabilistic analysis that produces a joint confidence level is performed for the mission baseline at KDP-C.

4 HELIOPHYSICS OVERVIEW

4.1 Goals and Objectives

The Heliophysics Explorers program addresses focused and timely science problems that are investigated with small, competed missions that complement the science of strategic missions within the LWS and STP programs. The goals and objectives flow down from the 2018 NASA Strategic Plan, Objective 1.1, "Understand the Sun, Earth Solar system and Universe" and the 2014 Science Plan for NASA's Science Mission Directorate, Section 4.1, heliophysics strategic objective to "understand the Sun and its interactions with Earth and the solar system, including space weather."

The Heliophysics division addresses its Agency objectives and the National Research Council decadal survey recommendations in the context of our national space policy by working to answer these fundamental science questions:

1. What causes the Sun to vary?

2. How do geospace, planetary space environments and the heliosphere respond?

3. What are the impacts on humanity?

SMD addresses the above strategic objective by conducting programs of heliophysics scientific research designed to address the following science goals:

For heliophysics research, the strategic objectives are to:

1. Explore the physical processes in the space environment from the Sun to the Earth and throughout the solar system;

2. Advance our understanding of the connections that link the Sun, the Earth, planetary space environments, and the outer reaches of our solar system; and

3. Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.

The Explorers program strives to:

1. Advance scientific knowledge of heliophysics processes and systems;

2. Add scientific data and other knowledge-based products to data archives for all scientists to access;

3. Publish scientific progress and results in the peer-reviewed literature to encourage, to the maximum extent possible, the fullest commercial use of the knowledge gained;

4. Implement technology advancements prepared in related programs; and

5. Announce scientific progress and results in popular media, scholastic curricula, and materials that can be used to inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.

The objectives, together with the major and supporting contributions of the Heliophysics Explorers program components to achieving the research objectives for the heliophysics science goals, are given in Table 6.

Table 6. Major and Supporting Contribution of the Heliophysics Explorers Program

2018 NASA Strategic Goal 1: Expand human knowledge through new scientific discoveries.			
2018 NASA Strategic Objective 1.1: Understand the Sun, Earth, Solar System, and Universe.			
2014 Heliophysics Strategic Objective: Understand the Sun and its interactions with Earth and the Solar System, including space weather			
	Applicability of Research Objectives for Heliophysics Science Goal to Explorers Program Components		
Heliophysics Goals	Explore the physical processes of the space environment from the Sun to Earth and throughout the solar system.	Advance our understanding of the connections that link the Sun, the Earth, Planetary space environments, and the outer reaches of our Solar System.	Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.
Science Missions			
ICON	M	M	S
GOLD	M	M	S
AWE	M	M	S
PUNCH	M	M	M
SunRISE	M	M	M
TRACERS	M	M	S

M = Major contribution; S = Supporting contribution

4.2 Program Architecture

See Section 2.2.

4.3 Stakeholder Definition

See Section 2.3.

4.4 Program Authority, Management Approach, and Governance Structure

See Section 2.4.

4.5 Implementation Approach

See Section 3.5.

5 HELIOPHYSICS PROGRAM BASELINES

5.1 Requirements Baseline

5.1.1 Program Requirements

See Section 3.1.1.

5.1.2 Requirements Documentation

See Section 3.1.2.

5.1.3 Program Requirements on Projects

See Section 3.1.3.

5.1.4 Mission Classification and Life Cycle Costs

Table 7 below defines the Heliophysics Explorers Mission categorization, the governing PMC, and the risk classification. The program level requirements including cost limits and launch dates for the missions are set forth by SMD in the PLRA.

Table 7. Heliophysics Explorers Program/Project Categorization, Governing PMC, and Risk Classification for Projects in Development or Operations

Class of Mission	Mission/TA	Category	Governing PMC	Governing CMC	Risk Classification
EX	ICON/GSFC	2	SMD	GSFC	C
MO	GOLD/GSFC	3	SMD	GSFC	C
MO	AWE/GSFC	3	SMD	GSFC	D
SMEX	PUNCH/GSFC	3	SMD	GSFC	D
SMEX	TRACERS/GSFC	3	SMD	GSFC	D
MO	SunRISE/JPL	3	SMD	JPL	D

Table 8 defines the key dates and time frames for the phase transitions for each project based upon the latest Heliophysics Explorers program master schedule dated August 2020. Dates and costs for projects in formulation are guidelines for planning purposes and are subject to change as the Heliophysics Explorers program matures.

