

EXPLORERS PROGRAM PLAN

EXP-PLAN-0001

**EXPLORERS PROGRAM
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**Goddard Space Flight Center
Greenbelt, Maryland**

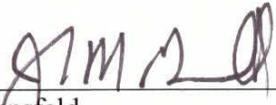
CONFIGURATION MANAGEMENT FOREWORD

This document is an Explorers program-controlled document. Changes to this document require prior approval of the Explorers program configuration control board chairperson. Proposed changes shall 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:

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EXPLORERS PROGRAM PLAN

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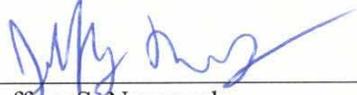
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By signing this document, signatories are certifying that the content herein is acceptable as direction for managing this program and that they will ensure its implementation by those over whom they have authority.

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1. PROGRAM OVERVIEW

1.1 Introduction

The Explorers program is the oldest continuous program in NASA. 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 close to 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.

Though historically not always this way, the program currently administers only principal investigator (PI) led science investigations for Science Mission Directorate's (SMD) Heliophysics and Astrophysics Divisions. Solicitations through the announcement of opportunity (AO) competitive selection ensure the most current and best strategic science will be accomplished. The program is loosely coupled with multiple projects.

Since the early 1990s, the Explorers program has provided several classes: Medium Explorers (MIDEX), Small Explorers (SMEX), and University Class Explorers of flight opportunities for the science program. These mission classes were designed to increase the number of flight opportunities in response to recommendations from the scientific community.

This program plan encompasses the Astrophysics and Heliophysics Explorers program missions. Each mission will develop a mission-specific project plan and a program level requirements appendix (PLRA) to this program plan. The Explorers program is a set of uncoupled missions wherein each mission has unique science. All missions are PI-led.

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 Office. The specific missions cited throughout this plan are provided as examples only, and will not be updated. Current missions will vary over time.

1.2 Related Explorers Program Missions of Opportunity

Missions of opportunity (MO) within the Explorers program are smaller investigations characterized by being part of a host space mission, sub-orbital flight, small complete missions, missions and new science investigations utilizing existing spacecraft or space station attached payloads. In the case of a non-U.S. hosted space mission, these partner investigations are conducted on a no-exchange-of-funds basis with the organization sponsoring the mission as defined by the AO. For each AO, the budget available for MO varies as do the types of investigations that may be proposed. Beginning with the 2012 Explorers MO AO, Explorers program MOs will be solicited through the NASA AO, Second Stand Alone Missions of Opportunity Notice.

2. ASTROPHYSICS

2.1 Goals and Objectives

One of NASA's strategic objectives is to "Discover how the universe works, explore how it began and evolved, and search for life on planets around other stars." Further information on NASA's strategic goals may be found in NASA Policy Directive (NPD) 1001.0, *NASA Strategic Plan*, outcomes and objectives are available through the NASA Online Directives Information System.

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 objective of the Explorers program is to provide frequent flight opportunities for world-class scientific investigations from space within NASA Astrophysics Space Science goals. These goals are consistent with the scientific goals of space science research in NPD 1001.0 and contained within the *2014 Science Plan for NASA's Science Mission Directorate*.

The Explorers program is designed to accomplish high quality space science investigations utilizing innovative, streamlined, and efficient management approaches. It seeks to contain mission cost through commitment to, and control of, design, development, and operations

costs. The Explorers program seeks to enhance public awareness of and appreciation for space science and to incorporate educational and public outreach activities as integral parts of space science investigations.

The specific mission objectives are defined by the PIs in their proposals and will be approved by NASA through confirmation review. These missions seek to conduct scientific investigations of modest and focused programmatic scope that can be developed relatively quickly, generally in 40 months or less, and executed on-orbit in 3 years or less. The mission specific objectives are defined in the individual project plans.

Life cycle cost (LCC) is defined as all costs that are necessary to complete an investigation beginning with selection through Phase F, including PI mission costs, contributions from U.S. (including non-SMD) and non-U.S. entities, launch vehicle cost (if applicable), and unallocated future expenses (UFE).

The Explorers program does not maintain a budget reserve to which investigations exceeding their cost commitments may have access for cost overruns. If, at any time, the cost, schedule, or scientific performance commitments of a selected mission appear to be in peril, the mission can be subject to a cancellation review by SMD.

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.

The Explorers program interfaces to other organizations both inside and outside of NASA through the projects. These include the Human Exploration and Operations Mission Directorate (HEOMD) for NASA-procured launch services and space communications and navigation. The Science Office for Mission Assessments (SOMA), located at Langley Research Center (LaRC), is used for mission acquisitions and assessments. Other NASA and institutional contacts are unique to the PI proposals and are contained in the individual project plans and PLRAs. 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 (ITAR), and Export Administration Regulations (EAR). LSP interfaces between the program/project office and the launch vehicle provider.

2.3 Stakeholder Definition

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

2.4 Program Authority, Management Approach, and Governance Structure

SMD and the Astrophysics Explorers program follow 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 HQ, *SMD Management Handbook*.

The Astrophysics Explorers program is a multi-project program. GSFC has been designated as the managing Center for the program. The Explorers program manager resides at GSFC and reports programmatically to the Associate Administrator (AA) for the SMD (AA/SMD) via the Astrophysics division director.

Explorers' program authority is delegated from the AA/SMD, through the Astrophysics division director, to the Explorers program manager within the Flight Projects Directorate (FPD) at GSFC. The PI for each mission is responsible for the overall success of the mission and is accountable to the AA/SMD for the scientific success, and through the Explorers program manager, for the programmatic success. The governing Program Management Council (PMC) is the SMD PMC.

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 (POC) 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 GSFC and SMD management, recommends necessary corrective and preventative actions, and provides access to GSFC and NASA expertise for the support of the PIs. The program office operates with a small management staff. The technical staff will be matrixed to the program with little or no dedicated discipline engineering. 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 (CSO) in providing technical authority (TA) insight and advice to the program manager and identify issues for which the projects need help.

Oversight to support program management and TA responsibilities will include the conduct of weekly telecons 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 Center Management Council (CMC). For missions managed by NASA Centers other than GSFC, TA resides at the host Center. For all other missions, TA resides at GSFC.

To support the life cycle review process, a Center chief engineer or equivalent will be a member of the standing review board (SRB) per NPR 7120.5 project reviews. For NASA-led missions,

the implementing Center shall make the initial recommendation of the SRB chair and suggested key members to NASA HQ. For non-NASA-led missions, the implementing organization and the program host Center shall make a combined initial recommendation of the SRB chair and the suggested key members to NASA HQ. The implementing organization, with the TA, leads the reviews below the SRB level. The SRB chair will report out results, significant actions and coordinate with the SRB per the comprehensive review plan. All Explorers SRBs will be conducted in accordance with the *NASA Standing Review Board Handbook (NASA/SP-2013-02-026-HQ)*.

