SPACE SCIENCE ENTERPRISE MANAGEMENT HANDBOOK

OFFICE OF SPACE SCIENCE
NASA HEADQUARTERS

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Approved by: (original signed by Edward J. Weiler) Date: 9/4/2002

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UPDATE LOG

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Filing Instructions
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SPACE SCIENCE ENTERPRISE MANAGEMENT HANDBOOK

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SPACE SCIENCE ENTERPRISE MANAGEMENT HANDBOOK

1. INTRODUCTION

1.1 INTRODUCTION TO THE SPACE SCIENCE ENTERPRISE

The National Aeronautics and Space Administration (NASA) accomplishes its mission and communicates with its external customers through five Strategic Enterprises: Space Science, Earth Science, Human Exploration and Development of Space, Biological and Physical Research, and Aerospace Technology. The Space Science Enterprise (SSE) is charged with addressing certain fundamental questions central to NASA's mission: How did the universe, galaxies, stars, and planets form and evolve? How can our exploration of the universe and our solar system revolutionize our understanding of physics, chemistry, and biology? Does life in any form exist elsewhere than on planet Earth? Are there Earth-like planets beyond our solar system?

The Space Science Enterprise mission is to advance and communicate scientific knowledge and understanding of the sun, the solar system, the universe and our space environment. To accomplish this mission, the SSE uses a combination of large observatories, deep space probes, Earth orbiting spacecraft, research balloons, sounding rockets, and aircraft. Employing these new techniques requires numerous steps. New spacecraft technology is developed and validated, and mission concepts are developed. New research instruments and scientific theories are developed through Research and Analysis. Programs and projects are formulated and initiated, and then implemented through development and launch. Satellite operations for scientific missions are supported and scientific data analyzed under Mission Operations and Data Analysis activities. Education and Public Outreach efforts are embedded throughout all OSS missions and research programs. The SSE is implemented by the Office of Space Science (OSS), led by the Associate Administrator for Space Science, located at NASA Headquarters in Washington, DC.

This Handbook addresses how the Space Science Enterprise fits within NASA and how it accomplishes its many-sided mission.

1.2 PURPOSE AND SCOPE OF THE HANDBOOK

The purpose of the Handbook is to serve as a management guide for the Office of Space Science, which is responsible for the successful implementation of the space science program. It is intended to serve as a "how to" manual for OSS employees, and to support On-the-Job-Training for new employees. It is also intended to be a resource for those, both inside and outside the Space Science Enterprise, who have roles in the formulation, approval, implementation, and evaluation of space science programs.

The Handbook shows the division of responsibility among the various levels of management prescribed in the NASA Strategic Management Handbook (NPG 1000.2), NASA Program/Project Management Directive (NPD 7120.4), and NASA Program and Project Management Processes and Requirements (NPG 7120.5). It describes key processes in a manner consistent with NASA Quality Management System Policy (ISO 9000) (NPD 8730.3). OSS Office Work Instruction (OWI) procedures and flow diagrams are incorporated in the appropriate sections of the Handbook. Employees should always check the current version of the OWI's for revision status and Quality Record requirements, at http://www.hq.nasa.gov/hqiso9000/library.htm.

The Handbook concentrates on the core processes of the Space Science Enterprise: research management, flight program management, and education and public outreach. It also describes key Enterprise supporting functions such as strategic planning and budget processes. The Handbook identifies external interfaces to SSE and their influence on SSE processes, and addresses performance measures by which the quality and effectiveness of the core processes are assessed.

1.3 ORGANIZATION OF THE HANDBOOK

The Management Handbook is organized into eight sections and five appendices. This first section provides a brief introduction to the Space Science Enterprise, and gives the purpose and organization of the Handbook.

Section 2 describes the environment within which the SSE operates: the Agency-wide Enterprise structure and the NASA team, including NASA Headquarters offices, the NASA Centers, industry, academia, and non-U.S. space agencies. The section then discusses the NASA Strategic Management and Strategic Planning Systems, how they implement the Government Performance and Results Act of 1993 (GPRA), the incorporation of a quality management system based on the International Organization of Standards ISO 9001 Quality Management System Standards**,** and how requirements from the GPRA, Congress, Office of Management and Budget, and other organizations flow down to the Space Science Enterprise.

Section 3 describes how the Office of Space Science is organized to implement the Space Science Enterprise. It gives an overview of the responsibilities of the Associate Administrator for Space Science as leader of the SSE, and of the organization that carries out the space science program.

The NASA Management Office at the Jet Propulsion Laboratory (JPL), a division of the Office of Space Science, provides management oversight for the NASA contract for operation of JPL. Section 4 describes the procedures for soliciting and awarding the contract, for generating and managing tasks under the contract, and for evaluating contract performance.

Section 5 describes the goals of the Space Science Enterprise, and the four themes that address these goals. This leads into the SSE Strategic Planning Process, the development of Enterprise priorities, and a discussion of SSE performance measures. Section 5 also describes budget formulation, approval and implementation. The roles of OSS, NASA's Chief Financial Officer, the NASA Centers, the Office of Management and Budget (OMB), and Congress are identified.

Science Management within the SSE is discussed in Section 6. The section begins with an overview of the major components of the SSE research program. A major subsection on research management identifies the responsibilities of Discipline Scientists and Program Scientists. The remainder of Section 6 is devoted to the solicitation and management of investigations, with particular reference to the Announcement of Opportunity and NASA Research Announcement processes.

Flight Program Management and Assessment are discussed in Section 7. The program management responsibilities of the Program Executive, and how these are derived from the responsibilities of the Associate Administrator, and of the Program Manager, are described. The section describes program management within the context of the NASA Strategic Management Handbook, NPD 7120.4 and NPG 7120.5, from formulation through implementation, from mission concept studies through on-orbit check-out. Section 7 also describes program/project tailoring, and budget control and descoping.

Education and Public Outreach are discussed in Section 8. An overview of the policy documents that govern SSE education and public outreach efforts is provided, and the management responsibilities of the Education and Public Outreach Director and other OSS managers for education and public outreach are described. Detailed descriptions of the elements of the OSS education and public outreach program as they are carried out through flight programs, research programs, and other channels, and the approach to reporting and evaluation, then follow.

The Handbook concludes with Appendices that briefly describe NASA offices with which OSS normally interfaces, define acronyms and common terms, list references for further information, and provide templates and sample documents.

2. OVERVIEW OF NASA ORGANIZATION AND MANAGEMENT

2.1 NASA ORGANIZATION AND THE NASA TEAM

2.1.1 The Strategic Framework

NASA's Vision and Mission describes NASA's mission as:

- to understand and protect our home planet,
- to explore the universe and search for life, and
- to inspire the next generation of explorers

  - - - as only NASA can.

NASA has established a framework of five Strategic Enterprises to accomplish this mission, and four crosscutting processes to support the Enterprises in developing and delivering products and services to customers. The Enterprises are:

The Space Science Enterprise (SSE) The SSE seeks to chart the evolution of the universe, from origins to destiny, and understand its galaxies, stars, planetary bodies, and life. The SSE develops space observatories and directs robotic spacecraft into the solar system and beyond.

The Earth Science Enterprise (ESE) The ESE is dedicated to understanding the total Earth system and the effects of natural and human-induced changes on the global environment. The ESE uses space platforms to study the Sun, Earth, and other planetary bodies, to develop predictive environmental, climatic, natural disaster, and natural resource models to help improve life on Earth.

The Human Exploration and Development of Space (HEDS) Enterprise The HEDS seeks to expand the frontiers of space and knowledge by exploring, using and enabling the development of space. HEDS develops and operates major spaceflight systems such as the Space Shuttle and the International Space Station (ISS).

The Biological and Physical Research Enterprise (BPR) The BPR undertakes basic and applied biological, physical, chemical and biomedical research. BPR conducts multidisciplinary scientific and technology research in the microgravity environment of space, collaborates with other organizations to transfer results to Earth, and works closely with HEDS to facilitate long-term exploration of space.

The Aerospace Technology Enterprise (AST) The AST identifies, develops, verifies, and transfers high-payoff aeronautics and space transportation technologies, and facilitates the application and commercialization of these technologies. AST seeks to enable technologies that expand and improve air and space travel with improved safety and affordability, and minimum impact on the environment.

NASA delivers its products and services to its customers through critical processes that cut across the Enterprises and functional offices, transforming inputs such as policies and resources into outputs such as knowledge. These four crosscutting processes, discussed in more detail in the NASA Strategic Management Handbook (NPG 1000.2), are:

Manage Strategically This process develops and implements an integrated approach to the planning, implementation, execution, and evaluation of NASA activities. It aims to deliver quality products and services to the public, while meeting legislative requirements regarding Agency management.

Provide Aerospace Products and Capabilities This process provides aeronautical and space technology to researchers, industry and the public. Management policies, procedures and guidelines for the formulation, approval, implementation and evaluation of NASA programs and projects are provided in NPD 7120.4 and NPG 7120.5.

Generate Knowledge This process provides a framework for ensuring that NASA basic and applied research is consistent with NASA strategic plans, and that the quality of research meets the highest standards. Directives and guidelines for this process are in NPD 1080.1 and NPG 1080.x.

Communicate Knowledge This process coordinates, integrates, disseminates and shares consistent information and experiences about the content, relevance, results, applications and excitement of NASA's mission. This process is described further in NPD 1090.x and NPG 1090.x.

2.1.2 NASA Headquarters Organization

The NASA organization consists of the NASA Headquarters and ten NASA Centers. NASA Headquarters is organized into Program Offices, which have direct management responsibility for accomplishing Agency research, development and operations, and Functional Offices, which support NASA programs and activities. The organization of these offices is shown in Figure 2.1-1. These offices are listed in Appendix A by their internal organizational code designations, with a brief citation of functions of greatest relevance to key OSS processes.

NASA Headquarters is the formal interface with external organizations, both within and outside the Government. It is the focal point for interactions with Congress and the Administration. It is the Agency interface with other Government organizations, such as the National Science Foundation, Department of Energy, Department of Defense, National Institutes of Health, and the National Oceanic and Atmospheric Administration, and with agencies of state and local governments. Agreements establishing international cooperative programs are negotiated and signed by NASA Headquarters in conformance to interagency concurrence processes. NASA Headquarters personnel also maintain cognizance of foreign space programs of interest to NASA and maintain contact with their counterparts in foreign countries.

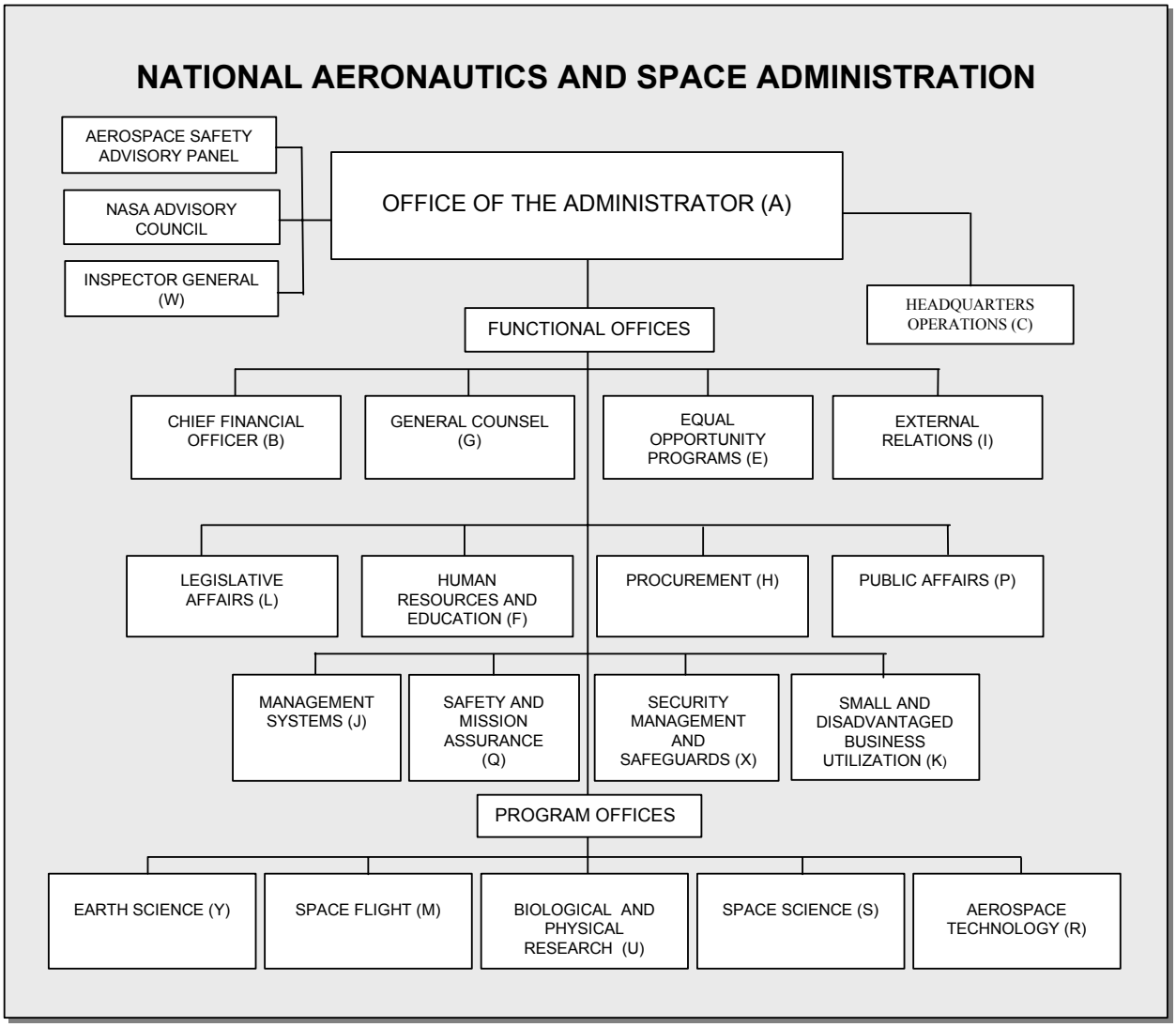


Figure 2.1-1 NASA Headquarters Organization

2.1.3 NASA Centers

The five Strategic Enterprises are directed from NASA Headquarters, but individual Enterprise programs and projects are managed by the Agency's ten NASA Centers. Along with these NASA Centers, industry, universities, other Government departments and agencies, and space agencies and scientists from other countries participate in the execution of Enterprise programs. Individual NASA Centers have specific areas of responsibility and Agency leadership, which denote primary concentrations of capabilities to support Strategic Enterprise goals. These responsibilities are summarized in Figure 2.1-2. In addition, each NASA program is assigned to a Managing Center for accomplishment; OSS Managing Center assignments are given in Section 3.

To ensure alignment between organizations and institutional capabilities, the Program Office with the dominant activity at each NASA Center is designated Institutional Program Office (IPO) for that Center. These relationships are shown in Figure 2.1-3. In providing institutional management, the Enterprise Associate Administrator (EAA) works with the Center Director and Functional Offices to develop long term Center strategies, and to determine staffing and facility investment requirements and other factors relating to Center infrastructure and operation.

The EAA's in their institutional management roles issue budget allocations and guidance to their institutional Centers. When an Enterprise other than the institutional management Enterprise assigns a program or project to a NASA

Note: The Jet Propulsion Laboratory (JPL) is currently operated by the California Institute of Technology (Caltech), but functions generally like a NASA Center. The JPL staff is employed by Caltech, not by the Federal Government.