Table 8. Heliophysics Explorers Key Milestones for Projects in Development*

Project	Start Formulation	Systems Requirements Review	Start Implementation	Ready for Launch	Start Prime Operations	End Prime Operations
ICON	04/2013	10/2013	10/2014	10/2019	12/2019	12/2021
AWE	05/2019	02/2020	12/2020	09/2022	01/2023	01/2025
PUNCH	09/2019	02/2020	07/2021	10/2023	01/2024	01/2026
SunRISE	03/2020	11/2020	08/2021	07/2023	08/2023	08/2024
TRACERS	05/2020	05/2021	10/2021	07/2024	09/2024	09/2025
EZIE	09/2021	10/2021	05/2022	09/2024	11/2024	032026
EUVST	10/2019	11/2021	09/2022	04/2025	Q1 2027	Q4 2029

*This table will not be maintained between major updates to the Program Plan.

5.2 Work Breakdown Structure Baseline

See Section 3.2.

5.3 Schedule Baseline

See Section 3.3.

5.4 Resource Baseline

Table 9 identifies the current Heliophysics Explorers program NOA requirement. Table 10 identifies the current Heliophysics Explorers program workforce requirements. These requirements reflect the FY 2021 PPBE budget submission in May 2019. Heliophysics Explorers program office requirements are based on the shared infrastructure approach identified below.

The Explorers program utilizes a shared infrastructure to accomplish program level requirements. The EHPD at Goddard encompasses the LWS, STP, and Explorers programs. Staff, IT infrastructure, and other routine resources are shared across the programs to any extent possible, to maintain efficiency and consistency across EHPD. Other than routine office space, there are no facilities requirements at the program level. Infrastructure requirements for Heliophysics Explorers projects, including acquisition, renovations, property/facilities, personal property, and IT resources are identified in the individual project plans.

Table 9. Heliophysics Explorers Program Office Budget*

Heliophysics Explorers Program					
FY 2022 PPBE Budget Submission					
($ in millions)					
	FY 2020	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**
	NOA	**NOA**	**NOA**	**NOA**	**NOA**
Program Management	2.4	9.3	7.4	4.9	4.2
Safety & Mission Assurance	0.6	1.0	1.0	0.7	0.1
Systems Engineering	2.3	2.3	2.1	2.4	2.2
Total	**5.3**	**12.6**	**10.5**	**8.0**	**6.5**

*This table will not be maintained. The budget is updated annually per the PPBE process.

Table 10. Heliophysics Explorers Program Office Work Force*

Heliophysics Explorers Program					
FY 2022 Workforce Submission					
	FY 2020	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**
	FTE/WYE	**FTE/WYE**	**FTE/WYE**	**FTE/WYE**	**FTE/WYE**
Program Management	18.6	24.2	25.7	26.2	24.6
Safety & Mission Assurance	2.6	2.7	3.2	3.3	2.0
Systems Engineering	3.7	3.4	3.3	3.9	3.5
Total	**24.9**	**30.3**	**32.2**	**33.4**	**30.1**

* This table will not be maintained.

5.5 Joint Cost and Schedule Confidence Level

See Section 3.5.

6 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 confirmation review.

6.1 Technical, Schedule, and Cost Control Plan

Monthly technical, schedule, and cost information is collected, analyzed, acted upon, and reported to Goddard's CMC, SMD, and agency budget and performance report to assure that all project and program requirements are being met with adequate reserves. The Explorers program and/or project manager and their team conduct project reviews, failure review boards, configuration control boards CCBs, and schedule and cost reviews.

Risk management is applied following the guidelines of GPR 7120.4, Risk Management Procedural Requirements. The minimum set of risk management tools that must be used are schedule, technical, and financial reserves, risk mitigation starting early in the program, probabilistic risk assessment, failure modes and effects analysis, fault tree analysis, engineering models, and use of descope options.

Technical status for each mission 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 tracked and reported.