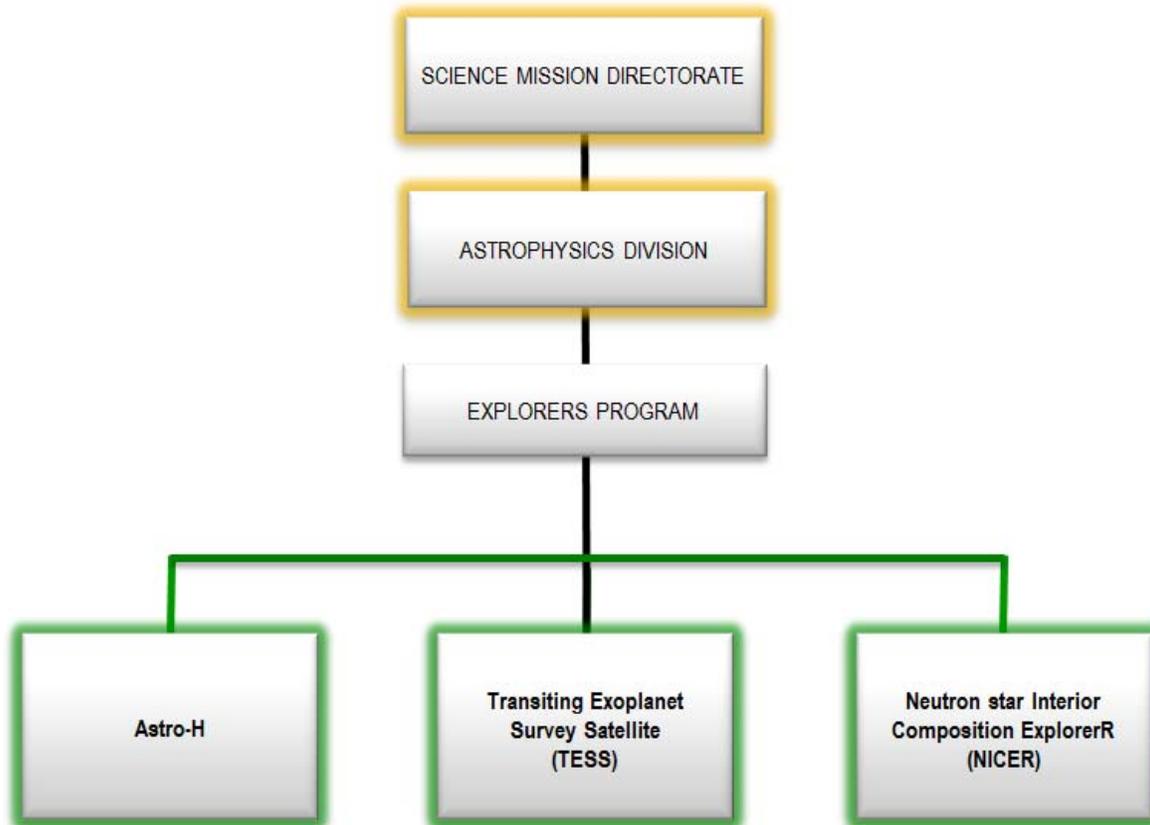


Figure 1: Explorers Astrophysics Program Organization Chart

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. It could be a NASA Center or it could be a wholly external organization such as a university, private lab, 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, GSFC, Explorers program office, mission manager, and PI are defined in the 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 (Key Decision Point (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
GSFC CMC (Missions with GSFC TA)	Technical Progress, Cost, Schedule	Monthly
SMD Weekly Status Report	Electronic Weekly Progress Report	Weekly

SMD may agree to participate in GSFC’s CMC reviews in lieu of separate presentations to NASA HQ. The Explorers program office electronically transmits a copy of its GSFC CMC report to the designated SMD monthly report web site.

2.5 Implementation Approach

The program implementation approach is to use NASA’s HQ-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. The mission implementation is proposed by each project in the project plan and approved by SMD. Make-or-buy and trade studies are conducted at the project level during formulation in support of this process. The acquisition strategy is also project-unique and is conducted 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 (CPIF), cost plus award fee (CPAF), etc. Partners are project unique and their provisions are controlled by project agreements. The individual projects will ensure that interfaces do not increase risk to mission success.

Current plans are for SMEX missions to be implemented as Category 3, Class C payloads. Future MIDEX missions will be implemented as Category 2, Class C payloads. Current MIDEX mission category and risk classifications are shown in Table 2. The applicable elements of the Class C mission's classification are as follows:

- Agency acceptable levels of risk are medium priority and medium risk.
- National significance is medium.
- Complexity is medium to low.
- Mission lifetime is short.
- Cost is medium to low.
- Launch constraints are few.
- Flight maintenance may be feasible.
- Re-flight opportunities are some or few.
- Medium risk of not achieving mission success may be permitted.

3. ASTROPHYSICS PROGRAM BASELINE

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. Selected projects shall support the Astrophysics Division objectives.
3. A program office shall be established for overall coordination across projects.
4. 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 Program Requirements on Projects

1. The technical performance requirements for the missions and projects shall be detailed in the appendices to the Explorers Program Plan and shall be baselined when each project begins implementation.
2. Program requirements that flow down to the projects are identified in Center processes and directives in discipline to include safety and mission assurance (SMA), risk management, schedule management, resources management and information, and configuration management 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 shall be 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 shall require approval of the program manager, Center Director, and the AA of the identified mission directorate (MD).
5. Changes to key project personnel require approval of the program manager and SMD.
6. Missions shall have no exclusive use data analysis periods, but shall 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 (SMAP) shall be used to confirm that the mission system has met all requirements and is ready for launch.

3.1.3 Mission Classification and Life Cycle Costs

1. There shall be multiple classes of projects, at different LCC levels.
2. Selected projects shall work within a definite cost cap as specified in the AO process. The cost shall be reviewed and may be adjusted at confirmation review.
3. Future Explorers missions (MIDEX) will be implemented as Category 2 missions with Class C payloads.
4. Future SMEX missions will be implemented as Category 3 missions with Class C payloads.
5. The MO will be implemented as Category 3 missions with Class B, C, or D payloads.
6. Program-level requirements such as cost limits and launch dates for the missions are set forth by SMD in the AOs.
7. Table 2 below defines the Explorers Mission categorization, PMC relationship, and the risk classification.
8. Table 3 shows the mission overview for current Astrophysics missions.

Table 2: Explorers Astrophysics Mission Categorization, PMC Relationship and the Risk Classification

Class of Mission	Mission/TA	Category	Governing PMC	Risk Classification
MIDEX	TESS/GSFC	2	SMD	C
MO	NICER/GSFC	3	SMD	Enhanced D (Payload)
MO	Astro-H/GSFC	3	SMD	C (Payload)

Table 3: Explorers Astrophysics Mission Overview*

Project	Start Formulation	Systems Requirements Review	Start Implementation	Ready for Launch	Start Prime Operations	End Prime Operations
<i>Projects in Implementation</i>						
Astro-H	6/2008	12/2008	6/2010	Mid 2015	Mid 2015	Mid 2018
<i>Projects in Formulation</i>						
TESS	5/2013	2/2014	TBD	TBD	TBD	TBD
NICER	5/2013	3/2013	2/2014	TBD	TBD	TBD

*This table will not be maintained

3.2 Work Breakdown Structure Baseline

The Explorers program work breakdown structure (WBS) is depicted in Figure 2. As an uncoupled mission program, each major program element or mission is funded by a unique project structure number. The program management element is depicted at level 2 and is executed by the Explorers program office. All other elements or projects are shown at level 1 only, as the WBS and WBS dictionaries are developed and controlled at the project level. Program and project WBS elements are established and maintained in accordance with NPR 7120.5.