NASA Center	Areas of Responsibility and Leadership
Ames Research Center (ARC)	Astrobiology; Aviation Operations Systems; Information Technology
Dryden Flight Research Center (DFRC)	Flight Research; Atmospheric Flight Operations
Glenn Research Center (GRC)	Aeropropulsion and Aerospace Power Systems Research and Technology; Turbomachinery
Goddard Space Flight Center (GSFC)	Earth Science; Physics and Astronomy
Jet Propulsion Laboratory (JPL)	Planetary Science and Exploration; Instrument Technology; Deep Space Systems
Johnson Space Center (JSC)	Human Exploration; Human Operations in Space; Astro Materials
Kennedy Space Center (KSC)	Space Launch; Launch & Payload Processing Systems
Langley Research Center (LaRC)	Atmospheric Science; Airframe Systems; Structures and Materials
Marshall Space Flight Center (MSFC)	Space Transportation Systems Development; Microgravity and Space Optics, Manufacturing Technology
Stennis Space Center (SSC)	Rocket Propulsion Testing; Commercial Remote Sensing

Figure 2.1-2 NASA Centers and Their Areas of Responsibility

ENTERPRISE	NASA PROGRAM OFFICE	INSTITUTIONAL CENTERS
Space Science	Space Science	Jet Propulsion Laboratory
Earth Science	Earth Science	Goddard Space Flight Center
Human Exploration and Development of Space	Space Flight	Johnson Space Center Kennedy Space Center Marshall Space Flight Center Stennis Space Center
Biological and Physical Research	Biological and Physical Research	
Aerospace Technology	Aerospace Technology	Ames Research Center Dryden Flight Research Center Glenn Research Center Langley Research Center

Figure 2.1-3 NASA Enterprises and Organizational Responsibilities

Center (e.g., SSE assigns a program to Goddard), the EAA making the assignment must have the concurrence of the EAA responsible for that Center that the program or project can be accommodated within Center staff levels and facilities, or agree to allocate additional staff or to construct additional facilities. Major actions at a Center are frequently coordinated through a forum of all EAA's who have work at the Center.

2.2 NASA STRATEGIC MANAGEMENT SYSTEM

2.2.1 Overview

NASA's Strategic Management System is an integrated approach to planning, implementing, executing, and evaluating NASA activities, and to delivering quality products and services to the public and other customers and stakeholders. The Government Performance and Results Act of 1993 (GPRA) requires executive branch agencies to develop strategic plans and management procedures to improve the efficiency of Government and increase public confidence in the Government. NASA established the Strategic Management System to fulfill these requirements (see Subsection 2.2.2). The Strategic Management System also incorporates requirements imposed by the Chief Financial Officer's Act and the Information Technology Management Reform Act. The ISO 9001 quality evaluation system (see Subsection 2.2.3) and other continual improvement techniques are used to plan and execute programs. The Strategic Management System is described in the NASA Strategic Management Handbook (NPG 1000.2).

The NASA Agency-level Strategic Management Process has four components: strategic planning, implementation planning, execution, and performance evaluation. Strategic planning establishes the long-term direction of NASA. Implementation planning provides the detailed and iterative performance planning and proposed resource allocation to implement Agency goals and objectives developed during the strategic planning process. It ensures compatibility between the planning and budgets needed to support Agency and Enterprise strategic plans. Implementation planning addresses capital investment planning and the 5-year budget, and provides the basis for evaluating performance. Execution is the means by which NASA delivers its products and services, and is carried out under NASA Policy Directive (NPD) 7120.4 and NASA Procedures and Guidelines (NPG) 7120.5. Performance evaluation is the end process to assess NASA's success in meeting the goals set forth in the performance plans developed during implementation planning.

The NASA program/project management system is introduced in Subsection 2.2.4. Figure 2.2-1 identifies key documents required to complete the four elements of NASA's Strategic Management process.

Strategic Planning	Implementation Planning	Execution	Performance Evaluation / Reporting
• Agency Strategic Plan • Enterprise Strategic Plan • Agency 5-year Budget	• Agency Program Operating Plan (POP) Guidance • Enterprise POP Guidance • Center Implementation Plans • Enterprise Budget Requests • Agency Budget • Agency GPRA Annual Performance Plan • Administrator's Performance Agreement with President • Program Plans and Program Commitment Agreements (PCA's)	• NASA Policy Documents (NPD's) • NASA Procedures and Guidelines (NPG's)	• Agency GPRA Annual Performance Report • Other External Reports and Assessments • Agency-wide, Enterprise, Process, and Program Metrics Presentations to Enterprise Council (as required)

Figure 2.2-1 Strategic Management Documentation Requirements

2.2.2 Government Performance and Results Act of 1993 (GPRA)

The Government Performance and Results Act was enacted in 1993 with a broad goal of improving effectiveness of the Federal Government. The Act's objectives are to improve the American people's confidence in the capability of the Government, improve program effectiveness by focusing on results, help Federal managers improve their services by requiring planning and collection of information about results and service quality, and improve Congressional decision-making by providing more objective information on achieving statutory objectives. The Act directs Federal agencies to develop customer-focused strategic plans that structure activities in accordance with missions and goals, to structure budget submissions in alignment with these plans, and to measure and report results in terms of these plans and budgets.

In short, GPRA provides that, after a phase-in period during the 1990s, each Federal agency will develop, and deliver to the Congress, a 5-year agency-wide strategic plan updated on at least a triennial schedule. Further, the law provides that each agency will deliver yearly a performance plan that provides the basis for retrospective evaluation of its performance after the end of the fiscal year. Finally, GPRA requires each agency to furnish a self-assessment against its performance plan no more than six months after the conclusion of the fiscal year in question. The first performance report, based on the FY99 performance plan, was delivered in March 2000.

The strategic planning function in the NASA strategic management system sets the framework for future programs. The NASA Strategic Management Handbook (NPG 1000.2) defines the strategic planning process. Five-year strategic plans must set forth the Agency mission, long term goals, and associated resource requirements.

The NASA Strategic Plan and the individual Enterprise strategic plans must be consistent, and must contain a vision statement, a mission statement, identification and description of external customers, an assessment of the external and internal environments, and statements of goals, ob-

jectives, and implementing strategies. Strategic plans should contain a description of the key elements of the program, the values of the organization, a description of its evaluation process, and an indication of how program evaluations will be used in establishing or revising goals. Each of the strategic plans should include a strategic roadmap that delineates the near- and far-term goals for the Agency and the Enterprises.

The NASA Strategic Plan, contained in NPD 1000.1, provides the Agency's top level strategy. The Enterprise strategic plans flow down from the NASA Strategic Plan, and must be aligned with it. The intent of the NASA Performance Plan is to require reporting from each Enterprise according to the themes developed in their Enterprise Strategic Plan. The mechanism for this reporting will be the Integrated Budget and Performance Document (IBPD), which is under development as this report is published. The intent is to combine the performance plan and the OMB Form 300B at the time of budget submittal. Details of this process will be added to this Handbook through updates when it becomes available.

2.2.3 Quality Management

NASA has adopted a quality management system based on the International Organization for Standards ISO 9001 Quality Management System Standard, dealing with the design, development, production, servicing, inspection and test of quality products. The ISO 9001 system also applies to NASA Centers, including JPL, and contractors as specified in their contracts. The NASA Headquarters Quality System is a three-tiered system consisting of a Quality System Manual, Headquarters Common Processes (HCP's), and Office Work Instructions (OWI's). These are supported by records and documents to prove that this system is being implemented per the standard. NPD 8730.3 describes NASA quality management policy. The NASA Headquarters Quality System Manual has been issued as HQSM 1200.1.

Formal registration or certification to the ISO 9001 standard is a key provision of the quality system. Registration is achieved through an audit by a non-NASA third party organization (i.e., a registrar) which reviews documentation and records to verify that work is carried out, and products are provided, according to the Quality System Manual, Headquarters Common Processes, and Office Work Instructions. Consequently, each NASA Headquarters organization must create and adhere to a formal ISO 9001 document control and quality records system. Subsequent to registration, the registrar performs a comprehensive surveillance audit every six months to ensure that the quality system is functioning continuously and effectively.

It is important that all OSS employees and detailees: 1) have a working knowledge of the NASA Headquarters Quality System; 2) are providing quality products in accordance with the Quality System; 3) are prepared to assist with the preparation and maintenance of ISO 9001 documents and records; and 4) can successfully participate in the various audits. Current information on OSS ISO 9001 practices can be found at http://www.hq.nasa.gov/hqiso9000/library.htm.

2.2.4 Program/Project Management

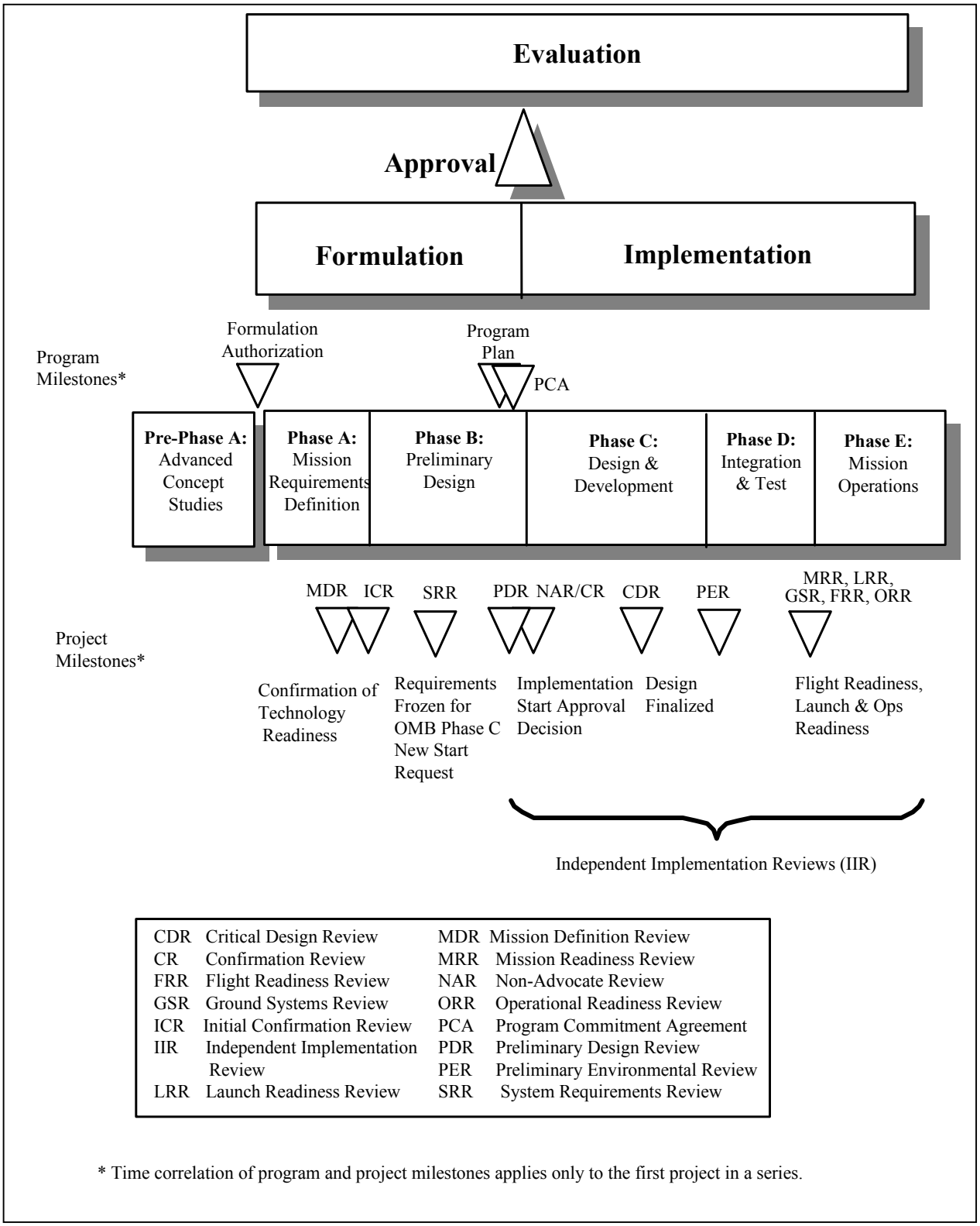
NPD 7120.4 and NPG 7120.5 establish the system under which NASA manages its programs and projects. A program is defined as a major activity within an Enterprise that has defined goals, objectives, requirements, and phased funding levels. A program may consist of one or more projects. Projects are significant activities within a program that have goals, objectives, requirements, life-cycle costs, and a beginning and end. The NASA Program and Project Management system must be used for all programs and projects that provide space and aeronautics flight and ground systems, technologies, and operations. It is not required for construction of facilities, small business innovative research, research and analysis, or other non-flight infrastructure projects.

NPD 7120.4 and NPG 7120.5 define a process in which programs are initiated in a Formulation phase and pass through an Approval gate into Implementation. The Approval gate occurs traditionally either at a Non-Advocate Review (NAR) presentation to the Agency Program Management Council (PMC) or a Confirmation Review with the Associate Administrator for Space Science. Overlaying the Formulation, Approval and Implementation elements of the NPG process is the fourth component, the Evaluation subprocess.

This subprocess provides for the independent assessment of programs and projects by external teams. The NPG also provides for multiple passes through the Formulation steps. In fact, it requires no certain number of iterations but allows passing into Implementation whenever the Approval requirements are met.

OSS traditionally has used a phased program/project management approach in which new programs and projects were developed in five distinct phases: A through E. This phased program/project approach has many useful aspects that give discipline to program and project scheduling and management. Thus, to provide continuity from the previous way of tracking programs and projects to the more generic phases in NPG 7120.5, the OSS has defined Phases A & B to constitute Formulation while Phases C, D and E constitute Implementation. This is further described in Section 7. In most cases, a Pre-Phase A encompassing Advanced Studies will be conducted prior to beginning Formulation. The point of Approval to proceed from Formulation into Implementation coincides with the transition between Phase B and Phase C. Note that the boundary between Phases C and D has been redefined as the start of Integration and Testing of the full up system, rather than Critical Design Review (CDR) as in the past.

The relationship of the NPG processes to the phased approach OSS is now using is graphically displayed in Figure 2.2-2. The 7120 subprocesses are shown at the top. The required program milestones are indicated below this and above the phase timeline. Some of the principal project milestones are shown below the phase timeline, and while the use of such reviews is sound engineering practice, as described in the NASA Systems Engineering Handbook (SP-6105), it is not intended to be proscriptive. The concept of tailoring, introduced in NPG 7120.5, allows modification of the standard approach to match the nature of the program or project. While OSS would like all programs and projects to follow this plan, deviations will be reviewed and accepted if warranted and the risks are appropriately managed. Note that phases A to E apply to projects and to those programs that consist of a single project. For multiple-project programs, the program milestones are aligned with the first project in the series, such that when the NAR is conducted for the inaugural project, the Approval process occurs for both the project and the program. In this case program Approval is indicated by the Administrator signing the initial PCA. The details of this process are more fully described in Section 7.



CDR	Critical Design Review	MDR	Mission Definition Review
CR	Confirmation Review	MRR	Mission Readiness Review
FRR	Flight Readiness Review	NAR	Non-Advocate Review
GSR	Ground Systems Review	ORR	Operational Readiness Review
ICR	Initial Confirmation Review	PCA	Program Commitment Agreement
IIR	Independent Implementation Review	PDR	Preliminary Design Review
		PER	Preliminary Environmental Review
LRR	Launch Readiness Review	SRR	System Requirements Review

* Time correlation of program and project milestones applies only to the first project in a series.

Figure 2.2-2 OSS Program/Project Phases

3. THE OFFICE OF SPACE SCIENCE: ORGANIZATION AND RESPONSIBILITIES

3.1 OVERVIEW OF THE SPACE SCIENCE ENTERPRISE

The mission of the Space Science Enterprise (SSE) is to further understanding of the universe and its origin, of the solar system, and of the sun-Earth connection, and to communicate this knowledge to the public. This includes the development of new technologies to continually improve scientific capabilities, and the transfer of science and technology advances to the public and private sectors to ensure U.S. scientific and technical leadership. The Office of Space Science (OSS) implements the NASA Space Science Strategic Plan through definition and management of the Space Science Enterprise. (See http://spacescience.nasa.gov.)