Schedule management for the Explorers program and projects is implemented under Goddard's schedule management policy (400-PG-7120.0.2B). Integrated master schedules are generated for all projects of the Explorers program using automated scheduling tools and appropriate schedule management methodology that shows both baseline and current schedule data. The integrated master schedules identify the project critical path for management and control and ensure that schedules contain 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 vs. actual forecast, and labor – (plan vs. actual) forecast. The project is responsible for implementing a system that meets NASA requirements as stated in NPR 7120.5 for a cost, schedule, and milestone tracking system that provides sufficiently detailed data to adequately and quantitatively assess the current progress of the mission on a monthly basis, and provide a forecast for accomplishing work to be completed within the remaining established cost and schedule parameters. Schedule and cost status must be provided as part of the monthly project review process.

Earned value management (EVM) is not implemented at the program level. Each project implements an EVM process under current NASA policies, NPR 7120.5 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 or Class D payloads with an estimated life-cycle cost below $150M, cost or fixed-price incentive contracts and subcontracts with a value of at least $20M are granted a deviation from the FAR and NFS 1834.201, Earned Value Management

Systems requirement.

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 office will use the project EVM data to perform independent cost and schedule analysis.

Dissenting opinion is based on the personal responsibility, which each individual has to adhere to the Agency's shared core values of safety, teamwork, integrity, and mission success. 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 TA [engineering or SMA TA] chain) in an open and timely manner, and without fear of retribution. The Explorers program office follows Goddard's 500-PG-7120.0.1A, section 2.5 (dissenting opinion), Engineering Technical Authority Implementation Plan.

6.2 Safety and Mission Assurance Plan

The Explorers program office is responsible for ensuring that Explorers projects develop approved SMA plans and implement those plans as listed in NPR 7120.5, section 3.2. The SMA processes of the project host organization will be used when the project office resides in that organization. The project office will address the SMA requirements included in NASA's procurement vehicle (e.g., AO, etc.) and obtain concurrence with the Explorers program office 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. Each project develops SMA plans that meet current requirements and reflect a project life-cycle process perspective, addressing areas including: procurement, management, design and engineering, design verification and test, software design, software verification and test, manufacturing, manufacturing verification and test, operations, and pre-flight verification and test.

For Goddard-managed projects, the program will utilize the 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 that are not hosted at Goddard will utilize their existing problem reporting system.

6.3 Risk Management Plan

The Explorers program addresses risk per the EHPD Program Continuous Risk Management Plan (EHPD-PLAN-0002). Each Explorers project must establish a project risk management plan that identifies the cost, schedule and technical risks within the project and methods to accommodate or mitigate them. Details of each project's risk management approach will be described in its risk management plan under the requirements of NPR 7120.5, NPR 8000.4, and GPR 7120.4 risk management procedures.

The project risk management plans govern how technical, cost, schedule, and other forms of risk will be identified, analyzed, tracked, controlled, communicated, and documented to increase the likelihood of achieving program/project goals. The goal of risk management in the Explorers projects is to identify risks and mitigations necessary to avoid occurrence or negative effects from these risks.

On a monthly basis, the program office holds an internal review with each project to focus on the risks, issues and status. The program office reviews each risk for proper classification per EHPD-PLAN-0002, the EHPD Program Continuous Risk Management Plan. The mitigations for risks are discussed and potential new risks are suggested. Crosscutting risks are identified and shared with the appropriate projects within EHPD. The program office presents the project risks to the Center and Headquarters at the Center MSR. The program evaluates each Explorers project's top risks and develops a program level top risk list, which is presented at the HPD Flight Program Review.

6.4 Acquisition Plan (NPR 7120.5 - Section 3.4)

There are no major acquisitions at the program level. The program office supports SMD in the identification of new missions and the conduct of the acquisitions strategy meeting (ASM). All major acquisitions are performed at the project level. Each project's acquisition strategy and processes are fully described in its acquisition plan per NPR 7120.5. Science investigations will be provided by SMD-selected PI's through AO's or an international or interagency partner under an approved agreement. In the acquisition of scientific instruments, spacecraft, and science investigations (including research and analysis), NASA will use full and open competitions to the greatest extent possible. Certain instruments, missions, or mission systems may be acquired without competition (e.g., through international partnerships or in-house builds) provided that there is a clear scientific, technological, or programmatic benefit to NASA to do so. Such arrangements must be approved by the SMD AA. The project manages the implementation of these investigations. Spacecraft may be provided through industry, in-house by a NASA field Center, or an international partner under an approved agreement. SMD retains make-or-buy decision authority for all spacecraft.