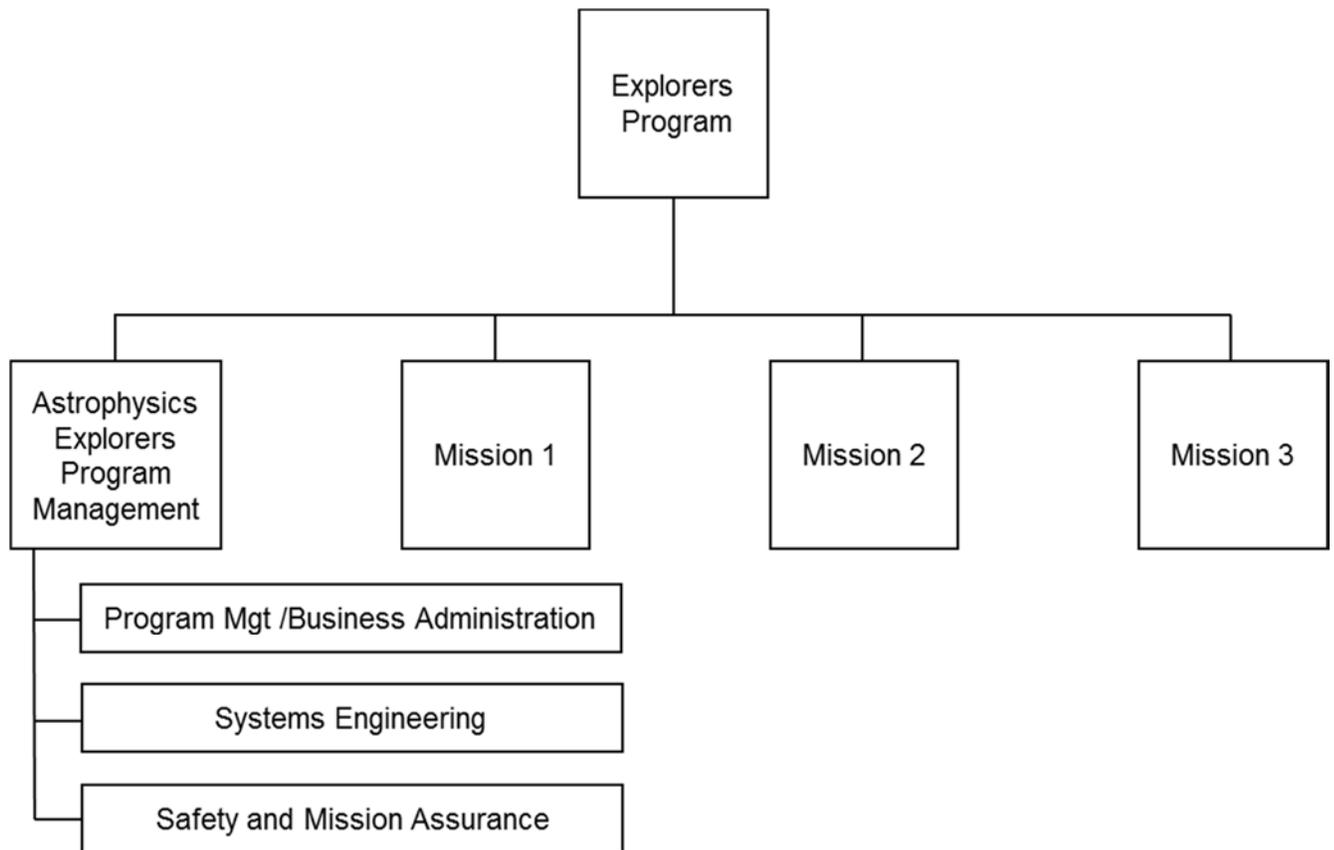


Figure 2: Explorers Astrophysics Program Work Breakdown Structure

The level 2 WBS dictionary for the Explorers program management elements, described below, is established and maintained by the project office.

Program Management/Business Administration contains the business and administrative planning, organizing, directing, coordinating, analyzing, controlling, and approval processes

used to accomplish overall program objectives, program-level reviews, and reports to the Center and Agency management. The effort includes Explorers Astrophysics program management, program office general support, configuration management, scheduling, information technology services, office space, Center assessments, and independent review funding for the Explorers program and its projects.

Systems Engineering contains the technical and management efforts of directing and controlling an integrated engineering effort for the program. This element includes the efforts to defining technical objectives, conducting trade studies, and overseeing mission engineering, integrated planning and control of technical program efforts of design engineering, software engineering, specialty engineering, system architecture development and integrated test planning, system requirements writing, configuration control and technical parameters. Engineering includes risk management to assure monitoring of the technical program and accomplishment of Explorers program goals. It also includes labor, procurements and other direct cost.

Safety and Mission Assurance contains the technical and management efforts of directing and controlling the SMA assurance elements of the program. This element includes design, development, review, verification of practices and procedures, and mission success criteria intended to assure projects meet performance requirements and function for their intended lifetimes. This element excludes mission and product assurance efforts directly related to Explorer projects, including efforts directed at their partners and subcontractors other than a review/oversight function. It also includes labor, procurements, and other direct cost.

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

The current Explorers program master schedule is depicted in Figure 3. Detailed mission schedules will show the logical relationships for the critical milestones, major events, project reviews, and critical paths as appropriate. This chart will not be maintained.

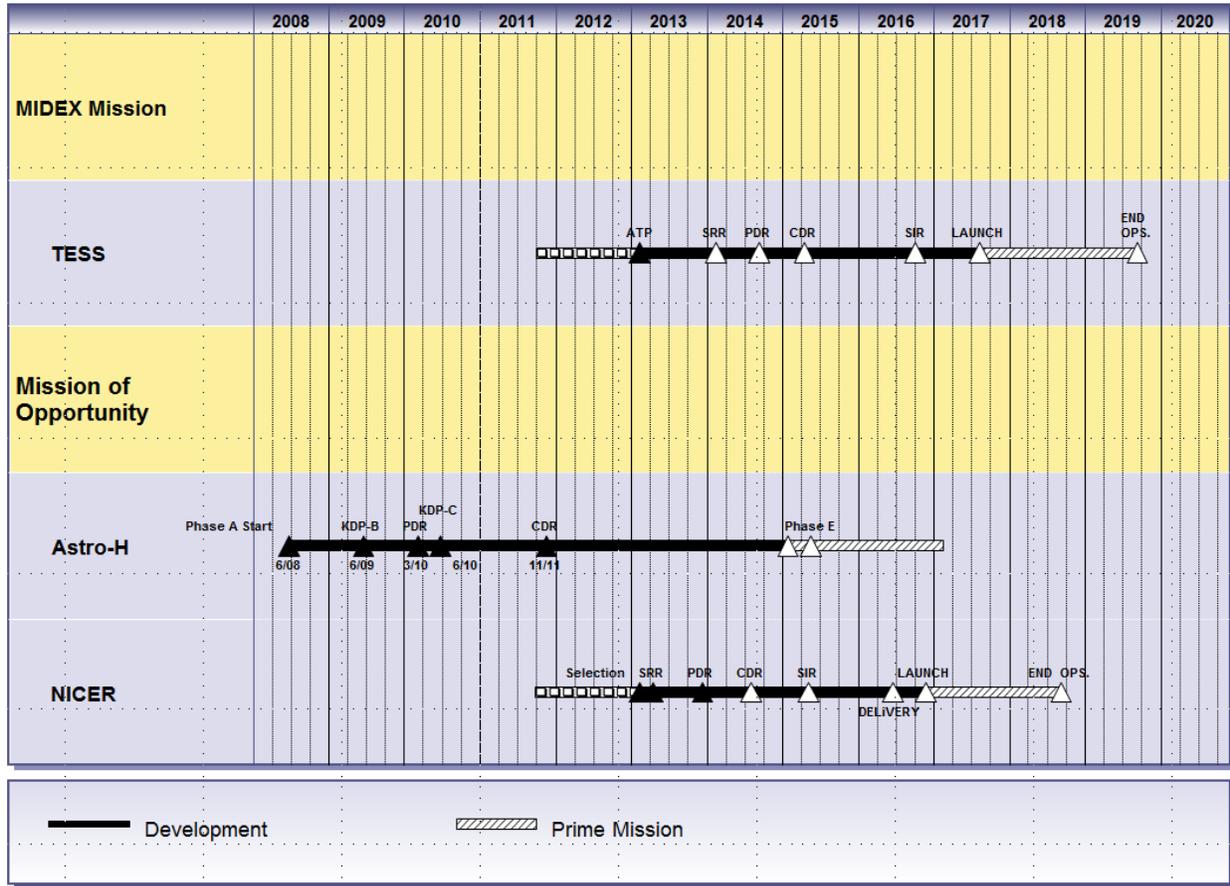


Figure 3: Explorers Astrophysics Program Master Schedule

3.4 Resource Baseline

Dollar and manpower figures will no longer be printed in this document. Resources data are consistent with the current planning, programming, budgeting, and execution (PPBE) exercise and are updated annually. Explorers program office funds are not included in the LCC of a project. These funds will be addressed during the yearly PPBE process. Explorers program office funds are not to be used to augment project responsibility.