In doing so, the Office of Space Science plans, openly competes, selects, directs, executes, and evaluates research extending from the uppermost levels of Earth's atmosphere (about 60 kilometers in altitude) to the edge of the universe billions of light years away, and providing the scientific foundation for expanding human presence beyond Earth orbit into the solar system.

The OSS organizes NASA's space science activities around the SSE mission elements. This structure (Figure 3.1-1) assigns research and program management responsibilities for these elements to three discipline divisions: Sun-Earth Connection (Code SS), Solar System Exploration (SE), and Astronomy and Physics (SZ). The Mars Exploration Program Office (SM) is a Special Program Office established to oversee the entire Mars Exploration Program. Three staff divisions, Resources Management Division (SP), Policy and Business Management Division (SB), and the NASA Management Office at JPL (SJ), provide crosscutting support. It is the intention of OSS to establish a new Program Office for the Nuclear Systems Initiative when it begins in FY'03.

Oversight of the Formulation and Implementation of space science programs and projects is provided by an Enterprise Program Management Council (EPMC), which is one management oversight level in the hierarchy of Program Management Councils by which the Agency operates (see Subsection 7.3.5.1). The EPMC is chaired by the Associate Administrator for Space Science, and is composed of the various directors of OSS along with representatives from selected functional offices at NASA Headquarters, as defined in Figure 6.5-2. Further discussion of the constitution and role of the EPMC can be found in Section 7.

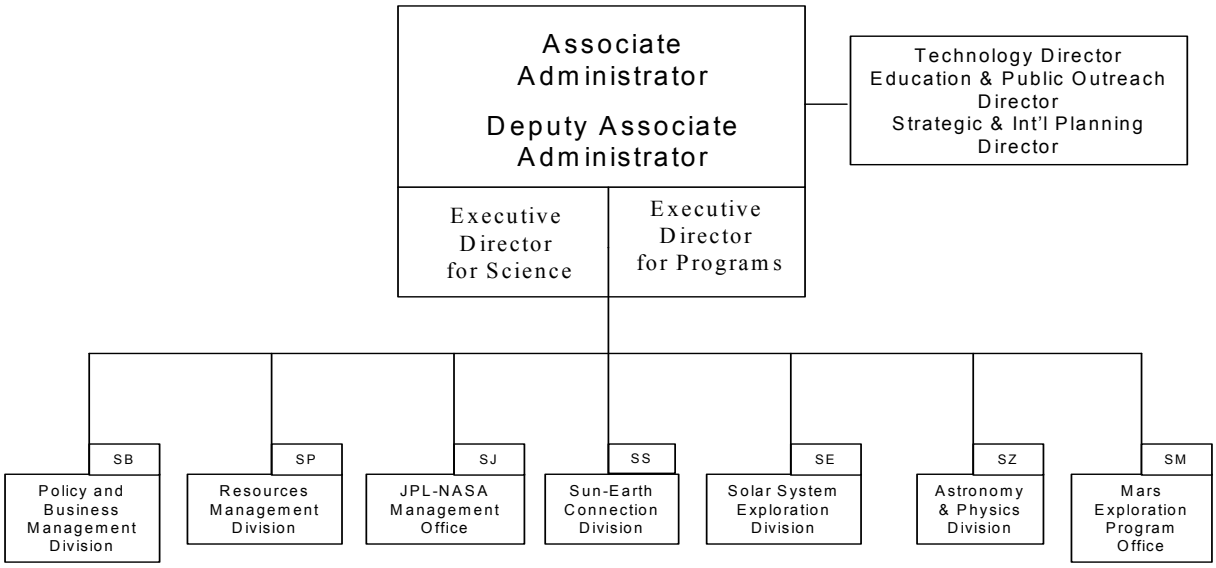


Figure 3.1-1 Organization of the Office of Space Science

3.2 ROLES AND RESPONSIBILITIES

3.2.1 Office of the Associate Administrator (Code S)

Associate Administrator

The Associate Administrator (AA) for Space Science is responsible for directing science research and flight programs, selecting science investigations and investigators for relevant research activities, infusing new technology into SSE programs, identifying opportunities for technology transfer, and coordinating OSS efforts with other NASA offices in support of integrated technology activities. The OSS AA directs program and project formulation, execution and evaluation for NASA-funded and reimbursable programs in space science. In addition to these specific responsibilities, the AA has strategic planning, organizational development, personnel management, and other responsibilities applicable to all officials-in-charge as outlined in The NASA Organization (NPG 1000.3). The AA also provides oversight of the institutional and contract elements of JPL, a Government-owned, contractor-operated (GOCO) NASA facility. JPL is given responsibilities and delegated authority under the terms of a contract currently with the California Institute of Technology (Caltech).

Deputy Associate Administrator

The Deputy AA works under the general direction of the OSS AA and shares the full range of responsibilities in OSS, with special emphasis on: general management; day-to-day program evaluation and direction; general management of overall SSE program management, including interfacing activities with senior NASA management on program operating issues and problems; interface activities with industry; and supporting the AA in presenting the SSE program and budget to the Congress and other external entities.

Executive Director for Science

The Executive Director for Science (EDS) serves as the principal interface between the OSS AA's office and the space science research community. This includes coordination on behalf of OSS with external advisory bodies such as the Space Science Board and its various committees. The EDS approves the content of Announcement of Opportunity (AO) and NASA Research Announcement (NRA) concurrence sheets and authorizes the beginning of an AO or NRA concurrence cycle, and serves as Chairman of the Space Science Steering Committee. The EDS ensures the quality and integrity of OSS science selections by organizing and conducting selection reviews with the goal of formulating selection recommendations, and presenting the recommendations to the OSS AA; and manages the Resident Research Associate and Resident Management Associate Programs in OSS.

Executive Director for Programs

The Executive Director for Programs (EDP) works under the general direction of the OSS AA and in concert with the DAA to direct overall programmatic aspects of SSE programs and projects. The EDP ensures consistent implementation of programs and projects across the divisions and the Mars Program Office, ensures that program/project formulation and implementation is compatible with Agency requirements, interfaces with the Chief Engineer's Office for program/project management policy relative to the Provide Aerospace Products and Capabilities cross cutting process, and mentors program executives in the divisions on policy and good practice in program management.

Strategic & International Planning Director

The Strategic and International Planning Director (SIPD) is responsible for space science strategic and long-range planning, including integrating thematic and disciplinary approaches to planning, strategic and implementation plan development, and roadmap development. He/she supports OSS activities in support of Agency GPRA performance planning and reporting. The SIPD is responsible for integrating OSS and Agency strategic planning activities, and coordinates long-range space science planning with foreign national and international space agencies. The SIPD is the OSS Headquarters point of contact for coordination of international agreements with the Office of External Relations and for establishing their relative priorities. He/she is also the OSS point of contact for the NASA Export Control program and for approval of Center non-program international travel.

Education & Public Outreach Director

The Education and Public Outreach Director (E&POD) is responsible for planning, implementing, overseeing and evaluating the SSE program in education and in public understanding of science. In matters involving all aspects of education and public outreach, the E&POD serves as the focal point for liaison with other NASA Headquarters offices, NASA Centers, other Government agencies, advisory committees, and local, regional and national groups involved in education reform and in educating the public about science. In this role, the E&POD establishes overall objectives and requirements for the SSE E&PO program, and sets policy and provides guidance for implementation by the discipline divisions of specific project E&PO activity. The E&POD is also responsible for the general oversight and assessment of SSE E&PO activities to ensure that they are consistent with SSE policies and the overall approach that the Enterprise has adopted for its E&PO program.

Technology Director

The Technology Director is responsible for planning, advocating, integrating, assessing, and optimizing a broad program of advanced technology in support of the future strategic mission needs of the science themes within the SSE. The Technology Director provides leadership and oversight in meeting near and far-term goals of the SSE. This includes interfaces with the other NASA Enterprises in the development of cross Enterprise technologies, as well as with non-NASA institutions, including government (DOD, DOE, et al.), industry and academia, where there may be advanced technology development of potential utility and value to the SSE.

Special Program Directors

At certain times and for specific programs with high visibility, a large investment or other Agency significance, the OSS AA may elect to appoint a Program Director who will have full programmatic authority over the planning and execution of a program and who ordinarily reports directly to the OSS AA. For example, a Cassini Program Director was appointed at Headquarters during the development of the spacecraft, through the launch approval process. The position was dissolved after launch. In 2001 OSS established a Mars Exploration Program Office (Code SM) to oversee the replanning and implementation of the Mars Exploration Program and all of its constituent projects. The Mars Exploration Program Office is staffed with direct report engineers for Program Executive support, but draws staff support from Code SE for Headquarters Program Scientist support. The Mars Exploration Program Director is the primary Headquarters point of contact for the Mars Exploration Program Manager at JPL, and they work together to plan and execute the program. The Mars Exploration Program and its projects are subject to NPD 7120.4 and NPG 7120.5 requirements as is any other space science program. The conduct of the program is defined by the Program Commitment Agreement and Program Plan.

It is anticipated that additional Program Directors will be established at Headquarters in the 2002-2003 timeframe, such that most major SSE programs will be headed by a Program Director.

3.2.2 Discipline Divisions

Each discipline division is responsible for oversight and coordination of the formulation and implementation of space science programs and projects, and coordinating the scientific research engendered by participation in such missions. The three discipline divisions correlate with the science themes of the Space Science Enterprise as follows:

- Sun-Earth Connection (SEC) Division
  -- Sun-Earth Connection theme
- Exploration of the Solar System (ESS) Division
  -- Solar System Exploration theme
- Astronomy & Physics Division (APD)
  --Astronomical Search for Origins and Planetary Systems (ASO) theme
  --Structure and Evolution of the Universe (SEU) theme

The discipline division staffs are made up of Civil Service employees and temporary staff members appointed under the Intergovernmental Personnel Act (IPA). The Civil Service staffs consist of the Division Directors, Discipline and

Program Scientists, Scientists, Program Executives, and administrative and clerical personnel. IPA appointees can serve as Discipline Scientists, Program Scientists, and MO&DA managers, generally for appointments of two to three years.

The discipline Division Directors provide intellectual leadership for their respective themes. They are responsible for defining and leading an interdisciplinary scientific effort that contributes to the definition of the overall space science program. Based on interactions with their science community and with appropriate advisory groups representing the science community, individual discipline Division Directors make decisions concerning the use of resources for their part of the Space Science Enterprise. In that context, they develop strategies and set budget priorities among program elements within their divisions.

Discipline Division Directors have full programmatic responsibility and accountability (budget, schedule, technical performance) for all programs, projects, and disciplines assigned to them. Directors integrate programs, including budget trades, within their scientific areas. In addition, Division Directors have supervisory responsibility for all employees in their divisions, and report directly to the OSS AA.

Oversight and coordination of space science programs and projects are implemented by Program Executives within each division. Their responsibility encompasses management and oversight over the lifetime of flight programs, from initiation of mission concept studies through the design and building of spacecraft, to launch and mission operations. They are also responsible for defining and overseeing the development of new technologies and concepts required to enhance and enable future space science missions. These activities are described in detail in Section 7.

Management of research under Research and Analysis (R&A) grants, and for Mission Operations and Data Analysis (MO&DA) for operating space science missions, is implemented by Program Scientists and Program Executives. Other responsibilities include the Information Systems, and NASA's Science Data and Computing Technology Program. These activities are described in detail in Section 6.

3.2.3 Staff Divisions

Resources Management Division (Code SP)

This division is responsible for program analysis, program control, procurement planning, information resources management, and ADP, institutional, business and administrative management, and evaluation and audit support for OSS and the NASA Management Office at JPL. Major responsibilities include forecasting and monitoring the resource requirements of OSS, ensuring that resources are properly allocated, reviewing accomplishments of existing programs, and recommending alternative strategies. The division oversees the planning, integration, evaluation, analysis, and final preparation of the program, institutional and support budget requirements, including implementation of budget strategy and resource justification for budget submissions to OMB and Congress. The division also coordinates OSS development of products required by the Government Performance and Results Act of 1993 (GPRA).

Policy and Business Management Division (Code SB)

This division provides executive staff support to the OSS AA, including policy analysis, preparation of briefing materials, presentations and speeches, processing of action items issued to the Associate Administrator for Space Science via the NASA Headquarters Action Tracking System (HATS), and development and management of education and public outreach products and materials. The division also coordinates actions from NASA's Office of Legislative Affairs, including development of written material, testimony, and responses to questions and correspondence from congressional members and staff. Code SB provides overall management of OSS personnel issues, including management of the OSS administrative budgets for promotions, travel, training and awards, and provides administrative support for advisory committee activities and correspondence control.

NASA Management Office at JPL (Code SJ)

The NASA Management Office (NMO) is located at the JPL in Pasadena, California, and is responsible for management oversight of the NASA contract for operation of JPL, including the

contractual implementation of task orders by which programs and projects are assigned to JPL and contractually funded. Further information on the selection and evaluation processes for this contract is found in Section 4. The NMO manages government property at the JPL facility, provides NASA management with legal support regarding patent and technology transfer issues related to work conducted by JPL, and manages contract activities related to NASA's Small Business Innovative Research (SBIR) Program at JPL.

The NMO also administers the government oversight function over the JPL purchasing and subcontract authorization system, The NMO provides local representation of NASA's oversight function to senior JPL and Caltech officials, and provides leadership and coordination of all NASA efforts for the JPL performance evaluation. The NMO is also responsible for contract management activities related to the NASA contracts with the Commonwealth of Australia and with the government of Spain for NASA's satellite tracking facilities in these two countries.

The NMO is the location for the Discovery Program Office, which manages this program of low cost, science community initiated projects of solar system exploration. The Discovery Program Manager, appointed by the NMO Director, has program management responsibility for Project development, launch, on-orbit checkout, mission operations and data analysis across the various organizations involved in the Program.

3.2.4 NASA Centers

OSS carries out the Space Science Enterprise through programs and projects implemented at NASA Centers. Figure 3.2-1 identifies science theme leadership responsibilities, research roles (consistent with Center areas of responsibility in Figure 2.1-2), and mission roles for the Centers supporting the SSE.