Launch vehicles will be acquired through existing contracts managed by the LSP in the HEOMD. The exception is when it is provided by an international partner or another organization under an approved agreement, or when the Explorers mission is not a primary payload on the launch vehicle. In the latter case, arrangements for access to space will be made on a case-by-case basis and documented using agreements. Acquisitions for operations services must be consistent with NASA policy. The project will utilize established host organization processes and procedures in accordance with NPR 7120.5.

For Goddard managed projects, the project acquisition plan is developed by the project manager, supported by Goddard Office of Procurement and is consistent with the results of the acquisition strategy planning meeting and the ASM. The project acquisition plan documents an integrated acquisition strategy that enables the project to meet its mission objectives, provides the best value to NASA, and complies with the FAR and NFS.

Projects describe completed or planned studies supporting project level make-or-buy decisions, considering NASA's in-house capabilities and the maintenance of NASA's core competencies, as well as cost and best overall value to NASA. For each science mission, the Astrophysics DD or Heliophysics DD may charter a science and technology definition team before the start of formulation to provide advice including prioritized science requirements and to identify a pre- concept that satisfies the science requirements constraints and technology development requirements for the project. These requirements may form the basis for an AO for the acquisition of scientific investigations that include science instruments.

If there are no program level agreements in place, projects will describe all agreements, memoranda of understanding (MOU), barters, contributions, and other arrangements for collaborative and/or cooperative relationships in the project plans. Partnerships created through mechanisms other than those prescribed in the FAR will be identified in the Level I requirements for each project. All such agreements (the configuration control numbers and the date signed, or projected dates of approval) necessary for project success will be listed. All agreements concluded with the concurrence of the program manager will be included and referenced.

When external (non- Explorers) agreements are needed and made, their documentation is part of the project-specific requirements appendix C to the Explorers Program Plan.

6.5 Technology Development Plan (NPR 7120.5 - Section 3.5)

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, paragraph 3.5, in NPR 7120.5.

6.6 Systems Engineering Management Plan (NPR 7120.5 - Section 3.6)

Each project within Explorers develops and maintains a project system engineering management plan (SEMP). The Explorers program systems engineer ensures that the project's SEMP meet the requirements defined in NPR 7123.1.

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 must also address software independent verification and validation.

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

6.7 Verification and Validation Plan

Explorers projects and the program will follow process defined in NPR 7123.1, NASA Systems Engineering Processes and Requirements.

6.8 Information Technology Plan (NPR 7120.5 - Section 3.8)

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

b. Each Explorers project manages information throughout its life cycle through the use of either the legacy EHPD Management Information System (MIS) or the new Technical Data Management System (TDMS).

   The EHPD MIS is an electronic library/CM system used 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. The MIS allows control of records, including documents and drawings from inception through disposition.

The MIS assigns document numbers to all Explorers program and project documents. The document number consists of the organization acronym (EXP), project name, configured item (CI) category, and a four-digit number assigned sequentially. The MIS serves as a central hub to track and update all revisions and relay information to all approved users.

The EHPD TDMS will eventually replace MIS as the authoritative document repository for EHPD program and project records. It provides a dedicated infrastructure for project documentation, online news and event information, and employee contact information. The TDMS currently houses most Code 460 project documentation, though some projects still use MIS instead. Access to the TDMS is handled through the NASA Access Management System (NAMS).

An Explorers organizational file plan is updated annually to serve as an inventory of all records maintained by Explorers. All records are identified by respective Agency filing schemes, record titles, record custodians, file locations, and retention periods. The retention period is established by the type of record it is. 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.

c. The Explorers program implements IT security requirements under NPR 2810.1, Security of Information Technology, through compliance with the Agency Consolidated End User Services (ACES) Security Plan, OA-999-M-NSS-1015-ACES Services.

6.9 Review Plan

6.9.1 Program Reviews

The Explorers program office supports reviews consistent with NPR 7120.5. A program level status review and program implementation review will be 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 DD. The review entrance and success criteria are derived from 7120.5 and 7123.1 and can be tailored by agreement between the SRB chair, the Project, Program Office and HPD or APD. This review will consider all aspects of the Explorers program and the flow down to individual projects.

6.9.2 Program Review of Projects

The Explorers program 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 will 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.