3.4.1 Current Missions

TESS (WBS 985788)

Science Objective: To discover new worlds transiting the nearest and brightest stars.

PI Institution: Massachusetts Institute of Technology

Astro-H Soft X-Ray Spectrometer (WBS 063015)

Science Objective: To explore the extreme universe including black holes and supernova explosions and observe galaxy clusters.

PI Institution: GSFC

Partner: Japan Aerospace Exploration Agency (JAXA)

NICER (WBS 273493)

Science Objective: To reveal the nature of matter in the interiors of neutron stars.

PI Institution: GSFC

3.5 Joint Cost and Schedule Confidence Level

Budget baselines shall be developed in accordance with NPR 7120.5 regarding the 70 percent joint confidence level (JCL) as applicable to PI-led missions, and implemented as directed in SMD Policy Document (SPD)-19, *Meeting the 70 Percent JCL Requirement in PI-led Missions*, dated June 18, 2010.

4. HELIOPHYSICS

4.1 Goals and Objectives

One of NASA's strategic objectives is to "Understand the Sun and its interactions with Earth and the solar system, including space weather." Further information on NASA's strategic goals may be found in NPD 1001.0, available through the program library.

NASA's SMD addresses these strategic goals by conducting programs of heliophysics science designed to answer the following science research objectives:

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 objective of the Explorers program is to provide frequent flight opportunities for world-class scientific investigations from space within NASA Heliophysics Space Science goals. These goals are consistent with the scientific goals of space science research in NPD 1001.0 and contained within the *2014 Science Plan for NASA's Science Mission Directorate*.

The Explorers program is designed to accomplish high quality space science investigations utilizing innovative, streamlined, and efficient management approaches. It seeks to contain mission cost through commitment to, and control of, design, development, and operations

costs. The Explorers program seeks to enhance public awareness of and appreciation for space science and to incorporate educational and public outreach activities as integral parts of space science investigations.

The mission-specific objectives are defined by the PIs in their proposals and will be approved by NASA through confirmation review. These missions seek to conduct scientific investigations of modest and focused programmatic scope that can be developed relatively quickly, generally in 40 months or less, and executed on-orbit in 3 years or less. The mission-specific objectives are defined in the individual project plans.

LLC is defined as all costs that are necessary to complete an investigation beginning with selection through Phase F, including PI mission costs, contributions from U.S. (including non-SMD) and non-U.S. entities, launch vehicle cost (if applicable), and UFE.

The Explorers program does not maintain a budget reserve to which investigations exceeding their cost commitments may have access for cost overruns. If, at any time, the cost, schedule, or scientific performance commitments appear to be in peril, the mission can be subject to a cancellation review by SMD.

Further information on the goals and objectives of NASA's Heliophysics programs may be found in the *2014 Science Plan for NASA's Science Mission Directorate* and the *2014 Heliophysics Roadmap*, available through the program library.

4.2 Program Architecture

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

The Explorers program relates to other organizations both inside and outside of NASA through the projects. These include HEOMD for NASA-procured launch services and space communications and navigation. The SOMA, located at LaRC, is used for mission acquisitions and assessments. Other NASA and institutional contacts are unique to the PI proposals and are contained in the individual project plans and PLRAs. 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, ITAR, and Export Administration Regulation (EAR). The NASA KSC/Launch Service Program interfaces between the program/project office and the launch vehicle provider.

4.3 Stakeholder Definition

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

4.4 Program Authority, Management Approach, and Governance Structure

SMD and the Heliophysics Explorers program follow NPD 7120.4 and NPR 7120.5, for both program and flight project management. SMD implements these procedures through the processes described in the NASA HQ *SMD Management Handbook*.

The Heliophysics Explorers program is a multi-project program. GSFC has been designated as the managing Center for the program. The Explorers program manager resides at GSFC and reports programmatically to the SMD AA via the Heliophysics division director.

Explorers' program authority is delegated from the AA/SMD through the Heliophysics division director to the Explorers program manager within the FPD at GSFC. The PI for each mission is responsible for the overall success of the mission and is accountable to the AA/SMD for the scientific success, and through the Explorers program manager, for the programmatic success. The governing PMC is the SMD PMC.

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 POC to the PI. The Explorers program office will develop integrated budgetary requirements and recommendations for SMD, based on NASA budgetary guidelines. The Explorers 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 GSFC and SMD management, recommends necessary corrective and preventative actions, and provides access to GSFC and NASA expertise for the support of the PIs. The Explorers program office operates with a small management staff. The technical staff will be matrixed to the program with little or no dedicated discipline engineering. 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 CSO in providing TA insight and advice to identify issues for which the projects need help.

Oversight to support program management and TA responsibilities will include the conduct of weekly telecons 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 missions managed by NASA centers other than GSFC, TA resides at the host Center. For all other missions, TA resides at GSFC.

To support the life cycle review process, a Center chief engineer or equivalent will be an ex-officio member of the SRB per NPR 7120.5. Staff will also attend and/or participate in selected lower level life cycle reviews. The program manager will approve the comprehensive project review plan. For NASA-led missions, the implementing Center shall make the initial recommendation of the SRB chair and suggested key members. For non-NASA led missions, the implementing organization and the program host Center shall make a combined initial recommendation of the SRB chair and the suggested key members to NASA HQ. The implementing organization, with the TA, leads the reviews below the SRB level. The program

manager will report out results and significant actions and coordinate with the SRB per the comprehensive review plan. The SRB will conduct its reviews and pre-brief cognizant parties.