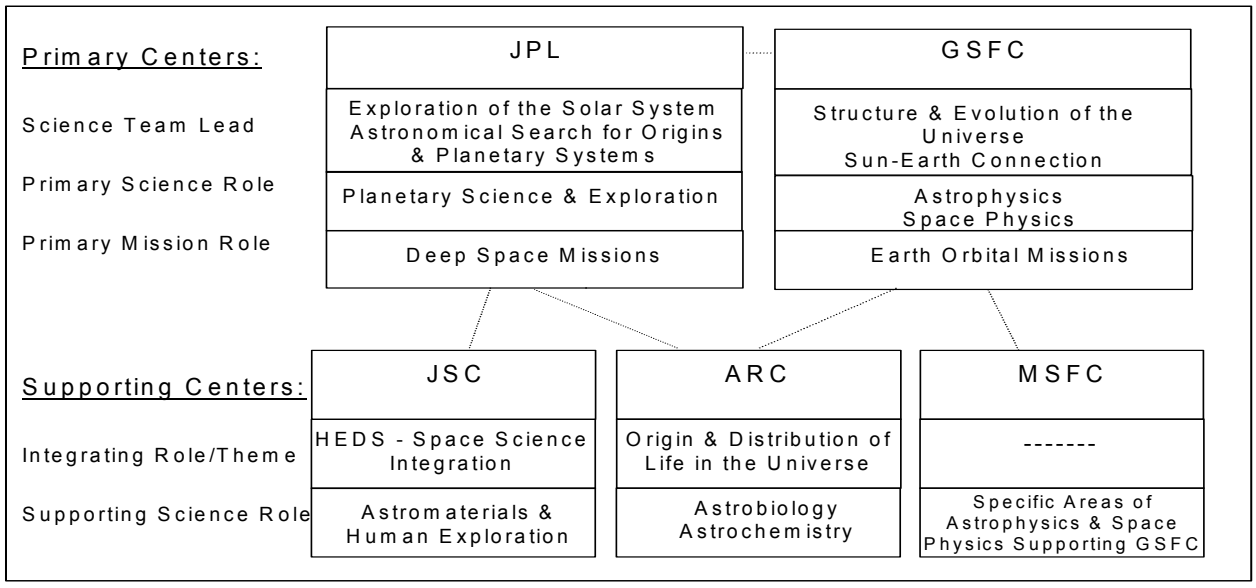


Figure 3.2-1 SSE Center Roles and Responsibilities

4. NASA MANAGEMENT OFFICE AT JPL

4.1 OVERVIEW

The NASA Management Office (NMO) is a division of the Office of Space Science (OSS), resident at the Jet Propulsion Laboratory (JPL) in Pasadena, California, and is comprised of approximately 25 NASA civil servants. The NMO's main charter is management oversight of the NASA contract (currently with the California Institute of Technology (Caltech)) for operation of JPL, NASA's only Federally Funded Research and Development Center (FFRDC). The NMO also provides management support to NASA Program Offices and NASA Centers for NASA work performed at JPL. In addition to negotiating NASA contractual requirements with Caltech, the NMO furnishes on-site institutional management oversight in such areas as security, safety, environmental management, and property management at the JPL facility. Further, the office provides NASA management with legal support involving patent and technology transfer issues associated with the work performed by JPL. The NMO also manages a variety of leading-edge technology agreements, as well as the NASA contract authorizing Deep Space Network (DSN) tracking operations in Australia and Spain and supporting the CSOC contract at Goldstone.

Other NMO responsibilities include continuous assessment of the vitality of JPL's acquisition process, and evaluation of proposed task orders from NASA and non-NASA (reimbursable) sponsors to ensure all work performed at JPL complies with Federal Acquisition Regulation (FAR) requirements governing management and operation of FFRDC's. In addition, the NMO monitors the efficiency and effectiveness of JPL's automated accounting and business management systems.

The Director of the NMO, assisted by the Procurement Officer, provides local representation of NASA's oversight function to senior JPL and Caltech officials and facilitates periodic evaluation of JPL's performance in institutional, programmatic and outreach areas pursuant to the Award Fee provisions of the prime contract.

4.2 COMPETING AND AWARDING THE PRIME CONTRACT FOR JPL OPERATIONS

Competing and awarding the prime contract for operation of the Jet Propulsion Laboratory is one of the primary responsibilities of the NMO Contracts Management Section. Historically, the contract is awarded for a five-year period of performance. Every five years, approximately 18 months before the end of the performance period for the extant contract for operation of JPL, the NMO initiates the process necessary to award a new contract, thereby ensuring that critical NASA programs managed by JPL continue without interruption.

The process of competing and awarding the prime contract for JPL operations is defined in HOWI5135-S009. (Always check http://www.hq.nasa.gov/hqiso9000/library.htm to ensure use of the most current OWI.) The process begins with the NMO Procurement Officer validating the requirement for a successor contract and preparing appropriate documentation supporting the decision in accordance with FAR clause 35.017-4. This documentation is subject to approval by the Assistant Administrator of the NASA Headquarters Office of Procurement (Code H). The NMO Procurement Officer creates a letter for the NASA Administrator to sign, providing written authorization for continued use of an FFRDC to satisfy NASA's space science programmatic requirements through completion of the coming five-year performance term.

If it is decided to continue to use Caltech as the contractor to manage JPL, the NMO Procurement Officer prepares and recommends approval of a Justification for Other than Full and Open Competition (JOFOC) in accordance with FAR clauses 6.302-3 and 6.303, and forwards it for approval by the Associate Administrator for Space Science.

Following JOFOC approval, the NMO Procurement Officer issues a notification in Federal Business Opportunities (FBO) of NASA's intent to award a contract for the operation of the Jet Propulsion Laboratory.

The NMO Procurement Officer issues a Request for Proposal (RFP) to potential interested parties and reviews proposals submitted by the offerer(s) for conformity with the requirements identified in the RFP. To facilitate a timely and complete evaluation, the NMO Procurement Officer may route portions of the proposal to cognizant NASA Headquarters Functional Offices for review and comment.

Following successful negotiations, the NMO Procurement Officer generates, as necessary, any requests for waivers/deviations from NASA regulations and/or FAR provisions (occasioned by the terms of the negotiated agreement) and submits them to the NASA Headquarters Office of Procurement (Code H) for approval. [Code H approval is provided via a signed cover letter.]

The NMO Procurement Officer then awards the new contract for managing JPL operations. [The contract is a bilateral instrument, requiring the signatures of both the NMO Procurement Officer and a representative of the Contractor.]

4.3 TASK ORDERS

Essentially all work performed by JPL is authorized and funded by use of unilateral Task Orders that are developed and issued by an NMO Contracting Officer. Task Orders provide specific authorization or direction to perform work within the scope of the prime contract. Each Task Order contains a separate statement of work describing the effort to be performed or the services or supplies to be furnished, an estimated dollar value, and a specified period of performance. The statement of work for each Task Order is derived from a specific Task Plan that is developed as a result of discussions between the sponsor and the JPL project.

Most of JPL's annual funding is devoted to NASA programs. The balance consists of support to non-NASA sponsors, which JPL is permitted to undertake provided that it falls within a special competency as defined in the prime contract. This non-NASA work is performed on a reimbursable basis as described in paragraph 4.3.2.

4.3.1 JPL Direct Task Order Award

The NMO awards direct Task Orders (TO's) under the NASA/Caltech prime contract for operation of the Jet Propulsion Laboratory. Individual TO's are used to authorize JPL to furnish scientific and technical support to NASA. Issuance of these TO's is a primary responsibility of the Contracts Management Section (CMS) of the NASA Management Office for JPL. This process commences when NASA determines that it wants to authorize JPL to perform work in support of a NASA mission. A Task Plan for the specific activity is developed through discussions between the NASA sponsor and the appropriate JPL Directorate. The cognizant NASA finance office then releases resource authority to the Regional Finance Office (RFO) at the Goddard Space Flight Center. The RFO generates a NASA Form 506A authorizing funding for JPL work to be performed, and faxes the document to the NMO. The Direct Task Order process is defined in HOWI5135-S020. (Always check http://www.hq.nasa.gov/hqiso9000/library.htm to ensure use of the most current OWI.)

4.3.2 JPL Reimbursable Task Order Award

JPL is permitted to furnish support to Reimbursable Sponsors, provided that this support falls within a special competency defined in the NASA/Caltech prime contract. Reimbursable-sponsored work is designated in bilateral TO's issued by the cognizant NMO Contracting Officer and accepted by the Caltech Office of General Counsel. Issuance of these TO's is another primary responsibility of the Contracts Management Section of the NMO.

The reimbursable TO process commences when a requirement for JPL services is identified via discussions between JPL and a Reimbursable Sponsor. This requirement is documented in an Advance Notice of Intent to Propose provided by JPL to the NMO Technical Specialist for approval. Following acceptance of the proposal by the sponsor, funds from the Reimbursable Sponsor are paid to NASA, which then issues a Reimbursable Task Order to JPL. The statement of work for the accepted proposal is the basis for the Reimbursable Task Order. The reimbursable Task Order process is defined in HOWI5135-

S021. (Be sure to check http://www.nasa.hq.gov/hqiso9000/library.htm. to ensure use of the most current OWI.)

For Federal-agency sponsors, rules governing interagency acquisitions apply. These rules may require creation of an Economy Act Order by the Reimbursable Sponsor. The Economy Act authorizes agencies of the Federal Government to enter into mutual agreements to obtain supplies or services. Federal agencies must also provide a Military Interdepartmental Purchase Request (MIPR) or equivalent document funding JPL work to be performed for the initial Task Order (TO) and any modification to it.

Non-Federal-agency sponsors must furnish an advance payment in addition to a Purchase Order or Authorization Letter referencing the Task Plan to be funded.

4.4 EVALUATING, APPROVING, AND AUTHORIZING THE AWARD FEE ON PRIME CONTRACT FOR JPL OPERATIONS

A cost-plus-award-fee contract is utilized for operation of JPL. Use of an award fee structure provides NASA considerable leverage in favorably influencing both the program performance and the business practices of the prime contractor at JPL. The award fee is administered per criteria contained in the Performance Evaluation Plan (PEP) for management of the Jet Propulsion Laboratory (see the sample PEP in Appendix A to HOWI5112-S010). This plan ensures complete, timely, and fair evaluations of JPL performance under the contract at regular intervals.

The award fee process encompasses all facets of evaluating performance, approving award fee amounts, and authorizing payment of the award fee earned under the contract in a given period, and is followed for each year of the five-year performance term of the contract. The Evaluation and Award Fee process is defined in HOWI5112-S010. (Always check http://www.hq.nasa.gov/hqiso9000/library.htm to ensure use of the most current OWI.)

The NASA Associate Administrator for Space Science serves as the Fee Determination Official (FDO), and is responsible for determining the actual amount of award fee earned by the contractor and payable during each evaluation period. Members of the Performance Award Evaluation Board (PAEB) are appointed not later than 30 calendar days after contract award. PAEB members are appointed by the PAEB Chairman [Deputy Associate Administrator for Space Science], subject to approval by the Fee Determination Official. The membership of the PAEB is drawn from NASA Headquarters senior officials of codes that perform functional oversight or sponsor programmatic tasks at JPL.

The Officials in Charge (OIC's) of cognizant NASA Headquarters codes appoint Contract Performance Monitors (CPM's) to assess contractor performance. The NMO Procurement Officer coordinates with these OIC's to ensure that they furnish an appropriate level of orientation and guidance to the CPM's concerning preparation of assessments for award fee determination purposes.

The OIC-appointed CPM's implement a request by the Associate Administrator for Space Science to generate JPL assessment reports. The CPM's assess contractor performance based upon personal observations and evaluation of performance data.

The CPM's submit completed performance reports to the Administrative Point of Contact (APOC) within the cognizant NASA Headquarters Functional Office. The APOC consolidates these reports and forwards them to the OSS Resources Management Division.

Interim evaluations are conducted at the midpoint of each fiscal year of the performance term of the contract and cover the preceding six months. Final evaluations are conducted at the conclusion of each fiscal year of the performance term of the contract and cover the entire year.

The PAEB develops an interim summary evaluation within 20 calendar days after the midpoint of the evaluation period. The PAEB Chairman briefs the contractor on interim findings within 10 calendar days of the PAEB interim meeting. The PAEB Chairman provides the interim summary evaluation to the FDO within 5 calendar days after the interim progress briefing to the contractor.

During the final evaluation, the PAEB receives optional written self-evaluation reports from the contractor. The PAEB meets and formulates final evaluation recommendations and provides them to the Performance Evaluation Board (PEB) and the FDO within 25 calendar days after the end of the evaluation period. The PEB advises the FDO of the final performance scores within 10 calendar days after the PAEB meeting. The FDO makes the final Incentive Award Decision and debriefs the contractor within 10 calendar days after the PEB meeting.

The NMO Procurement Officer authorizes payment to the contractor based upon contract modification within 60 calendar days after the end of the evaluation period.

5. ENTERPRISE STRATEGIC PLANNING AND BUDGETING

5.1 STRATEGIC PLANNING

5.1.1 Overview

Strategic management is the process by which long range scientific goals, flight mission implementation, and evaluation processes are established, documented and executed. This process involves all Space Science Enterprise (SSE) stakeholders, and coordinates their needs and interests into a unified program within the constraints of national policy, projected budgets, and technological capability. The foundation of the process is the Space Science Enterprise Strategic Plan, which serves as a basis for formulating, explaining, and advocating space science projects and initiatives over the near-term future. The nominal time scale of the plan is ten years, with general outlines provided for an additional 5-10 years. The plan is revised every three years to ensure that the program's planning base remains scientifically, technologically, and programmatically current.

Preparation of the SSE Strategic Plan is the responsibility of the OSS Headquarters science management, working with the scientific guidance of the broad research community and under the programmatic guidance of the Associate Administrator for Space Science (AA), coordinated by the OSS Strategic and International Planning Director (SIPD).

The SSE Strategic Plan informs, and is in turn guided by, the Agency-wide NASA Strategic Plan. The SSE plan harmonizes the research and flight programs that respond to Enterprise stakeholders with provisions of the Agency plan. The process of developing the SSE Strategic Plan must take cognizance not only of science imperatives from the research community and budget and technological realities, but also the goals and structure of the top-level Agency plan as it evolves.

The SSE strategic planning process includes Enterprise performance planning and assessment. These subprocesses develop SSE contributions to the Agency's Performance Plan, and eventually to its Performance Report against the Performance Plan as provided in the Government Performance and Results Act of 1993 (GPRA). The SSE planning sequence and key inputs are illustrated schematically in Figure 5.1-1.

Preparation of the Agency-level GPRA documentation is primarily the responsibility of

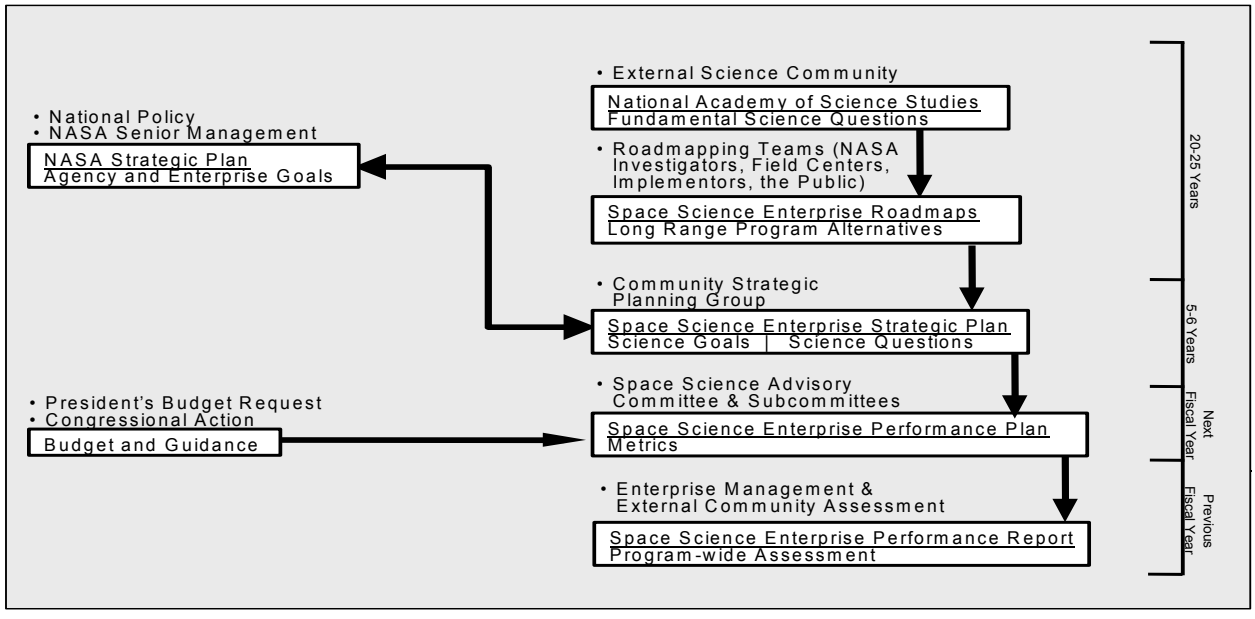


Figure 5.1-1 Space Science Enterprise Strategic Planning

the Office of the Chief Financial Officer (Code B), with SSE contributions coordinated by the OSS Resources Management Division. Technical support by OSS Program Executives and Program Scientists in developing the SSE elements is essential.