6.9.3 Review Processes for the Project Office(s)

The project office will ensure 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:

1. Project gate reviews leading to each KDP, as defined by NPR 7120.5, will be conducted by the SRB and defined in the project plan. These formal reviews will be convened by MDAA and Center Director or their designees. The review entrance and success criteria are derived from 7120.5 and 7123.1 and can be tailored by agreement between the SRB chair, the Project, Program Office and HPD or APD.

2. Engineering Peer Reviews - A comprehensive set of engineering peer reviews will be established by the organization that is the provider of the engineering product. Participants will be selected by the project office host organization and are independent of the development activity under review. Every effort will be made to include technical experts from, or recommended by, Goddard. The results of the review will be reported to the Explorers program office.

3. Anomaly Reviews – Review boards for anomalies that have an unknown cause and represent significant programmatic or technical risk, will be held and will beindependent of the project and established by the project office host organization's SMA office and chief engineer with applicable membership from the Explorers program office's supporting TA.

4. Management Reviews - The project office host organization will conduct regular status reviews and provide reports to the SMD weekly reporting system (as required by SMD), and monthly and/or quarterly status reviews. The project office will provide/present an overall project assessment to include the following: 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. The Explorers program office will have a standing seat in the project office host organization's monthly senior status review process. A summary of the project's status must be provided to the Explorers program office in support of the program's monthly review process. The project office will present to Goddard's CMC on a monthly basis.

5. Assessment Reviews – The project office host organization will convene, when necessary, assessment reviews to evaluate the readiness of the project to execute a mission critical event, e.g., launch, encounter, etc., or to assess the design risk of a pending implementation. Representatives of the Explorers program office and NASA Headquarters can also participate in these reviews.

6.9.4 Cancellation Review Criteria

During implementation, each project will develop the mission within the established performance, schedule, and cost requirements identified in the PLRA (Level 1 document). If at any time during development, it is determined that the project is unable to achieve the PLRA (Level 1) requirements or that the project is anticipated to exceed the Agency baseline

commitment in terms of cost or schedule, the project is subject to a cancellation review.

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

6.9.5 Mission Termination Review

Within SMD, mission termination refers to the decommissioning of a mission. It is the process for ending a project that has conducted part of or its entire prime mission and which 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 mission termination:

1. The first is through a programmatic path, such as the outcome of a senior review or a significant budget reduction.

2. 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.

6.10 Mission Operations Plan

There is no Explorers mission operations plan since the program is un-coupled missions each of which have dedicated mission operations plans.

6.11 Environmental Management Plan

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

The Explorers program office supports the project offices in the development of this plan. Products and processes having environmental issues will be identified at the earliest possible time during formulation to ensure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts. Project environmental data management plans must be submitted to the Explorers program office for approval.

6.12 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 Explorers project offices prepare logistics plans utilizing established Center/institutional processes and procedures in accordance with the project plan requirements in NPR 7120.5 and NPD 7500.1, Program and Project Logistics Policy.

6.13 Science Data Management Plan

There is no Explorers program-level science data management plan as the requirement is flowed down to the Explorers projects. In accordance with NASA policy, data is to be released as soon

as possible after a brief validation period appropriate for the mission. Explorers' mission teams shall be 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 shall provide this plan in his or her proposal. The plan shall describe how the project shall manage the scientific data generated and captured by the operational mission and describe how data shall be generated, processed, distributed, analyzed, and archived. The plan shall be submitted to the Explorers program for approval.

6.14 Configuration Management Plan

The Explorers program has a stand-alone CM process, 460-PG-1410.2.2, Explorers Configuration Management Procedure. This procedure defines the CM requirements for the Explorers program and projects to meet the requirements of NPR 7123.1 and GPR 1410.2, Configuration Management.

The Explorers 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. It also describes how CM will be audited.

The CM procedure addresses CM requirements for document configuration control only. Configuration control for products is not required at the program office level but is addressed as necessary in project office CM procedures.

The Explorers CM system uses CCBs at both the program and project levels. This allows for CM to be handled at the most appropriate level within the organization. For each organization level, types of CIs have been assigned for CM. The Explorers program CCB is chaired by the Explorers program manager or designee who has overall responsibility for all Explorers program and project office activities.

The Explorers CM procedure does not apply to Explorers directives posted in Goddard's Directives Management System. These directives are controlled using the procedures described in GPR 1410.1, Directives Management.