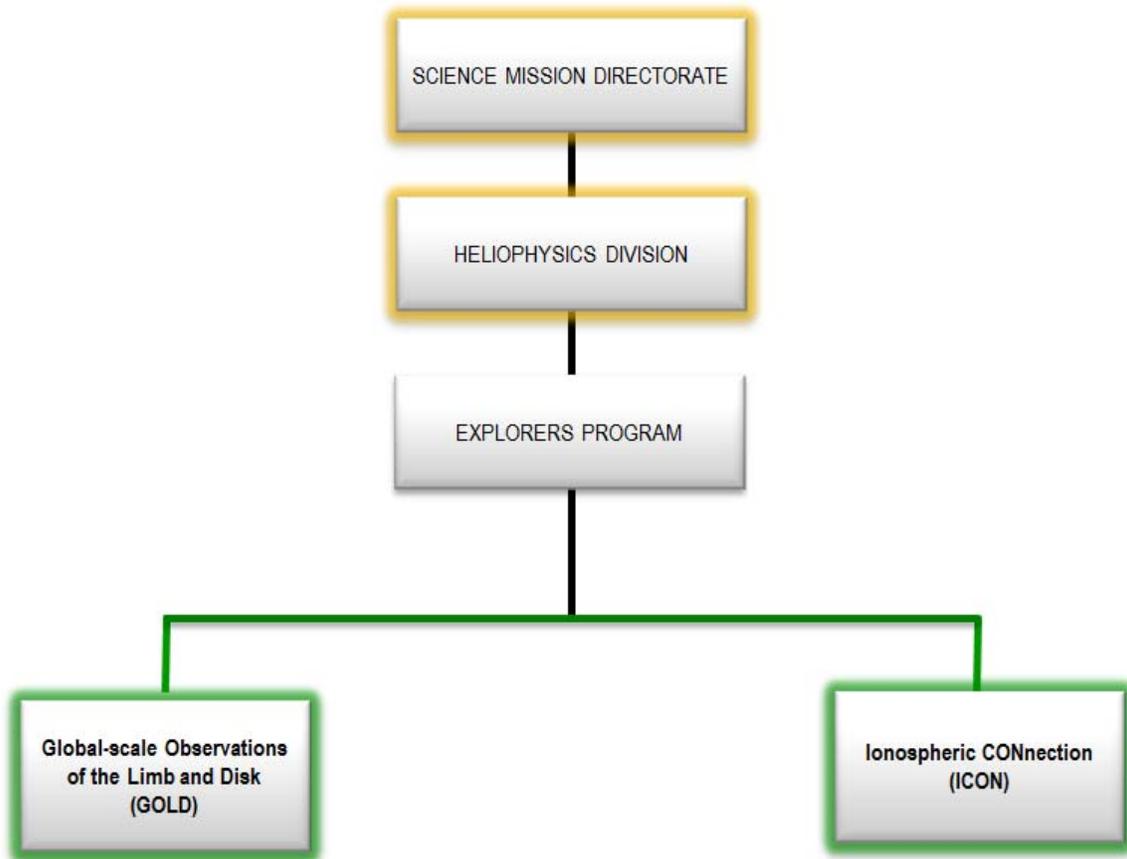


Figure 4: Explorers Heliophysics Program Organization Chart

The PI is in charge of each mission, with full responsibility for its scientific integrity, safety, and success. 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, and could be a NASA Center or a wholly external organization such as a university, a government laboratory, or private industry. As a PI mission, it is expected that the PIs will manage the development of the mission in accordance with best practices and standards of his/her parent organization and principal suppliers. The roles and responsibilities of SMD, GSFC, Explorers program office, the mission manager, and the PI are defined in the GPR 7120.3 and will form the foundation of how missions are managed by the Explorers program office.

It is NASA's intent to allow the successful AO proposers to implement their missions utilizing the standards, practices, and processes that they best determine supports their team, provided that those standards, practices, and processes are comprehensive and proven 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 adequately funded schedule reserve.

The Explorers program is required to report the status of all mission activities to senior NASA management on a regular basis (Table 4).

Table 4: Explorers Reports to NASA Management

SMD (All Missions)	Technical Progress, Cost, Schedule	Monthly
GSFC CMC (Missions with GSFC TA)	Technical Progress, Cost, Schedule	Monthly
SMD Weekly Status Report	Electronic Weekly Progress Report	Weekly

SMD may agree to participate in GSFC's CMC Reviews in lieu of separate presentations to NASA HQ. The Explorers program office electronically transmits a copy of its GSFC CMC report to the designated SMD monthly report web site.

4.5 Implementation Approach

The program implementation approach is to use NASA's HQ 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. The mission implementation is proposed by each project in the project plan and approved by SMD. Make-or-buy and trade studies are conducted at the project level during formulation in support of this process. The acquisition strategy is also project unique and is conducted 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 CPIF, CPAF, etc. Partners are project unique and their provisions are controlled by project agreements. The individual projects will ensure that interfaces do not increase risk to mission success.

Current plans are that SMEX missions are being implemented as Category 3, Class C payloads. Future MIDEX missions will be implemented as Category 2, Class C payloads. Current missions and categories are given in Table 5. The applicable elements of the Class C mission's classification are as follows:

- Agency acceptable levels of risk are medium priority and medium risk.
- National significance is medium.
- Complexity is medium to low.

- Mission lifetime is short.
- Cost is medium to low.
- Launch constraints are few.
- Flight maintenance may be feasible.
- Re-flight opportunities are some or few, and
- Medium risk of not achieving mission success may be permitted.

5. HELIOPHYSICS PROGRAM BASELINE

5.1 Requirements Baseline

5.1.1 Program Requirements

1. High-level requirements are defined in NPR 7120.5. The program independently assesses the project's compliance with those requirements.
2. Selected projects shall support the Heliophysics Division objectives.
3. A program office shall be established for overall coordination across projects.
4. For each mission, the Level 1 requirements defined in the proposal by the PI shall be documented in a mission specific PLRA to this program plan for approval by SMD at confirmation review.

5.1.2 Program Requirements on Projects

1. The technical performance requirements for missions and projects shall be detailed in the appendices to the Explorers Program Plan and shall be baselined when each mission or project begins implementation.
2. Program requirements that flow down to projects are identified in Center processes and directives in SMA, risk management, schedule management, resources management and information, and configuration management as well as SMD and NASA strategic objectives and requirements.
3. Compliance verification and traceability of requirements that flow down from the program to projects shall be conducted as part of the review and signature of the project plan and during the life cycle through regular MSRs, project reviews, and assessments.
4. Changes to program requirements shall require approval of the program manager, Center Director, and the AA/MD.
5. Changes to key project personnel require approval of the program manager and SMD.
6. Missions shall have no exclusive use data analysis periods, but shall release mission data as soon as possible after a brief validation period.
7. A requirements traceability and verification matrix, as defined in the SMAP, shall be used to confirm that the mission system has met all requirements and is ready for launch.

5.1.3 Mission Classification and Life Cycle Costs

1. There shall be multiple classes of projects, at different LCC levels.
2. Selected projects shall work within a definite cost cap as specified in the AO process. The cost shall be reviewed and may be adjusted at confirmation review.
3. Future MIDEX missions shall be implemented as Category 2 missions with Class C payloads.
4. Future SMEX missions will be implemented as Category 3 missions with Class C payloads.
5. MO will be implemented as Category 3 missions with Class B, C, or D payloads.
6. Program-level requirements such as cost limits and launch dates for missions are set forth by SMD in AOs.
7. Table 5 below defines the Explorers mission categorization, its relationship with PMC, and the mission's risk classification.
8. Table 6 shows the mission overview for current heliophysics missions.

Table 5: Explorers Heliophysics Mission Categorization, PMC Relationship, and the Risk Classification

Class of Mission	Mission/TA	Category	Governing PMC	Risk Classification *
MIDEX	ICON/GSFC	2	SMD	C
MO	GOLD/GSFC	3	SMD	C

*Receipt of Phase A, concept study

Table 6: Explorers Heliophysics Mission Overview

Project	Start Formulation	System Requirements Review	Start Implementation	Ready for Launch	Start Prime Operations	End Prime Operations
<i>Projects in Formulation</i>						
ICON	5/2013	1/2014	TBD	TBD	TBD	TBD
GOLD	5/2013	1/2014	TBD	TBD	TBD	TBD

*This table will not be maintained.

5.2 Work Breakdown Structure Baseline

The Explorers program WBS is depicted in Figure 5. As an uncoupled mission program, each major program element or mission is funded by a unique project structure number. The Explorers program management element is depicted at level 2 and is executed by the Explorers program office. All other elements or projects are shown at level 1 only, as the WBS and WBS dictionaries are developed and controlled at the project level. Program and project WBS elements are established and maintained in accordance with NPR 7120.5.