5.1.2 Enterprise Themes and Science Objectives

The SSE scientific program is divided into four broad thematic areas:

- Astronomical Search for Origins and Planetary Systems
- Structure and Evolution of the Universe
- Exploration of the Solar System
- Sun-Earth Connection

The discipline Division Directors for these thematic areas (see Subsection 3.2.2) are responsible for leading long-range science and mission definition in these areas. Science objectives identified in the Enterprise 2000 Strategic Plan are provided in Figure 5.1-2.

5.1.3 Advisory Groups

Stakeholder involvement in the SSE strategic planning process is vital. NASA's space science programs have evolved a system of advisory committees to ensure that high quality and broadly-based science community guidance is obtained. The SSE is assisted in identifying and analyzing scientific opportunities and priorities by two parallel but distinct advisory committee systems. One set, managed by the National Research Council (NRC), operates independently to develop long-range strategic science advice and occasionally to perform scientific or programmatic assessments. The other set, managed by NASA Headquarters under provisions of the Federal Advisory Committee Act (FACA), addresses near-term programmatic and prioritization issues.

National Research Council

The NRC is the operating arm of the National Academy of Sciences and the National Academy of Engineering. Supported primarily by grants and contracts, it provides independent scientific advice to agencies across the Federal Government. In 1958, the NRC established the Space Science Board (now the Space Studies Board, SSB) specifically to serve NASA space science program needs for independent advice. In operation since that time, the SSB in turn operates a number of discipline committees and ad hoc task groups that respond to NASA requests for studies and assessments on specific issues. Major products of the Board over the past two decades have been its science strategies, typically issued on a decennial basis in the major space science disciplines.

Space Science Advisory Committee

The NASA Advisory Council (NAC, see Figure 5.1-3) provides the NASA Administrator with counsel and advice on NASA programs and

1. Understand the structure of the universe, from its earliest beginnings to its ultimate fate
2. Explore the ultimate limits of gravity and energy in the universe
3. Learn how galaxies, stars, and planets form, interact, and evolve
4. Look for signs of life in other planetary systems
5. Understand the formation and evolution of the Solar System and Earth within it
6. Prove the origin and evolution of life on Earth and determine if life exists elsewhere in our Solar System
7. Understand our changing Sun and its effects throughout the Solar System
8. Chart our destiny in the Solar System

Figure 5.1-2 Space Science Enterprise Science Objectives (2000)

issues. The Space Science Advisory Committee (SScAC) of the NAC is established consistent with the Federal Advisory Committee Act. The FACA Charter of the SScAC can be found on the NAC Internet site referenced in Appendix D. The SScAC, through the NAC, advises the NASA Administrator on programs, policies, plans and other matters pertinent to space science missions, technology development and infusion, and basic research. Membership ensures a balanced representation among industry, academia, and Government with recognized knowledge and expertise in scientific, technological, and programmatic fields relevant to space science. Activities of the SScAC include roadmapping and strategic planning.

The SScAC is authorized to establish subcommittees for particular areas of space science and technology. These report to the SScAC and, like the parent organization, typically meet three times per year. Currently, four subcommittees are approved:

- Astronomical Search for Origins and Planetary Systems Subcommittee (OS)
- Structure and Evolution of the Universe Subcommittee (SEUS)
- Solar System Exploration Subcommittee (SSES)
- Sun-Earth Connections Subcommittee (SECAS)

The SScAC is also authorized to establish task forces for special studies, existing for limited durations and reporting to the SScAC.

Planetary Protection Advisory Committee

The NASA Advisory Council also has established a Planetary Protection Advisory Committee (PPAC) to advise the NASA Advisory Council on programs, policies, plans, and other matters pertinent to the Agency's responsibilities for biological planetary protection, as defined in NPD 8020.7, including planetary protection policy documents and components, implementation plans, and organization. The Committee also provides a forum for advice on interagency coordination and intergovernmental planning related to planetary protection, by including non-voting representatives from other Federal Agencies in the U.S. and non-U.S. space organizations such ESA, CNES, ISAS, etc. PPAC conforms to the same basic organizational provisos (e.g., FACA, etc.) as those governing SScAC, and anticipates 2 meetings per year.

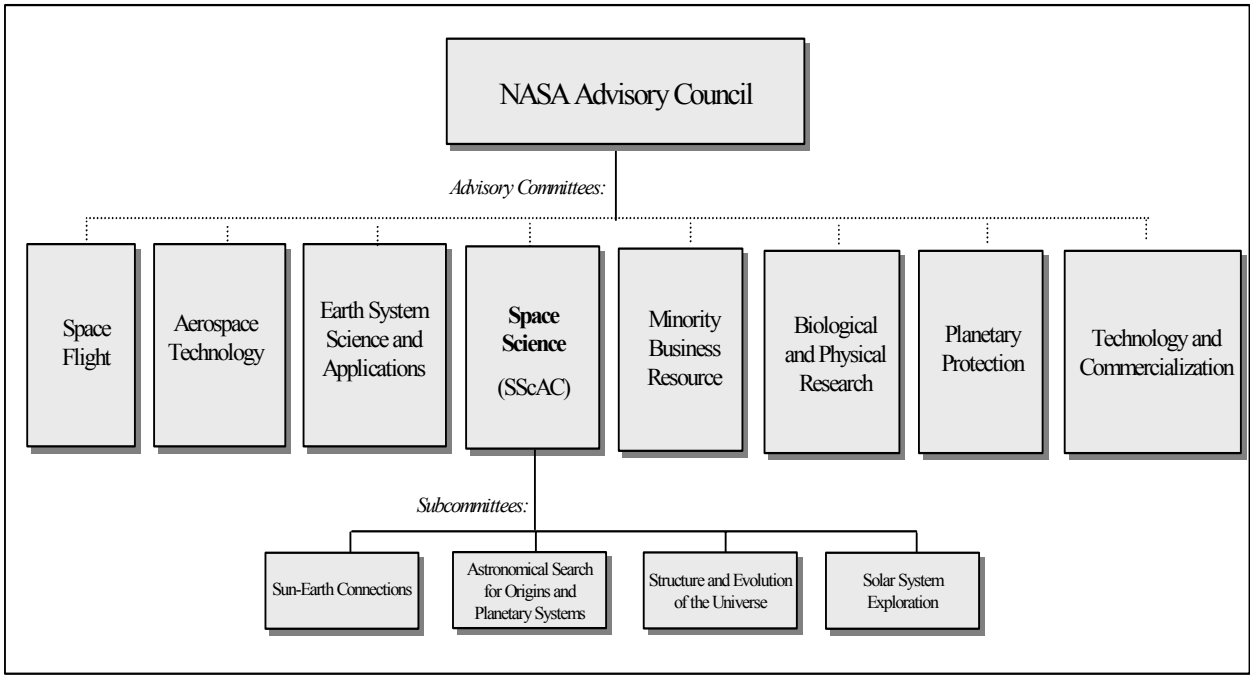


Figure 5.1-3 NASA Advisory Council

PPAC's chief interests at this point in time are focused on OSS activities in Solar System Exploration (especially Mars and outer planet satellites), but it will provide advice to NASA about any mission that may encounter a solar system body other than the Earth.

5.1.4 Strategic Plan

The Agency-level context for Enterprise strategic planning is described in Section 3 of the *NASA Strategic Management Handbook*. All employees should be familiar with this Handbook. Preparation of the triennial SSE Strategic Plan is the responsibility of OSS Headquarters management. The flow of activities involved in the strategic planning process is given in Figure 5.1-4 below (from HOWI7020-S001) and the following procedure (numbered steps refer to the figure). (To ensure use of the most current OWI, check http://www.hq.nasa.gov/hqiso9000/library.htm.)

1. Representing OSS senior management, the OSS Strategic and International Planning Director (SIPD) negotiates with the Code B Senior Advisor for Strategic Planning the schedule and format of the SSE input to the development of the agency-wide NASA Strategic Plan.

2. In accordance with agreements reached with the Code B Senior Advisor for Strategic Planning in Step #1 and in consultation with the Executive Secretary of the SScAC and the Directors of Code SE, Code SS, and Code SZ, the SIPD lays out a schedule for the development, review, and publication of the SSE Strategic Plan. After a detailed schedule (with milestones for partial completion) is established, the SIPD documents and disseminates it to: (1) the SScAC and its thematic subcommittees; (2) the Space Studies Board of the NRC; (3) OSS Program Executives, Program Scientists, and Discipline Scientists; and (4) Code SP Program Analysts.

3. In conformance to the overall schedule for the SSE Strategic Plan, the Directors of Code SE, Code SS, and Code SZ task the SScAC advisory subcommittees or establish ad hoc community working groups to evaluate existing theme roadmap documents in science and technology for necessary revisions or extensions. The OSS Education and Public Outreach Director (E&POD) supports the education and public-outreach components, the OSS Technology Director (TD) supports the technology components, and OSS Program Scientists and Discipline Scientists support the science components of this activity. These revisions and extensions include deleting obsolete data, updating near- and farther-term planning based on progress and new information, and extending the near- and farther-term plan by the amount of time elapsed since the previous roadmaps. Participants in the roadmapping process include not only community members but also industry representatives and individuals from the education and public outreach sectors.

   Information in the science components of the roadmaps focuses on proposed missions with science justification. Technology components present an analysis of key areas where technological advancement is needed to enable the proposed missions described in the science roadmaps. The roadmapping teams document the results of these thematic roadmapping activities in science and technology roadmap documents suitable for use in assessing and advocating alternative space science program structures over the near- and farther-term.

4. The Associate Administrator for Space Science and the Directors of Code SE, Code SS, and Code SZ (supported by the SIPD, TD, and OSS Program Executives, Program Scientists, and Discipline Scientists) assemble a strawman SSE Strategic Plan program profile consisting of operating missions, missions in development, and desired new starts for the near-term period. Key necessary technology initiatives are also identified. The resulting program is balanced and responsive to current NASA mission thrusts, technical feasibility, and likely resource availability. The SIPD and the Directors of Code SE, Code SS, and Code SZ integrate and refine the science objectives set.

5. OSS briefs the resulting strawman SSE Strategic Plan to community representatives, including participants in the science and technology roadmapping activities. The SIPD

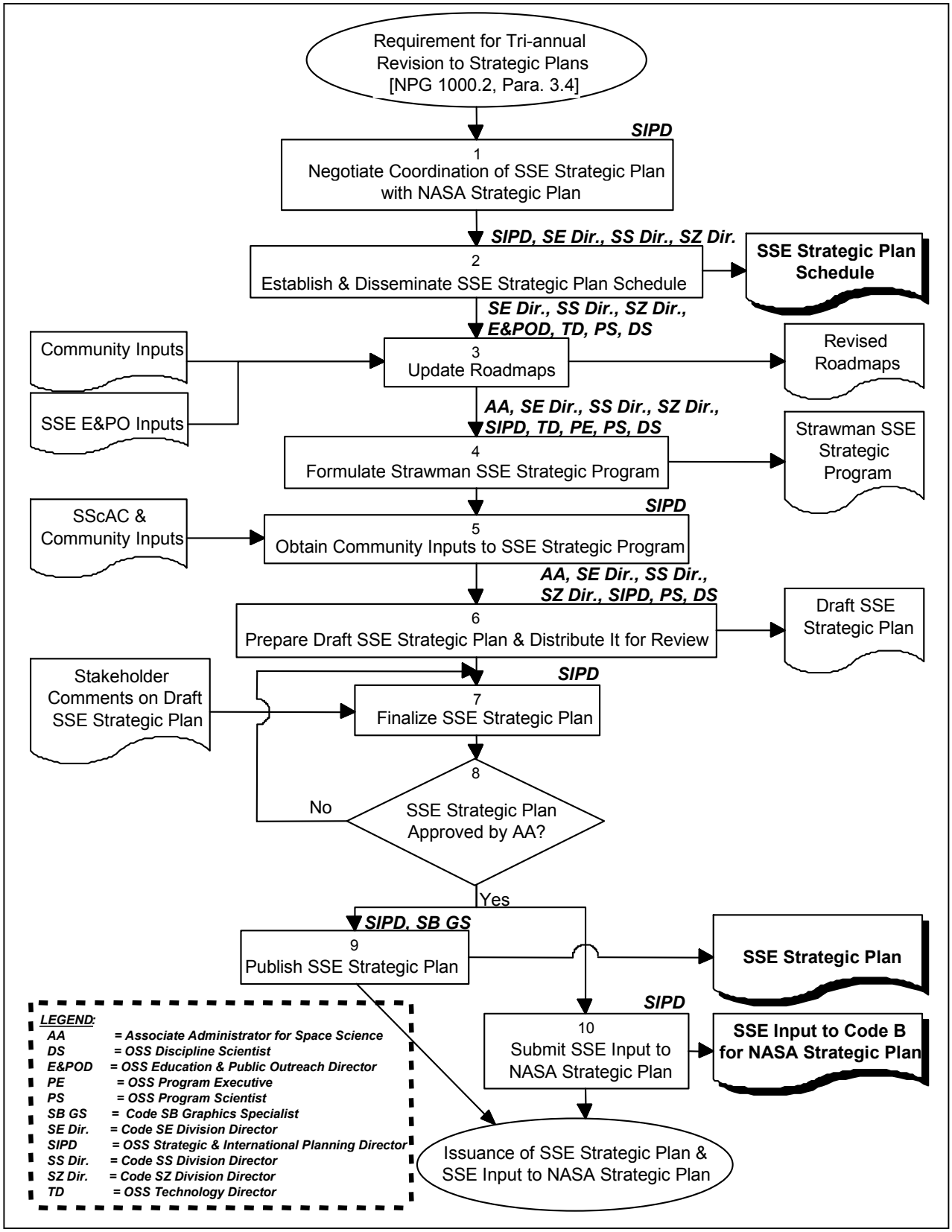


Figure 5.1-4 Prepare Strategic Plan

obtains inputs for suggestions or elaborations. One option for implementing this step is to have a large workshop including NASA science and technology managers and roadmapping participants and other community members.

6. In consultation with the Directors of Code SE, Code SS, and Code SZ and taking into account community inputs obtained in Step #5, the Associate Administrator for Space Science makes final program decisions that will be documented in the SSE Strategic Plan. The SIPD and OSS Program Scientists and Discipline Scientists prepare a draft SSE Strategic Plan for external review. Per the established schedule for SSE Strategic Plan development, the SIPD circulates this draft to the community and other stakeholders (including the SScAC and its subcommittees and the Space Studies Board) for comment.
7. Taking into account inputs received from stakeholders in response to circulation of the draft SSE Strategic Plan, the SIPD revises the draft SSE Strategic Plan.
8. If the Associate Administrator for Space Science approves the finalized SSE Strategic Plan via signature contained within the master copy of the document (after consultation with the Directors of Code SE, Code SS, and Code SZ), proceed to Step #9 and Step #10. If the SSE Strategic Plan is not approved, the SIPD returns to Step #7 and incorporates revisions required by the Associate Administrator for Space Science.
9. Working with Code SB graphics specialists, the SIPD compiles images and then interfaces with the NASA Headquarters print shop to produce final printed copies of the SSE Strategic Plan. The copies of the SSE Strategic Plan are broadly distributed to the community and other stakeholders, including Presidential Administration officials and Congressional members and staff.
10. In accordance with agreements reached with the Code B Senior Advisor for Strategic Planning in Step #1, the SIPD coordinates the revised SSE Strategic Plan with development of revisions to the NASA Strategic Plan. This entails generating summary SSE information for incorporation into the revised NASA Strategic Plan. The SIPD addresses any issues identified by Code B regarding the SSE input, revises it to accommodate Code B comments, and resubmits it to Code B.