The Explorers program follows the information management and knowledge capture requirements in NPD 2200.1, Management of NASA Scientific and Technical Information, NPR 2200.2 Requirements for Documentation, Approval, and Dissemination of NASA Scientific and Technical Information, NPD 1440.6, NASA Records Management, and NPR 1441.1, NASA Records Retention Schedules.

For each mission, the PI shall describe the configuration management plan that shall be used for configuration identification, configuration control, interface management, records traceability, and document status. It shall include how important information records are created, maintained, and retained.

6.15 Security Plan

6.15.1 Security Requirements

The Explorers program methodology for ensuring security and technology protection will use 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 such as "Cybersecurity and sensitive unclassified information awareness training course" is recorded and maintained in the SATERN learning system. The program's approach to implementing IT security requirements are in accordance with NPR 2810.1. The content of these plans addresses the emergency notification system, types of emergency situations, occupant response procedures, and incident management responsibilities. The program office identifies an individual who works with the facilities operations managers to maintain and communicate building emergency plans.

6.15.2 Information Technology Requirements

Projects hosted at other centers or organizations will use their own institutional requirements and applicable NPRs.

The Explorers program IT system is covered under the OA-999-M-CIO-2965 ACES Security Plan. This IT security plan covers all of the areas specified in National Institute of Standards and Technology 800-53, "Recommended Security Controls for Federal Information Systems," and Federal Information Processing Standards 199 "Standards for Security Categorization of Federal Information and Information Systems."

The IT plan covers the following: access, control and authentication; training; auditing; certification, accreditation and assessment; CM; contingency planning; incident response; maintenance; media protection; physical and environmental protection; personnel security; risk assessment; system and services acquisition; system and communication protection; and system and information integrity.

6.15.3 Emergency Response Requirements for Facilities

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

6.16 Threat Summary

Threat summaries attempt to document the threat environment that a NASA space system/constellation or aircraft is most likely to encounter as it reaches operational capability. These documents contain top secret/sensitive compartmented information on the valid threats to United States space systems and are the basis for establishing threat levels that the program office will use to develop survivability strategies. Threat summaries are completed by an Agency team with proper clearances at the request of the program manager through the Office of the Chief Engineer. This team discusses with the program manager risk mitigation strategies which are incorporated into the program threat summary. Secret information is handled appropriately and not included in the program plan.

Explorers program managers will provide program and project documentation to aid in the preparation of threat summaries, such as, mission overviews/requirements and operations concepts to either crewed or robotic space protection program personnel to draft these documents. High-risk threat information will be extracted from the threat summary at the secret level and transferred to the hostile threat section of the project protection plan to develop mission survivability strategies and protection measures. The Explorers program manager will provide program and project/mission documentation to adhere to this process at the appropriate level. Each NASA mission works with Space Asset Protection Program to develop a project protection plan. Each plan will define the specific space asset protection measures based on threat assessment for individual mission.

6.17 Technology Transfer Control Plan

Each project prepares and implements an export control plan as required. There will be no Explorers program level export control plan as the deliverables subject to export control are provided at the project office level. Individual Explorers project office export control plans will be prepared and implemented at the project office level working with Goddard's Export Control Office. Explorers project offices will comply with the export control requirements specified in NPR 2190.1, 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), MOUs, 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 State Department via OIIR so they can be used to get 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 approval through the State Department for the import. Applications for licenses and technology assistance agreements to the State Department for Explorers missions are routinely routed through the Explorers program executives for concurrence. United States International Traffic in Arms Regulations and Export administration regulation laws still apply.

Explorers program and project office personnel will receive U.S. International Traffic in Arms Regulations training per NPR 2190.1. All international technical exchanges will be approved by Goddard's Export Control Office.

6.18 Education Plan

There is no budget for Explorers program-level education activities. The project-level education plans will follow the current guidance provided by the SMD in a separate memorandum. All education activities will follow the established SMD policy.

6.19 Communications Plan

There is no Explorers program level communication plan. The requirement is flowed down to the Explorers projects. The Explorers projects will follow the current guidance provided by the SMD in a separate memorandum.

6.20 Knowledge Management Plan

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

6.21 Human Rating Certification Package

There is no Explorers program-level human rating certification package. The requirement is flowed down to Explorers projects, when applicable. The projects will follow NPR 8705.2, Human Rating Requirements for Space Systems.