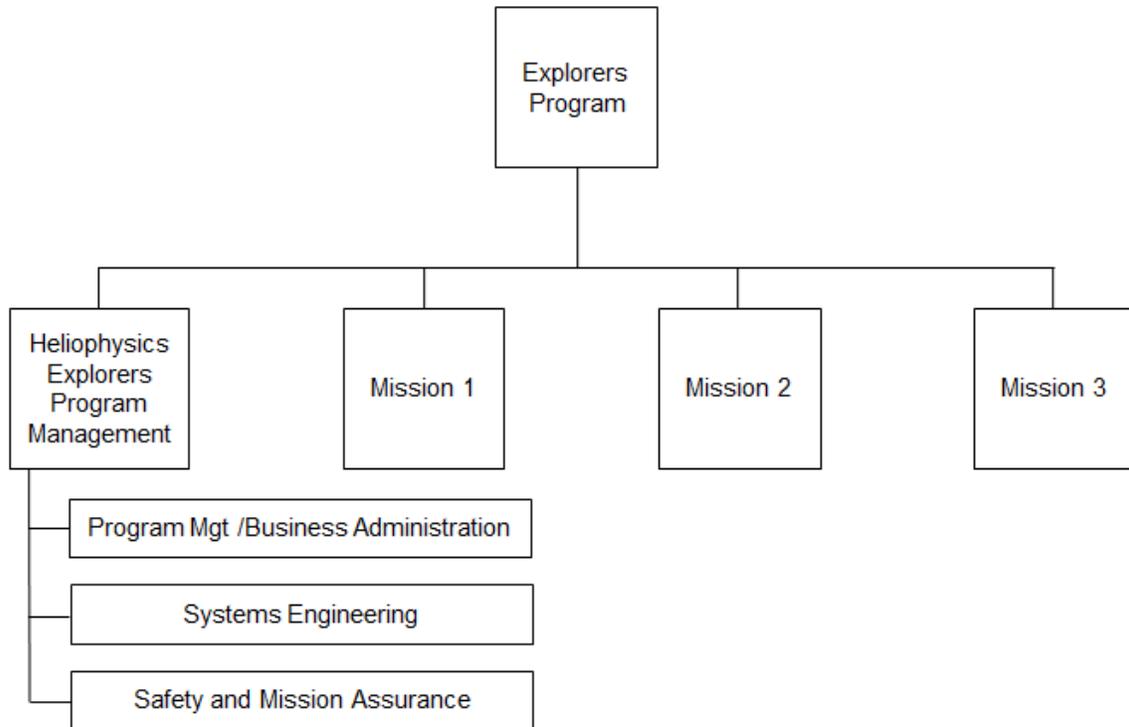


Figure 5: Explorers Heliophysics Program Work Breakdown Structure

The level 2 WBS dictionary for the Explorers program management elements, described below, is established and maintained by the project office.

Program Management contains the business and administrative planning, organizing, directing, coordinating, analyzing, controlling, and approval processes used to accomplish overall program objectives, program-level reviews, and reports to Center and Agency management. The effort includes Explorers Heliophysics program management, program office general support, configuration management, scheduling, information technology services, office space, center assessments, and independent review funding for the Explorers program and its projects.

Systems Engineering contains the technical and management efforts of directing and controlling an integrated engineering effort for the program. This element includes the efforts to defining technical objectives, conducting trade studies, and overseeing mission engineering, integrated planning and control of technical program efforts of design engineering, software engineering,

specialty engineering, system architecture development and integrated test planning, system requirements writing, configuration control, and technical parameters. Includes risk management to assure monitoring of the technical program and accomplishment of Explorers program goals. It also includes labor, procurements, and other direct cost.

Safety and Mission Assurance contains the technical and management efforts of directing and controlling SMA elements of the program. This element includes design, development, review, and verification of practices, procedures, and mission success criteria intended to assure projects meet performance requirements and function for their intended lifetimes. This element excludes mission and product assurance efforts directly related to Explorer projects, including efforts directed at their partners and subcontractors other than a review/oversight function. It also includes labor, procurements, and other direct cost.

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.

5.3 Schedule Baseline

The current Explorers program master schedule is depicted in Figure 6. Detailed mission schedules will show logical relationships for critical milestones, major events, project reviews, and critical paths as appropriate. This chart will not be maintained.

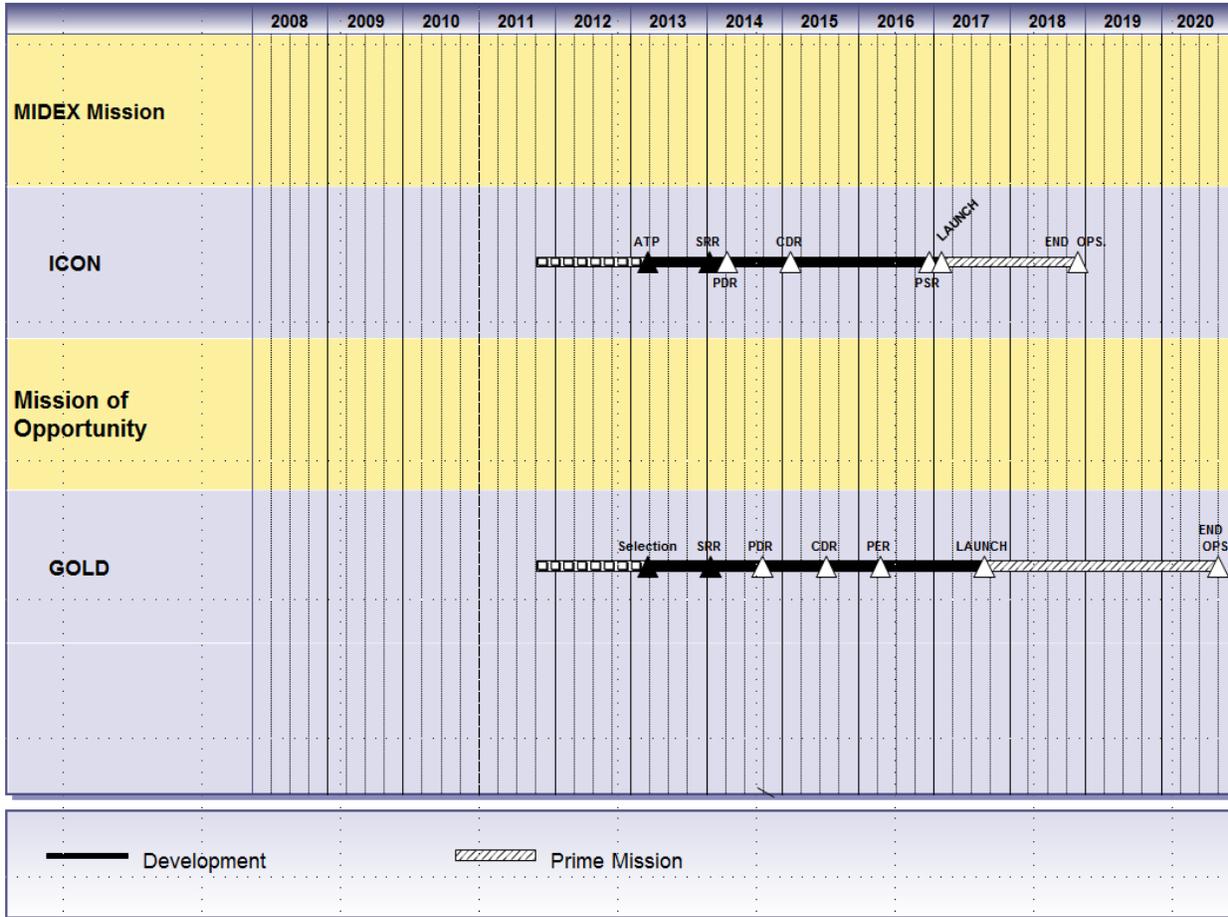


Figure 6: Explorers Heliophysics Program Master Schedule

5.4 Resource Baseline

Dollar and manpower figures will no longer be printed in this document. Resources data is consistent with the current PPBE exercise and is updated yearly. Explorers program office funds are not included in the LCC of a project. These funds will be addressed during the yearly PPBE process. Explorers program office funds are not to be used to augment project responsibility.

5.4.1 Current Missions

ICON Explorer (WBS 581067)

Science Objective: To understand the extreme variability in the Earth's ionosphere.

PI Institution: University of California, Berkeley

5.4.2 Mission of Opportunity

GOLD (WBS 496787)

Science Objective: To perform remote-sensing measurements of the Earth's thermosphere and ionosphere, using an ultraviolet imaging spectrograph located in a geostationary orbit.

PI Institution: University of Central Florida

5.5 Joint Cost and Schedule Confidence Level

Budget baselines shall be developed in accordance with NPR 7120.5, regarding the 70 percent JCL as applicable to PI-led missions, and implemented as directed in SPD-19, *Meeting the 70 Percent JCL Requirement in PI-led Missions*, dated June 18, 2010.

6. PROGRAM CONTROL PLANS (Applies to both Astrophysics and Heliophysics Explorers)

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 GSFC's CMC and SMD to assure that all project and program requirements are being met. The Explorers mission manager and his or her team shall work with the PI and his or her team and participate in project reviews, failure review boards, configuration control boards, and schedule and cost sessions. Risk management shall be applied following the guidelines of GPR 7120.4, *Risk Management*. The basic risk management tools that shall be used are schedule 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.