5.1.5 Performance Plan

The Agency Performance Plan is presented yearly to OMB, coincident with the budget submission. The performance measures are based on project schedules for mission concepts and missions under development during the fiscal year covered by the plan, and on mission and science objectives for missions in operation and returning data during the fiscal year. Preparation of the SSE Annual Performance Goals (APG's) and supporting Performance Plan Indicators is the responsibility of an OSS Code SP Program Analyst, based upon information obtained from program and project offices at the NASA Centers and/or cognizant Program Executives, the Education and Public Outreach Director (E&POD), and the Directors and Program Scientists from Code SE, Code SM, Code SS, and Code SZ, with support from the Strategic and International Planning Director (SIPD). The flow of activities involved in the development and documentation of SSE APG's in accordance with the NASA annual fiscal-year budget process is given in Figures 5.1-5 and 5.1-6 (from HOWI7040-S002) and the following procedure (numbered steps refer to the figure). (Check http://www.hq.nasa.gov/hqiso9000/library.htm to ensure use of the most current OWI.)

1. In accordance with NASA-level guidance received from Code B (e.g., potential Performance Plan formulation instructions to NASA Centers), the current SSE budget structure, and the current SSE Strategic Plan, and in consultation with the SIPD, the Code SP Program Analyst formulates a Performance Plan Indicator (PPI) information request that is incorporated into the NASA Program Operating Plan (POP) call that initiates its budget cycle. These PPI's are events in OSS-budgeted programs and projects that will occur during the fiscal year of the OSS/SSE budget in development. Not all budget elements can be represented by discrete events. Some

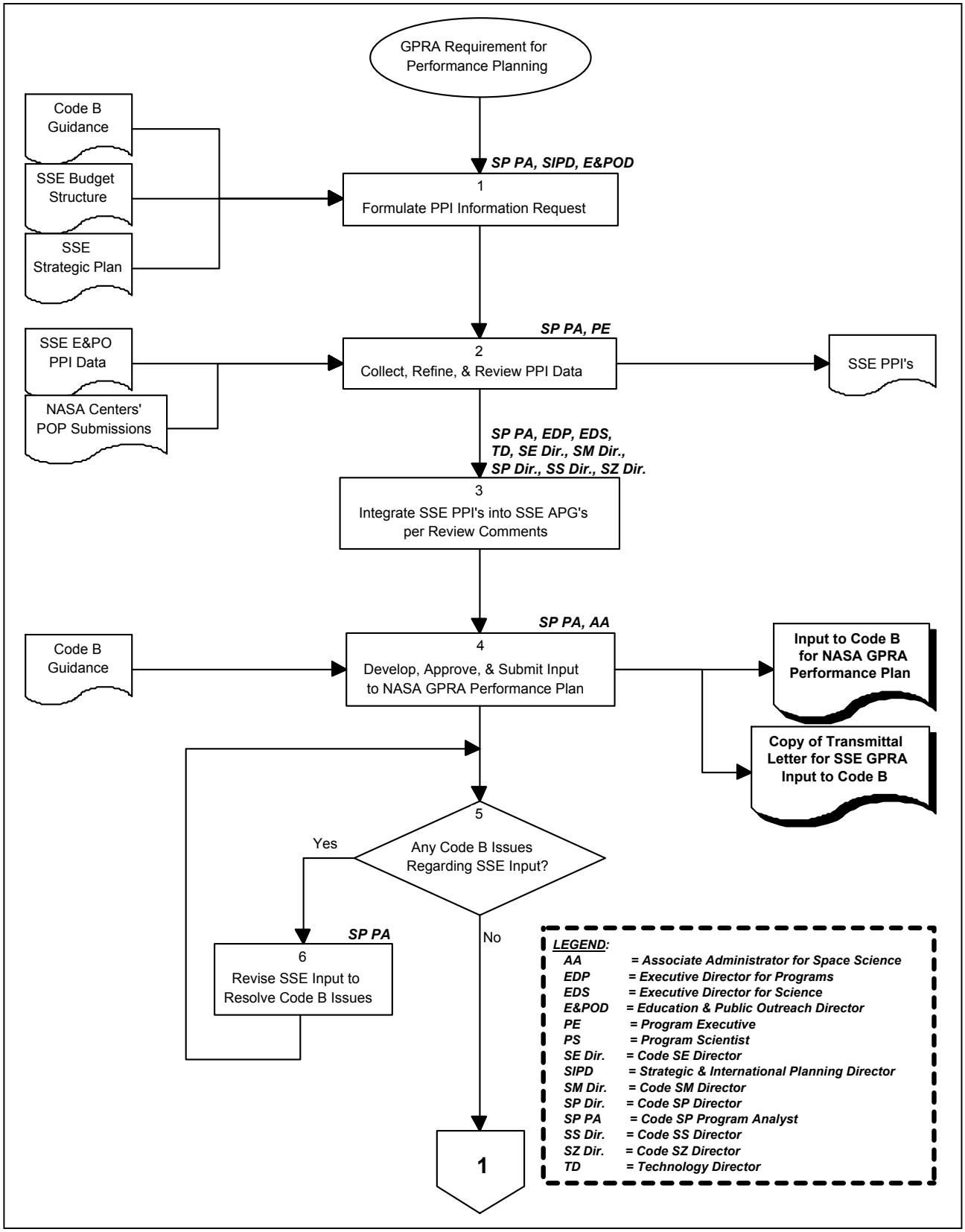


Figure 5.1-5 Develop Input to NASA GPRA Performance Plan

programs (such as R&A, data analysis, and some basic-technology research programs) are evaluated at the conclusion of the fiscal year by a retrospective assessment process. These are explicitly identified and excluded from the request for event-based PPI's.

2. The Code SP Program Analyst receives SSE Education and Public Outreach (E&PO) PPI data from the E&POD and POP submissions from the NASA Centers, refines these inputs into PPI's, and reviews them with the cognizant Program Executives in Code SE, Code SM, Code SS, and Code SZ.

3. As the OSS/SSE budget proposal matures, the Code SP Program Analyst checks the collected PPI's for continued alignment with the budget. The objective is to produce a representative set of clearly-verifiable milestone accomplishments selected by the Director of Code SP and the Code SP Program Analyst (i.e., the objective is not to develop an exhaustive statusing framework for each individual project, but rather a broad means to assess the integrated condition of the SSE at the end of the fiscal year). The Code SP Program Analyst integrates the PPI's into APG's and circulates them for comment to the: (1) OSS Executive Director for Programs (EDP); (2) OSS Executive Director for Science (EDS); (3) OSS Technology Director (TD); and (4) Directors of Codes SE, SM, SP, SS, and SZ. As a component of the budget proposal, the APG's may be included in the budget embargo.

4. The GPRA requires federal agencies to submit a formal performance plan with their budget submissions for each fiscal year. Responding to Code B guidance, the Code SP Program Analyst formats the APG's and PPI's and develops accompanying narrative material for incorporation into the NASA GPRA Performance Plan. The Associate Administrator for Space Science indicates approval of the SSE input to the NASA GPRA Performance Plan via signature on the accompanying transmittal letter. The Code SP Program Analyst then forwards the SSE GPRA Performance Plan input to Code B.

5. If Code B notifies the Code SP Program Analyst of issues it has regarding the SSE input to the NASA GPRA Performance Plan, proceed to Step #6. If not, proceed to Step #7.

6. The Code SP Program Analyst revises the SSE input to resolve the issues raised by Code B and resubmits the revised SSE input to the NASA GPRA Performance Plan to Code B at Step #5.

7. In accordance with guidance from Code B, the Code SP Program Analyst develops briefing materials on the SSE Performance Plan input for presentation to the NASA Capital Investment Council (CIC) by the Associate Administrator for Space Science (or designee).

8. The Code SP Program Analyst and the Code SP Director develop materials on the SSE Performance Plan input to be presented by the Associate Administrator for Space Science (or designee) as part of the budget briefing to the Office of Management and Budget (OMB).

9. If the SSE initial input to the NASA GPRA Performance Plan needs to be revised, proceed to Step #10. If not, proceed to Step #11.

10. In accordance with guidance from the cognizant Code B analyst, the Code SP Program Analyst reviews NASA's Congressional funding appropriation for impacts to the SSE APG's and PPI's. The Code SP Program Analyst consults with Code S Program Executives and/or the Directors of Codes SE, SM, SS, and SZ for making any adjustments to the APG's and PPI's. The Code SP Program Analyst submits any modifications to the SSE input to the NASA GPRA Performance Plan to Code B.

11. Approximately six to ten weeks before the beginning of the fiscal year to which the SSE input to the NASA GPRA Performance Plan applies, the Code SP Program Analyst works with the Directors and cognizant Program Scientists in Codes SE, SM, SS, and SZ to document specific operating-mission information to support related PPI's. The Associate Administrator for Space Science indicates approval of this supporting information

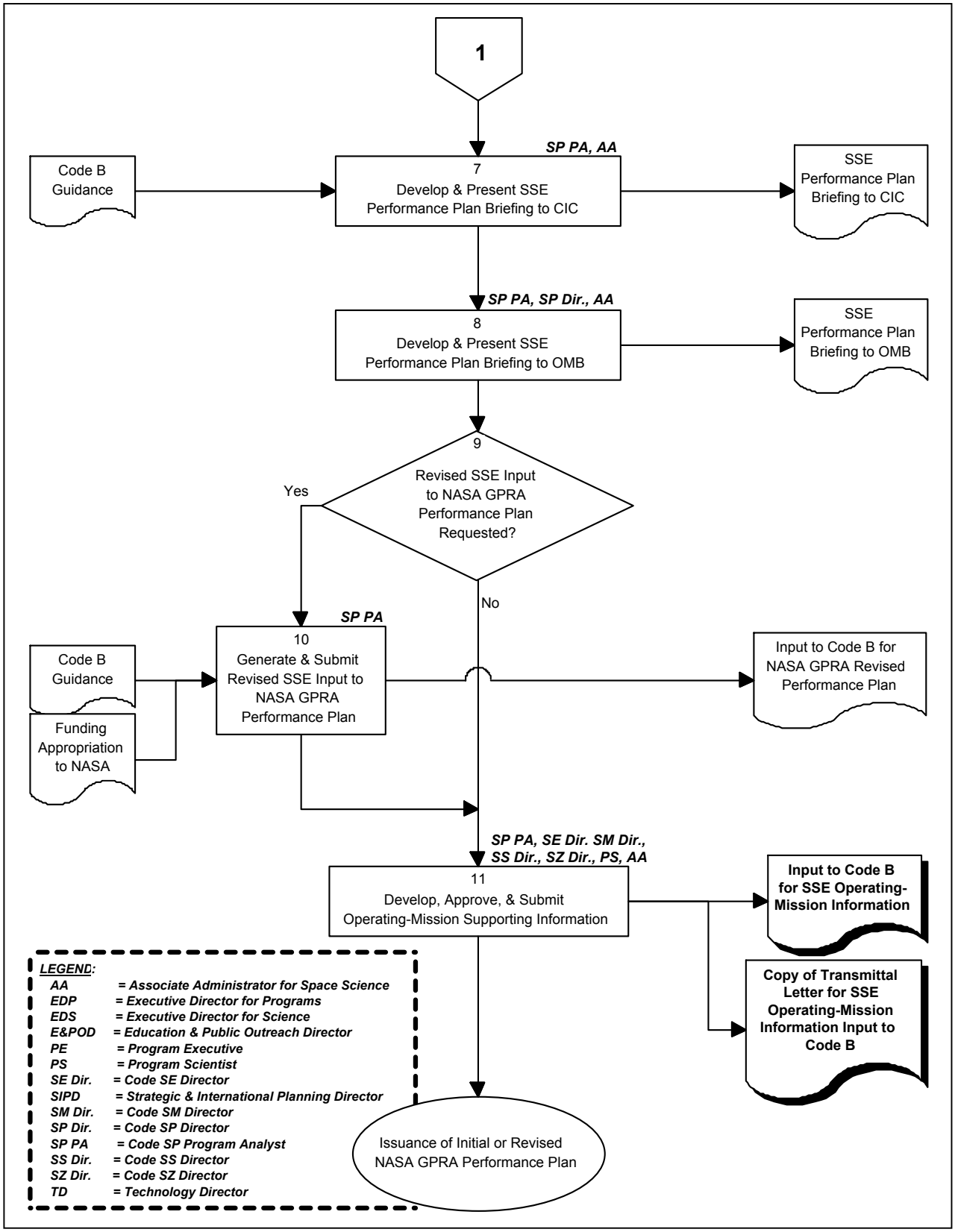


Figure 5.1-6 Submit Input to NASA GPRA Performance Plan

via signature on the accompanying transmittal letter. The Code SP Program Analyst forwards the input to Code B on or prior to the first day of the fiscal year.

5.1.6 Performance Report

The NASA Performance Report (PR) for each fiscal year is due to Congress during the second quarter of the following year. Section 5 of the *NASA Strategic Management Handbook* provides the Agency-level framework for performance analysis and reporting, including in Section 5.3 the role of external reviews. Preparation of the SSE Performance Report Data (PRD) is the responsibility of the OSS Headquarters science, flight, and technology program management, based upon information obtained from program and project offices at the NASA Centers and independent (i.e., non-NASA) assessment evaluators. Coordination is provided by the Code SP Program Analyst, with guidance from the Strategic and International Planning Director (SIPD). The flow of activities involved in assessing and reporting performance is given in Figures 5.1-7 and 5.1-8 below (from HOWI7040-S003) and the following procedure (numbered steps refer to the figure). (Always check with http://hqiso9000.hq.nasa.gov/library.htm to ensure use of the most current OWI.)

1. The Code SP Program Analyst formulates an approach for development of SSE Performance Report Data (PRD), based upon NASA-level guidance received from Code B. The NASA GPRA Performance Report is aligned with the components of the NASA GPRA Performance Plan. The SIPD develops a detailed methodology for assessing the status of the research programs. This methodology is then implemented by the Directors of Codes SE, SM, SS, and SZ (or their designees). Because of the long time lag associated with negotiating arrangements with volunteer independent (i.e., non-NASA) evaluators, preparatory actions need to be taken in this area well in advance of the close of the current fiscal year.
2. The OSS Program Executives and Program Scientists collect and validate project-performance data for fiscal-year performance targets from NASA Center program and project offices and provide these data to the Code SP Program Analyst for integration and analysis. The E&POD provides performance data for SSE Education and Public Outreach activities.
3. Because SSE research programs are not susceptible to progress measurement by means of key-event milestones, they are subjected to a self-assessment, which in turn is independently evaluated. Self-assessment summaries of SSE research programs are assembled by the Directors of Codes SE, SM, SS, and SZ (or their designees). The SIPD coordinates the self-assessment process.
4. The SIPD provides the information assembled in Step #3 to the independent evaluators, coordinates their review of it, and facilitates clarification of issues. The Code SP Program Analyst provides the independent evaluators with related project-performance data. The SIPD receives the inputs from the independent evaluators and forwards this information to the Code SP Program Analyst.
5. The Code SP Program Analyst integrates the project-performance data (from Step #2) with the independent evaluators' performance assessments (from Step #4) to assemble the draft SSE Performance Report Data.