7 WAIVERS OR DEVIATIONS LOG

The program shall maintain a waivers log consistent with the requirements of NPR 7120.5.

Waivers currently in place are:

- NASA Science Mission Directorate (SMD) Class-D Tailoring/Streamlining Decision Memorandum dated December 17, 2017

8 CHANGE LOG

Revision	Effective Date	Description of Changes (Reference the HPD CB/ERB Approval Date)
Baseline (-)	4/1/1999	Initial Release
Revision A	8/5/2008	Entire document updated to reflect NASA Procedural Requirement NASA Procedural Requirement (NPR) 7120.5D and Class D missions.
Revision B	9/14/2014	Update to conform to the Explorers and Heliophysics Projects Division (EHPD) Management Information System (MIS), NPR 7120.5E and other current documentation / EXP-CCR-0003
Revision C	8/31/2021	Explorer program plan updated and made edits to keep document current. EXP-CCR-0015. Specifically, Section 6.4, 4th paragraph- "For each science mission, the Astrophysics DD or Heliophysics DD may charter… Section 6.9.1- "with concurrence from the Explorers program office and APD or HPD." Section 6.9.3 (1.)- "with concurrence from the Explorers program office and APD or HPD early in the phase." As per Headquarters, added TRACERS and SunRISE to various tables and spelled out various acronyms and provided clarification. Expanded verbiage in Section 1.1 to include more detail on mission classes. Updated figures 1-3. Updated dates for missions in development in tables 3 and 8.

Appendix A Acronyms

AA	Associate Administrator
ACES	Agency Consolidated End User Services
AO	Announcement of Opportunity
ASM	Acquisitions Strategy Meeting
AWE	Atmospheric Waves Experiment
CCB	Configuration Control Board
CI	Configured Item
CM	Configuration Management
CMC	Center Management Council
DD	Division Director
EHPD	Explorers and Heliophysics Projects Division
EVM	Earned Value Management
EXP	organization acronym
FAR	Federal Acquisition Regulation
FY	Fiscal Year
GOLD	Global-scale Observations of the Limb and Disk
GPR	Goddard Procedural Requirement
GSFC	Goddard Space Flight Center or Goddard
GUSTO	Galactic/Extragalactic ULDB Spectroscopic TerahertzObservatory
HPD	Heliophysics Division
ICON	Ionospheric Connection Explorer
IT	Information Technology
IXPE	Imaging X-ray Polarimetry Explorer
JPL	Jet Propulsion Laboratory
KDP	Key Decision Point
LOA	Letter of Agreement
LSP	Launch Services Program
LWS	Living With a Star
MIDEX	Medium-Class Explorer
MIS	Management Information System
MOU	Memorandum of Understanding
MO	Mission of Opportunity
MSFC	Marshall Space Flight Center
MSR	Monthly Status Review
NARA	National Archives and Records Administration
NASA	National Aeronautics and Space Administration
NFS	NASA’s FAR Supplement
NOA	New Obligation Authority
NPD	NASA Policy Directive
NPR	NASA Procedural Requirement

NSS	NASA Safety Standard
OIIR	Office of International and Interagency Relations
PCA	Program Commitment Agreement
PI	Principal Investigation
PLRA	Program Level Requirements Appendix
PMC	Program Management Council
PPBE	Planning, Programming, Budgeting, and Execution
SEMP	System Engineering Management Plan
SPHEREx	Spectro-Photometer for the History of the Universe, Epoch of Reionization and Ices Explorer
SMA	Safety and Mission Assurance
SMD	Science Mission Directorate
SMEX	Small Class Explorer
SRB	Standing Review Board
STP	Solar Terrestrial Probes
TA	Technical Authority
TBD	To Be Determined
TDMS	Technical Data Management System
TESS	Transiting Exoplanet Survey Satellite
WBS	Work Breakdown Structure
XRISM	X-Ray Imaging and Spectroscopy Mission

Appendix B Program Level Requirements Appendices

This section includes all appendices to the Explorers 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.

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

Appendix C PLRA Cover Sheet (optional)

Appendix <Appendix Number>
to the
<Program Name> Program Plan

Program Logo
Not wider than 3”

Program-Level Requirements Appendix (PLRA)
for the
<Project Name> Project

Project Logo
Project logo optional; not wider than 3”

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National Aeronautics and Space Administration