The technical status for each mission shall be tracked via requirements shown in the level 1 to level 4 requirements traceability and test verification matrix. Tracking shall follow processes and requirements specified in the project SMA requirements document as well as the PI's systems engineering management plan (SEMP) and risk management plan. Design margins shall be established and the reserves tracked and reported.

Schedules shall be generated for all elements of the mission using appropriate scheduling tools and methodology. They shall identify the project's critical path for management and control, contain all critical milestones for internal and external activities, show schedule reserves, and provide schedule integration and traceability.

Cost control shall incorporate 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.) The PI institution shall be responsible for implementing a system that meets NASA's requirement—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. An earned value management (EVM) plan must be included.

For government entities, EVM requirements are listed in NPR 7120.5. For entities receiving contracts, EVM requirements are listed in NASA Federal Acquisition Regulation (FAR) Supplement (NFS) 1852.234-2.

A copy of this report shall be provided to the Explorers mission manager as part of the monthly project status reporting process.

6.2 Safety and Mission Assurance Plan

The *Standard Mission Assurance Requirements* (320-MAR-1001A) addresses all of the life cycle SMA functions and activities. The PI shall submit a mission-specific systems safety implementation plan and a performance assurance implementation plan prior to confirmation review. These documents shall be submitted to the Explorers program office for approval.

6.3 Risk Management Plan

The Explorers program shall implement the NASA continuous risk management process in accordance with GPR 7120.4. PIs shall develop a mission risk management plan in their proposals. The plan shall describe the risk management process adequate for the mission and include the initial significant risk list showing the appropriate actions to mitigate each risk. Risk information shall be provided to the Explorers mission manager for inclusion in the monthly reviews. The plan shall be submitted to the Explorers program for approval.

6.4 Acquisition Plan

Scientific investigations (missions) shall be procured through the AO process. A single PI shall lead each Explorers mission investigation team. The PI may be from any category of U.S. or non-U.S. organization, including educational institutions, industry or nonprofit institutions, NASA Centers, Jet Propulsion Laboratory, other federally-funded research and development centers, or other U.S. Government agencies. The PI team may be formed from any combination of these institutions. The AO selection of a PI team provides the full authority necessary to contract with all members of that team without further competition for that project. The PI shall define the mission acquisition plan in his or her proposal. The plan documents the overall acquisition strategy for the major deliverables and support contracts, and documents all NASA and non-NASA agreements and relationships. The plan shall be submitted to the Explorers program for approval and appended to the mission project plan.

6.5 Technology Development Plan

There is no program-level technology development plan. Projects shall provide a technology development plan if required.

6.6 Systems Engineering Management Plan

The Explorers program shall implement systems engineering management in accordance with the content required by GPR 7123.1, *Systems Engineering*. PIs shall develop a SEMP in their proposals. It shall describe the overall approach for systems engineering from early design to product realization. The plan shall describe how performance verification is done as well as the technical management process. The proposed plan shall follow GPR 7123.1. The SEMP shall be submitted to the Explorers program for approval.

6.7 Product Data and Life Cycle Management Plan

This plan is not applicable to the Explorers program.

6.8 Verification and Validation Plan

Projects and program will follow process defined in NPR 7123.1, *NASA Systems Engineering Processes and Requirements*.

6.9 Information Technology Plan

1. Each Explorers project shall develop 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*.
2. Each Explorers mission/project manages information throughout its life cycle through the use of the Explorers and Heliophysics Projects Division (EHPD) Management Information System (MIS). The EHPD MIS is an electronic library/configuration management system used to identify, control, and disposition program and project records in accordance with NPD 1440.6, *NASA Records Management* and 1441.1 *NASA Records Retention Schedules*. The MIS system allows control of records, including documents and drawings from inception through disposition.

The MIS system assigns document numbers to all Explorers program and project documents. The document number consists of the organization acronym (e.g., EXP), project name, configured item category, and a 4-digit number assigned sequentially. The MIS system serves as a central hub to track and update all revisions and relay information to all approved users.

An Explorers organizational file plan is done annually to serve as an inventory of all records currently kept by Explorers. All records are identified by their Agency's filing scheme, record title, record custodian, file location, and retention period. The retention period is established 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. The Explorers program implements information technology (IT) security requirements in accordance with NPR 2810.1, *Security of Information Technology*, through compliance with the *ACES System Security Plan (SSP) OA-999-M-NSS-1015-ACES Services*.
4. The Explorers program ensures that acquired and/or utilized IT complies with NPR 2830.1, *NASA Enterprise Architecture Procedures* through adherence to *SSP OA-999-M-NSS-1015-ACES Services*.

6.10 Review Plan

6.10.1 Review Processes for Missions/Projects

Per NPR 8705.4, *Risk Classifications for NASA Payloads*, an independent review program shall be established consistent with NPR 7120.5 and NPR 7123.1 to review each mission throughout its development lifecycle.

In an AO-driven project, the proposing teams are doing formal project formulation (e.g., putting together a detailed WBS, schedules, cost estimates, detailed designs, and implementation plan) during the funded Phase A concept studies. From the program's point of view, formulation has already begun. KDP A can be considered to be the point where Phase A concept studies are initially selected from proposals submitted in response to the AO. KDP-B is considered to be the point where the next downselect is made from Phase A concept study reports. Following downselection, the process becomes conventional. The SRB shall be established in accordance with NPR 7120.5 and will conduct major reviews. This is intended to align the technical basis, management, and resource plans into a comprehensive review and approval process for NASA and the PI to commit to execution of the mission.

6.10.2 Cancellation Review Criteria

During Implementation, each project will develop the mission within the established performance, schedule, and cost requirements identified in the PLRA.

If at any time during development, it is determined that the project is unable to achieve the PLRA 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.

6.10.3 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. Through a programmatic path, such as the outcome of a Senior Review or a significant budget reduction; and
2. As a result of a condition on the spacecraft, this may be an unexpected on-orbit anomaly, or the exhausting of consumable resources.

6.11 Mission Operations Plan

Not required for loosely-coupled programs.

6.12 Environmental Management Plan

There is no program-level environmental management plan as the requirement is flowed to the Explorers projects. The Explorers projects shall prepare environmental management plans utilizing GPD 8715.1, *GSFC Safety Policy*, GPR 1700.1, *Occupational Safety Program at GSFC*. The Explorers program office shall support the PI in the development of this plan. Products and processes having environmental issues shall be identified in the proposal for inclusion in the plan. Usually corporations, manufacturing facilities, and other institutions already have these plans in place for such items. These existing plans shall be reviewed for their acceptability. The plan shall comply with NPR 8580.1, *NASA National Environmental Policy Act Management Requirements*. The plan shall be submitted to the Explorers program for approval.

6.13 Integrated Logistics Support Plan

There is no program-level logistics plan. PIs shall submit a logistics plan appropriate to their missions. This logistics plan shall be appended to the mission project plan.

6.14 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.

6.15 Configuration Management Plan

The Explorers program shall implement 460-PG-1410.24, *Configuration Control*, for configuration management. The Explorers program office maintains a document management system, by which it stores and manages the distribution of program and project top-level documentation. The Explorers program provides access to documentation via the program office library in hard copy or electronically via EHPD MIS. The Explorers program shall follow the requirements of GPR 1440.8, *Records Management*, for records management and records retention.

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.

6.16 Security Plan

6.16.1 Security Requirements

The Explorers program methodology for ensuring security and technology protection will utilize established procedures in GPR documents with the assistance of GSFC's Facilities and Security divisions. GSFC maintains building emergency plans (700-SFTY-0001). The Explorers program's approach to implementing IT security requirements shall be 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 Explorers program office identifies an individual who works with the facilities operations managers (FOMs) to maintain and communicate building emergency plans.

6.16.2 Information Technology Requirements

Projects hosted at other Centers or organizations will use their own institutional requirements and applicable NASA NPRs (NPR 2810.1, etc.)