   [NOTE: In order to comply with deadlines levied by Code B in its guidance received at Step #1, the Code SP Program Analyst may occasionally need to submit a preliminary version of the draft SSE PRD pending receipt of information from the independent evaluators, based upon the schedules and availability of these non-NASA experts. If inputs from the independent evaluators become available after the initial OSS submission of the draft SSE PRD to Code B, the Code SP Program Analyst then compiles an updated version and submits it to Code B.]
6. The Code SP Program Analyst circulates the draft SSE PRD to the TD and the Directors of Codes SE, SM, SS, and SZ for comment.
7. The Code SP Program Analyst resolves any issues resulting from the review comments from Step #6, incorporates the results into the

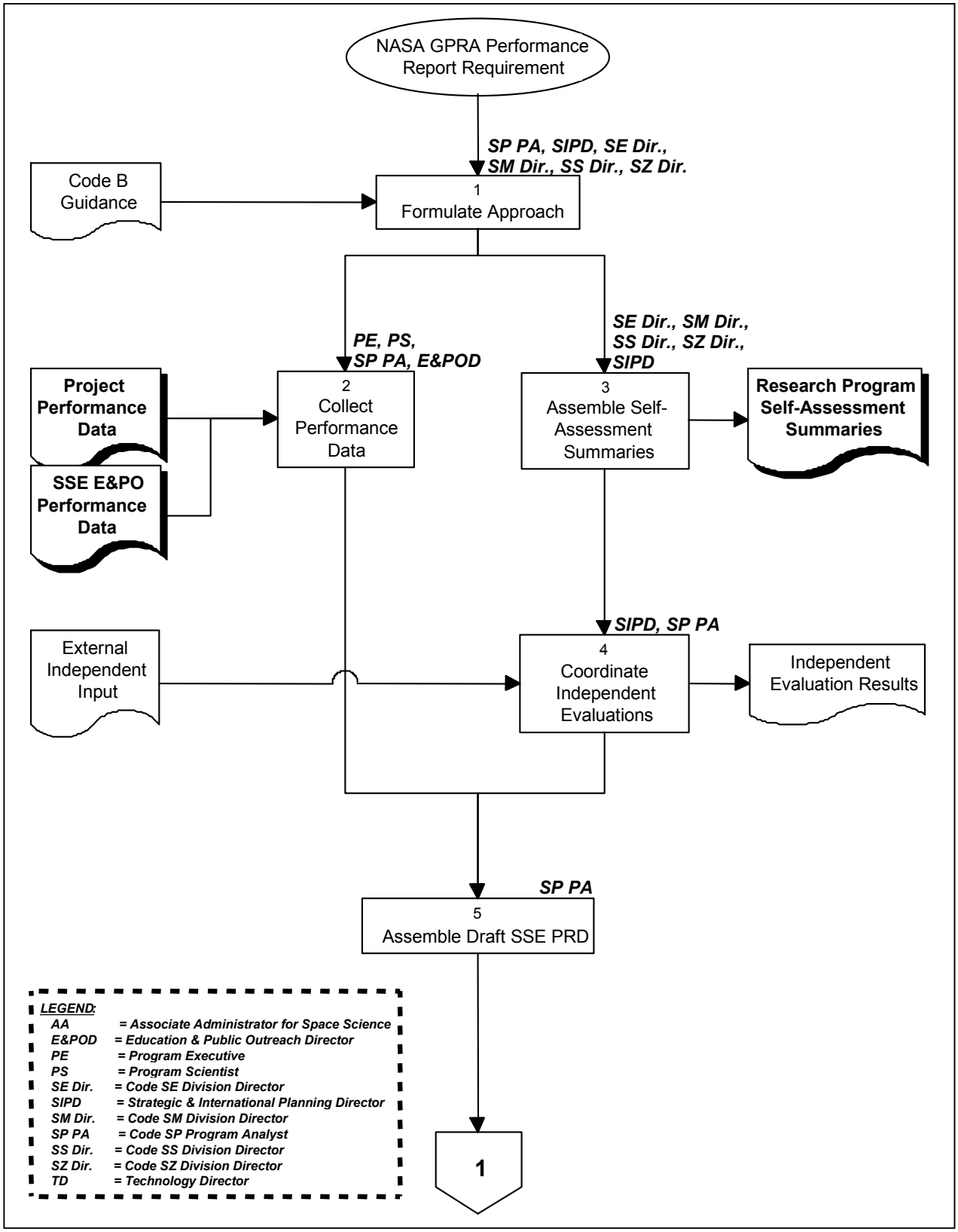


Figure 5.1-7 Prepare Draft SSE Performance Report Data

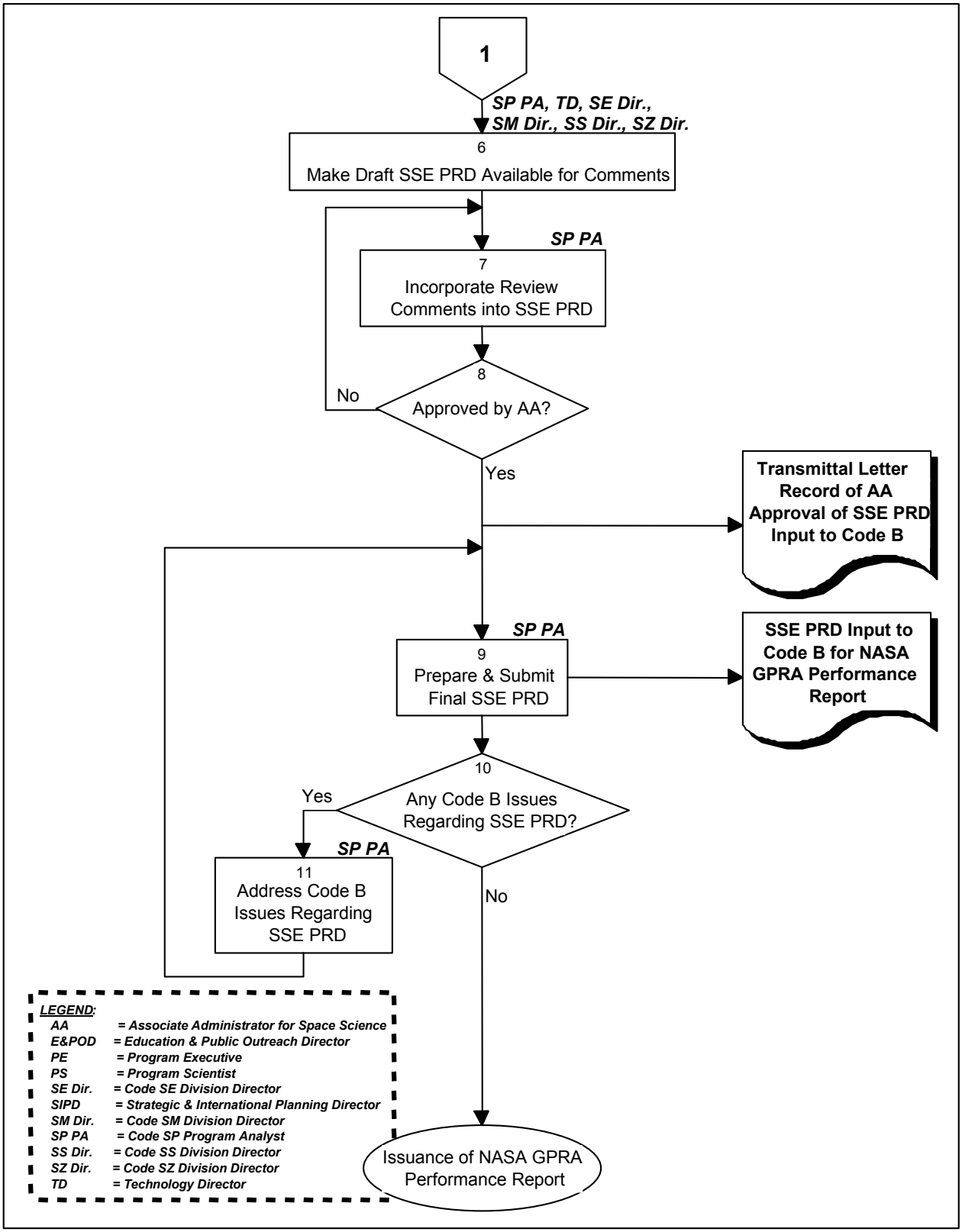


Figure 5.1-8 Submit SSE PRD for NASA GPRA Performance Report

SSE PRD, and submits it to the Associate Administrator for Space Science.

8. If the Associate Administrator for Space Science approves the SSE PRD via signature on its Transmittal Letter, the Code SP Program Analyst proceeds to Step #9. If the SSE PRD is not approved, the Code SP Program Analyst resolves issues identified by the Associate Administrator for Space Science.
9. The Code SP Program Analyst prepares the final SSE PRD and associated documentation and submits them to Code B for incorporation into the NASA GPRA Performance Report, in accordance with the Code B guidance letter received in Step #1.
10. If Code B notifies the Code SP Program Analyst of issues it has regarding the SSE PRD submission, the Code SP Program Analyst proceeds to Step #11. If not, the process is finished.
11. The Code SP Program Analyst reviews any issues raised by Code B regarding the SSE PRD, exercises his/her professional judgment to determine whether and how to revise it, and provides the results of this activity to Code B.

5.2 BUDGET FORMULATION, APPROVAL, AND IMPLEMENTATION

5.2.1 Overview

The OSS budget process is driven by the overall Federal budget process and by the internal NASA budget process. Within OSS the focal point is the Resources Management (RM) Division, Code SP. Outside of OSS, the key organizations that play important roles in the budget process include the Office of Management and Budget (OMB), several Congressional committees and subcommittees (including both House and Senate authorization and House and Senate appropriation committees), and within NASA, the Office of the Chief Financial Officer (Code B).

The three major phases to the budget process are formulation (also known as development), justification (also known as advocacy), and execution (also known as implementation). The budget flow is illustrated in Figure 5.2-1. One of the most important characteristics of the budget process is that at any given time, some aspect of all three phases of the budget process is occurring. In a given year OSS formulates the budget for the fiscal year that is two years away, justifies the budget for the upcoming year, and executes the budget for the current year. Figure 5.2-2 illustrates these three concurrent budget processes. Actual milestone dates may vary from year to year.

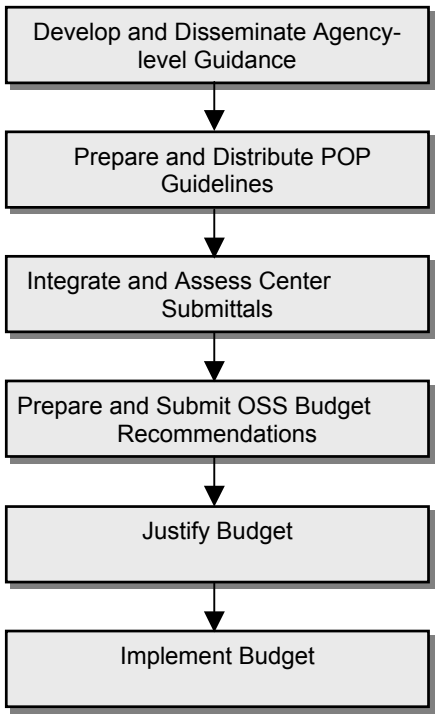


Figure 5.2-1 Budget Process Overview

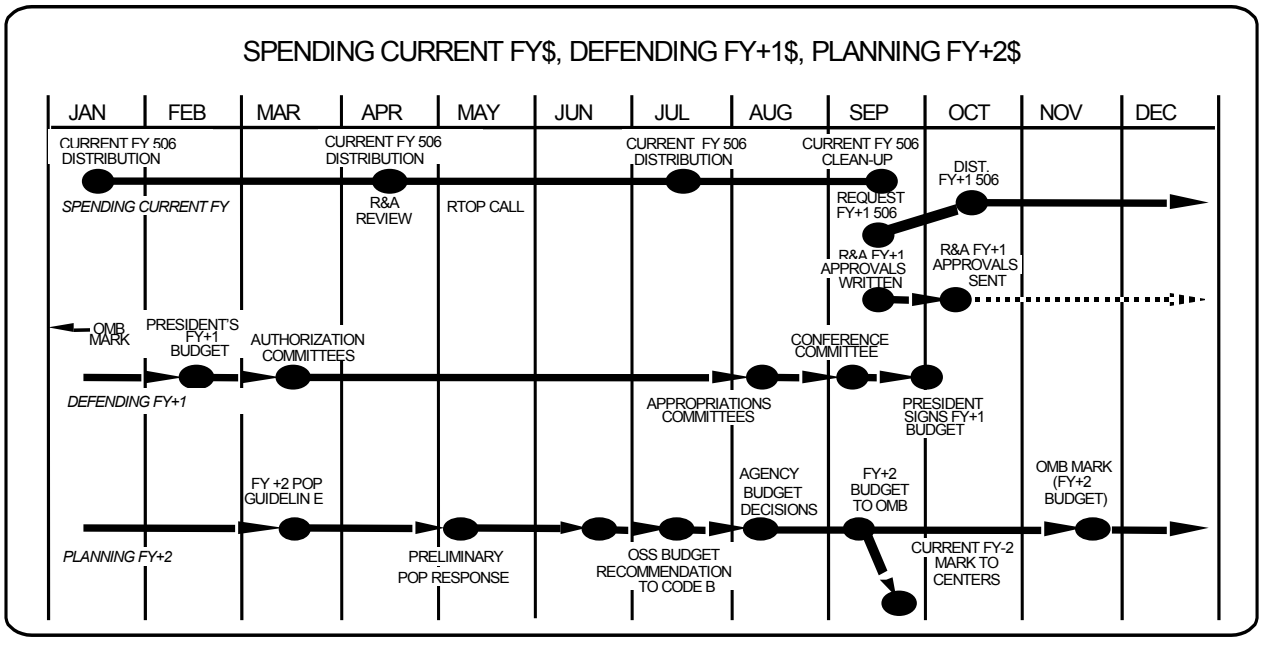


Figure 5.2-2 Concurrent Budget Processes

5.2.2 Budget Formulation

The budget formulation process is often equated with the development of the Program Operating Plan (POP). The objective of the POP is to establish the budget requirements for the budget year (current year plus two) and the four subsequent years. Although the main result of this process is a Program Financial Plan (PFP), project content and schedules as well as the funding plans are often adjusted to enable the total OSS program to stay within its budget envelope. The budget formulation process consists of three significant stages: preparation of POP guidelines, assessment of NASA Center submittals, and development of the integrated OSS budget recommendation.

The flow of activities involved in the Budget Formulation process is given in Figures 5.2-3 and 5.2-4 below (from HOWI7410-S014) and the following procedure (numbered steps refer to the figures). (Always be sure to check http://www.hq.nasa.gov/hqiso9000/library.htm to ensure use of the most current OWI.)