The Explorers program IT systems are covered by *Agency System Security Plan OA-999--1015 – ACES Services*. The IT security plan covers all of the areas specified in NIST 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 access, control and authentication; training; auditing; certification, accreditation and assessment; configuration management, 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.

6.16.3 Emergency Response Requirements for Facilities

The Explorers program complies with NPR 1040.1, *NASA Continuity of Operations Planning and Procedural Requirements*, and GPR 8710.2, *GSFC Emergency Management Plan*. The program office identifies an individual (nominally the program support manager) who works with the FOM to maintain and communicate building emergency plans.

6.17 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 U.S. 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 (OCE). This team discusses risk mitigation strategies with the program manager incorporates strategies into the program threat summary. Secret information is handled appropriately and not included in the program plan.

The Explorers program shall comply with all requirements associated with preparing threat summaries, and where deemed necessary, with project protection plans for each of its missions and projects.

Currently, NASA is prioritizing NASA critical space systems. The program manager will provide program and project/mission documentation to adhere to this process at the appropriate level.

6.18 Technology Transfer Control Plan

Each project shall prepare and implement 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 the GSFC 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 Letters of Agreement (LOA) and/or Memorandum of Understanding (MOU). HQ leads the establishment of LOAs and MOUs with the support of program and project offices. LOAs can either be exclusively for formulation if the dollar value of the contribution is high and then

followed by a MOU during implementation or a LOA can cover both formulation and implementation if the dollar value is low. MOUs and LOAs are only established for hardware and software contributions and not for science contributions. MOUs and LOAs go through the State Department, so they can be used to get technology assistance agreements in some cases. 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. U.S. ITAR and EAR laws still apply.

Explorers program and project office personnel will receive ITAR training per NPR 2190.1. All international technical exchanges will be approved by the GSFC Export Control Office.

6.19 Education Plan

There is no budget for Explorers program-level education activities. The project-level education plan for the future shall include efforts and activities to improve science literacy by engaging the public in understanding the program, its objectives, and benefits and develop education activities, services, and products that contribute to our Nation's efforts in achieving excellence in science, technology, engineering, and mathematics (STEM) education or to stimulate interest in STEM through program-related public outreach activities. All education activities will follow the established SMD policy.

6.20 Communications Plan

There is no Explorers program-level communication plan. The requirement is flowed down to the Explorers projects. The Explorers program office shall support the Explorers PIs and SMD in developing necessary communications material.

6.21 Lessons Learned Plan

The mission manager shall be responsible for determining lessons learned and entering them into NASA's database after launch in accordance with NPR 7120.6, *Knowledge Policy on Programs and Projects*.

7. WAIVERS LOG

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

Waivers currently in place are:

- Non-government software independent verification and validation for Class D missions;
and
- EVM system waiver for OCE to delegate authority to Explorers program for Class D missions.

8. CHANGE LOG

Revision Ltr/Change No.	Date Submitted	Submitted By	Description/Pages Effected	Date Approved

APPENDICES

Appendix A. Acronyms

AA	Associate Administrator
AO	Announcement of Opportunity
CMC	Center Management Council
CPAF	Cost Plus Award Fee
CPIF	Cost Plus Incentive Fee
CSO	Chief Safety and Mission Assurance Officer
DPMC	Directorate Program Management Council
EAR	Export Administration Regulation
EHPD	Explorers and Heliophysics Projects Division
EVM	Earned Value Management
FAR	Federal Acquisition Regulation
FOM	Facilities Operations Managers
GOLD	Global-scale Observations of the Limb and Disk
GPR	Goddard Procedural Requirement
HEOMD	Human Exploration and Operations Mission Directorate
ICON	Ionospheric CONnection Explorer
IT	Information Technology
ITAR	International Traffic in Arms Regulations
JCL	Joint Confidence Level
KSC	Kennedy Space Center
LaRC	Langley Research Center

LCC	Life Cycle Cost
LOA	Letter of Agreement
LSP	Launch Services Program
MIS	Management Information System
MD	Mission Directorate
MO	Mission of Opportunity
MOU	Memorandum of Understanding
MSR	Monthly Status Review
NARA	National Archives and Records Administration
NFS	NASA Federal Acquisition Regulation (FAR) Supplement
NICER	Neutron star Interior Composition ExploreR
NPD	NASA Policy Directive
NPR	NASA Procedural Requirement
OCE	Office of the Chief Engineer
PI	Principal Investigator
PLRA	Program Level Requirements Appendix
PMC	Program Management Council
POC	Point of Contact
PPBE	Planning, Programming, Budgeting and Execution
SEMP	Systems Engineering Management Plan
SMA	Safety and Mission Assurance
SMAP	Safety and Mission Assurance Plan
SMD	Science Mission Directorate

SMEX	Small Explorers
SOMA	Science Office for Mission Assessments
SOMD	Science Operations Mission Directorate
SMAP	Safety and Mission Assurance Plan
SMSR	Safety and Mission Success Review
SRB	Standing Review Board
SSP	System Security Plan
STEM	Science, Technology, Engineering and Mathematics
TA	Technical Authority
TESS	Transiting Exoplanet Survey Satellite
TBD	To Be Determined
UFE	Unallocated Future Expenses
WBS	Work Breakdown Structure

Appendix B. Funds Management for the Explorers Program Office

GSFC Explorers program office is responsible for the overall program management of the SMD Explorers program. Funding for the Explorers program office occurs two ways:

- 1. Funding outside the project LCC covers the overall program-level integrated oversight and risk reduction activities and program office functions such as staffing not specifically related to a particular project.**

Examples of typical program office funding support responsibilities outside the project LCC include, but are not limited to, SRB members and managing their contracts, independent systems/discipline engineering support, launch vehicle interface manager, NASA network interface engineers, NASA flight dynamics engineering, risk assessment, tiger teams, independent engineering analyses, resident office/contractor-site embedded to provide insight, mission manager, and business manager. These activities are all part of program office oversight and not inline project engineering, manufacturing, testing, component assurance screening, and etc.

- 2. Funding within the project LCC but outside the PI cost cap includes risk reduction activities specifically related to a particular project.**

Risk reduction activities captured within the project LCC are for risk reduction activities that are not part of the PI's responsibilities/scope and include activities such as items identified in the AO being provided to the project by NASA and additional hardware/software added to the instrument and/or spacecraft to increase mission success above what is in the project's proposed and approved scope. The content and funding level will be agreed to between the program office and the division and presented to the SMD Directorate Program Management Council (DPMC) for approval with resolution captured in the KDP-C decision memo.

Note: The program office should not duplicate work that rightfully belongs in the PI's own budget, but it can conduct independent analyses as it deems appropriate. If the program office and/or division decides additional tasks are warranted to reduce risk or ensure mission success and these elements were not in the agreed to implementation plan, program office UFE should be applied and resolution for implementation responsibilities worked on a case-by-case basis among the division, the program office, and the project.

Funding:

1. Explorers program office general operations
 - a. Funding provided by the divisions as part of the overall program office funding requirements addressed during the annual PPBE process;
 - b. Funds are outside any project LCC
2. UFE within the LCC
 - a. Typically the 70 percent JCL number as agreed to at the SMD DPMC;
 - b. Comprised of UFE held at both HQ and the division or program office (split)
 - c. Content to be finalized at KDP-C

3. Launch Vehicle Funds
 - a. Within the LCC
 - b. Held either within or outside the PI cap
 - c. Mission specific
4. PI Cost Commitment for the project:
 - a. PI content: project content without project held reserve
 - b. Includes project management
 - c. PI reserve: typically ~30 percent reserve at Concept Study Report in addition to project content, or as specified in the AO.

Reporting:

The use and status of division-held or program-held UFE will be reported monthly at the SMD Flight Program Review.

Appendix C Level 1 Documents for ASTRO-H, NICER, ICON, and GOLD Missions