1. In accordance with NASA agency-level guidance from Code B and the SSE Strategic Plan, Code SP Program Analysts prepare draft OSS budget-development guidelines, with inputs from OSS Program Executives. The Associate Administrator for Space Science defines the overall program priorities and budget strategy for the upcoming process. Code SP Program Analysts prepare numeric and narrative guidance consistent with this direction.
2. Code SP Program Analysts coordinate the draft OSS budget-development guidelines with the Directors of Codes SE, SM, SS, and SZ. Code SP Program Analysts then send the finalized OSS budget-development guidelines to the cognizant NASA Centers.
3. Code SP Program Analysts develop funding controls consistent in total with the most recently submitted President's budget. There is often some redistribution among projects to accommodate the latest approved requirements or to reflect changes in program priorities. These funding controls are broken out in a spreadsheet by NASA Center and, within each Center, by project.
4. Code SP Program Analysts prepare the Program Operating Plan (POP) guidelines that establish the funding envelope for the OSS program in its entirety, as well as for individual projects. In addition, the POP guidelines provide data requirements and formats, a budget-preparation schedule, and specific direction to projects regarding assumptions, option analysis, and unique data requests.
5. Code SP Program Analysts distribute the POP guidelines electronically to cognizant NASA Centers. Access to these electronic data is controlled in accordance with Paragraph 2.7 of HCP1400-1 and Code B requirements.
6. The assessment of NASA Center POP submittals is conducted as a joint activity among Code SP Program Analysts, OSS Program Executives, and the Directors of Codes SE, SM, SS, and SZ. Code SP Program Analysts integrate the NASA Center POP inputs to develop program and budget recommendations to the Associate Administrator for Space Science. This activity ensures that the NASA Center inputs provide all the required data in the appropriate formats.
7. Code SP Program Analysts and OSS Program Executives use data from the NASA Center submittals and from POP reviews to identify and resolve issues. Issues may include variances in the budget relative to guidelines, milestone changes, technical problems, contract or subcontract growth, or reserve levels. These issues form a basis for further investigation and analysis, and Code SP Program Analysts may present selected issues to the Associate Administrator for Space Science for direction as to the range of options that should be pursued. Code SP Program Analysts document the results of this activity in a Summarized Guideline Variance Report.
8. Code SP Program Analysts work with OSS Program Executives to develop budget recommendations on a project-by-project basis. Following the presentation of the separate budget recommendations from Codes SE, SM, SS, and SZ to the Associate Administrator for Space Science, Code SP Program Analysts consolidate these recommendations and provide the Associate Administrator for Space

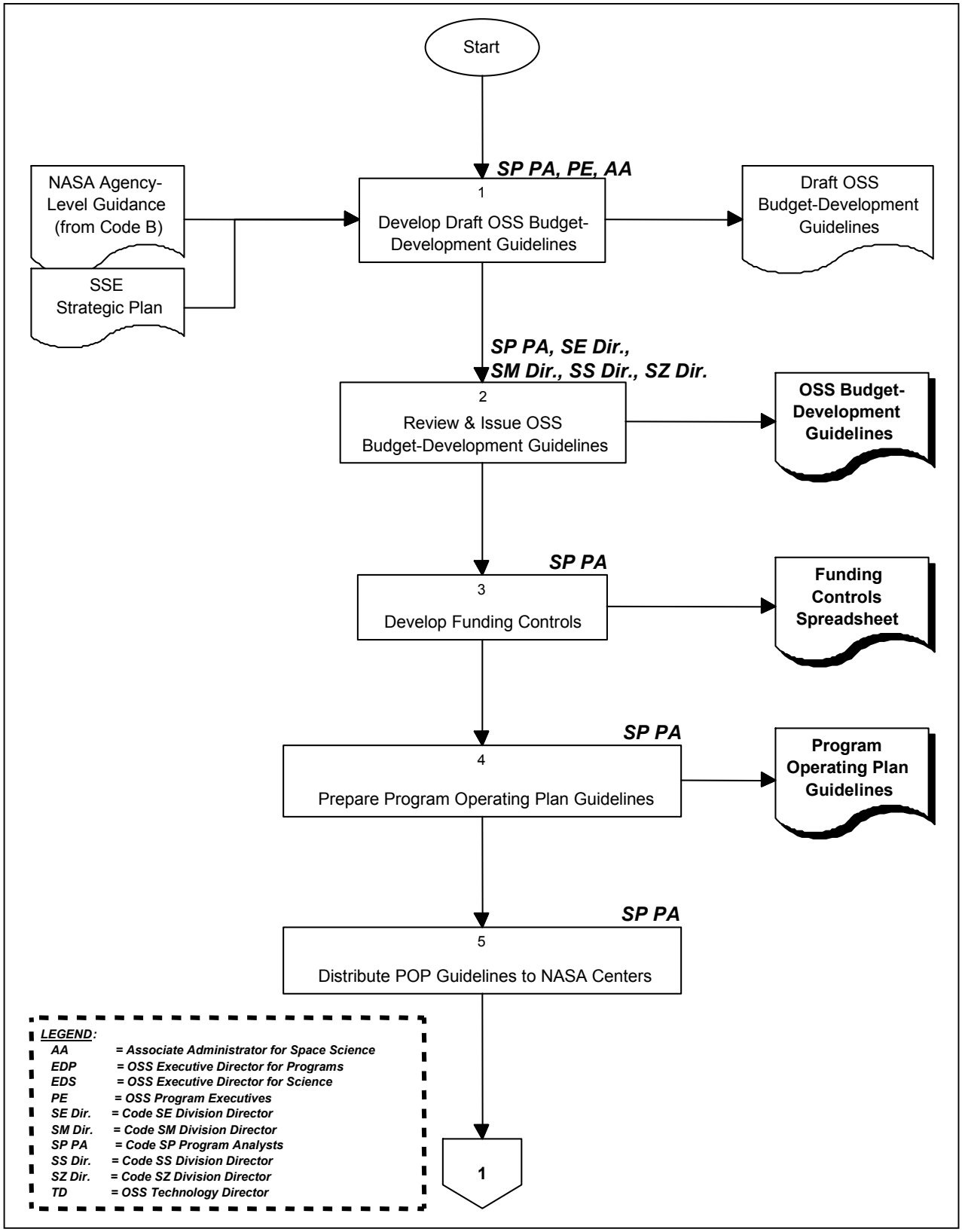


Figure 5.2-3 Prepare and Distribute POP Guidelines

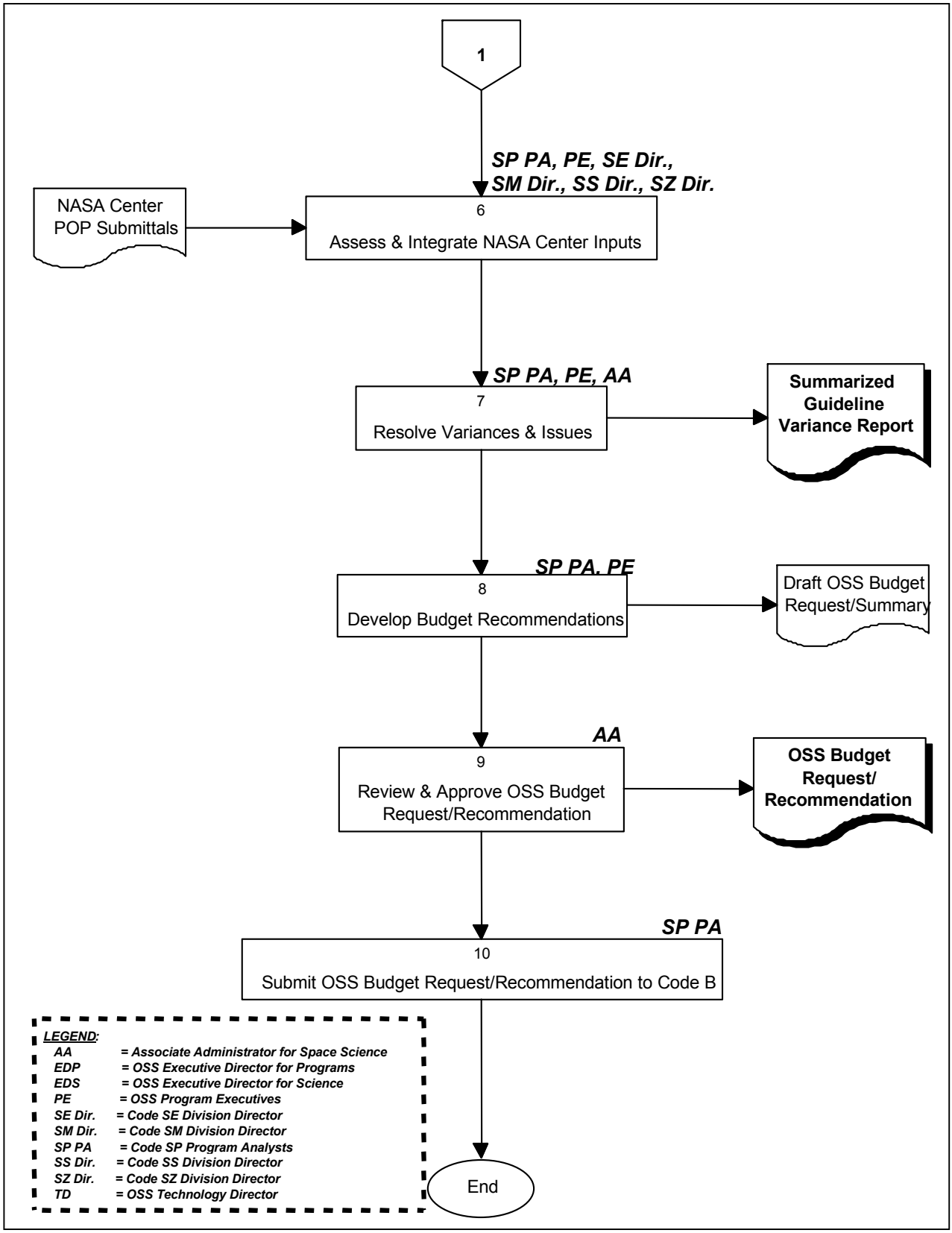


Figure 5.2-4 Prepare and Submit Budget Recommendation

Science with a total draft OSS budget request/summary.

9. The Associate Administrator for Space Science reviews the final options, considers the overall budget situation, and makes final decisions to balance the total program to the guideline level. Approval of the OSS Budget Request/Recommendation is indicated via signature of the Associate Administrator for Space Science on an attached letter.

10. Code SP Program Analysts submit the OSS Budget Request/Recommendation to the NASA Headquarters Office of the Chief Financial Officer (Code B). The submittal consists of a letter from the Associate Administrator for Space Science that summarizes the Space Science Enterprise's budget priorities and issues, a Program Financial Plan, and supporting documentation as required by Code B. The supporting documentation usually consists of budget traces that display changes from the previous year's baseline to the current recommendation, content charts that show a lower level of budget detail than is contained in the Program Financial Plan, and several formats that are required for NASA's reports to the federal Office of Management and Budget (OMB).

5.2.3 Budget Justification

The budget justification process is viewed as having two major elements: internal advocacy and external advocacy. Internal advocacy encompasses those activities that occur between the OSS submittal to the NASA Headquarters Office of the Chief Financial Officer and NASA's submittal to the OMB. External advocacy encompasses a broad range of activities that are completed when the Congress authorizes a budget. The flow of activities involved in the Budget Justification process is given in Figure 5.2-5 below (from HOWI7410-S015) and the following procedure (numbered steps refer to the figure). (To ensure use of the most current OWI, always check http://www.hq.nasa.gov/hqiso9000/library.htm.)

1. Code SP Program Analysts (with support from the Directors of Codes SE, SM, SS, and SZ) prepare a series of presentations that includes: (a) a summary of program accomplishments and status; (b) changes to the previous budget baseline, program and project schedules, and content; and (c) major issues. The Associate Administrator for Space Science briefs the presentations to the Capital Investment Council (CIC) and the SMC.

2. Code SP Program Analysts update the OSS Budget Request/Recommendation (developed per HOWI7410-S014) via an iterative process involving meetings among the NASA Administrator, the NASA Comptroller (in Code B), and the Associate Administrator for Space Science. These final budget decisions form the basis for NASA's budget submittal.

3. Code SP Program Analysts (with support from the Directors of Codes SE, SM, SS, and SZ) prepare a series of presentations to the OMB that focus on the past year's accomplishments, current status, performance measures, and future plans. The Associate Administrator for Space Science provides these presentations to the OMB in the form of budget narratives, briefings, and follow-up responses. Code SP Program Analysts provide additional narrative and formats to Code B for subsequent interactions with OMB.

4. Code SP Program Analysts update the budget request in an iterative manner in response to OMB budget marks provided via Code B. This forms the basis of NASA's portion of the Presidential budget request to Congress.

5. Code SP Program Analysts prepare the draft narrative for the OSS section of NASA's Presidential budget request and a back-up book to provide supporting information on budget changes, program and project schedules, and staffing.

6. The Code SB Congressional Policy Analyst prepares (in coordination with Code L and Code B) the following types of budget advocacy to the Congress: (a) white papers; (b) briefings; (c) testimony; and (d) responses to Congressional questions. All of these activities provide the Congress with a more extended discussion of program accomplishments, status, and future planned activities. The requirements for these products may vary

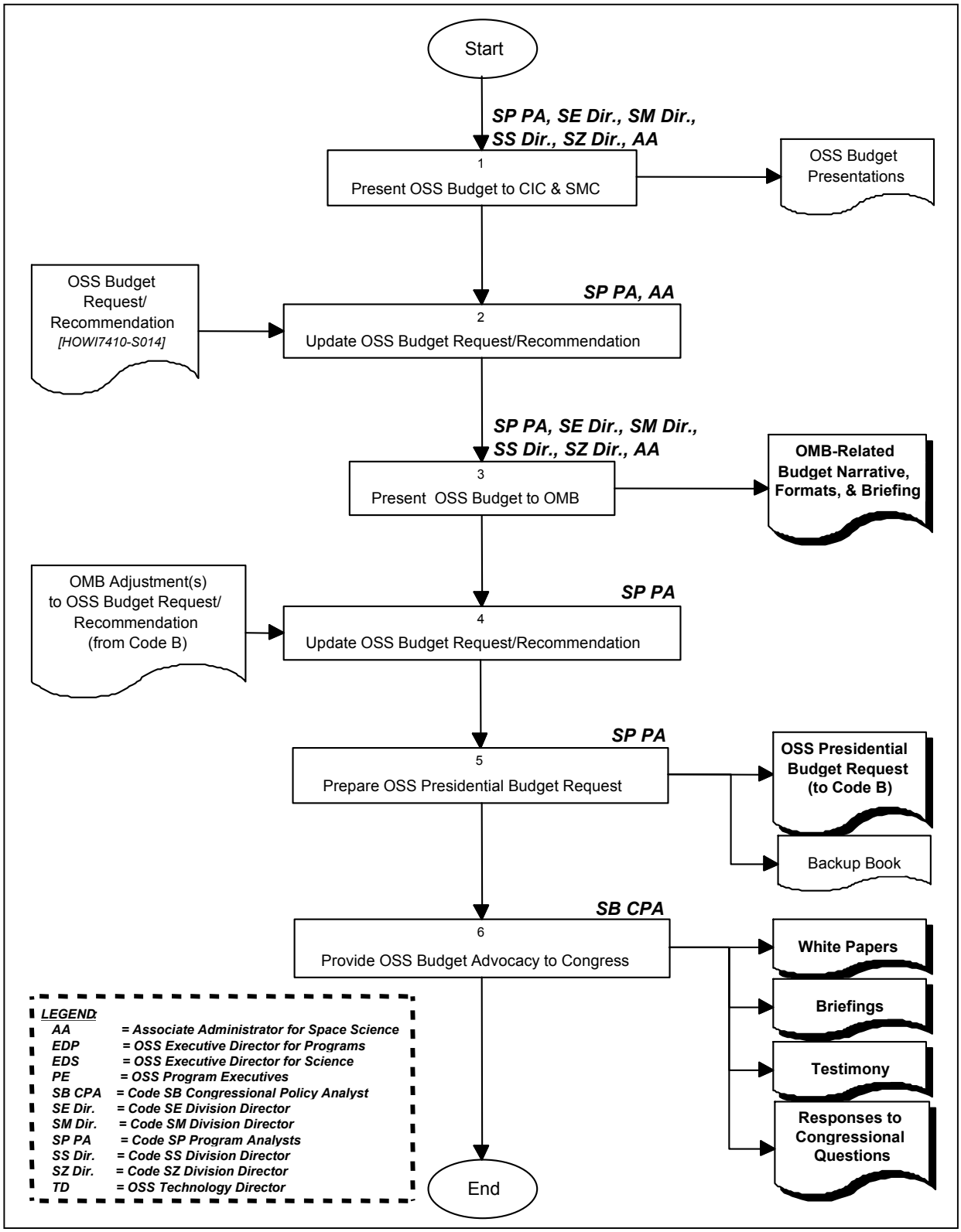


Figure 5.2-5 Justify Budget

from year to year, depending upon the specifics of the Congressional review process.

Congressional actions on the Authorization and Appropriations bills should be completed by October 1, the beginning of the Federal Government fiscal year. If not, Congress usually passes a "continuing resolution", which allows continued spending by Government agencies until some specified date. This action usually limits spending to the level available in the fiscal year just ended. This is not ordinarily a serious limitation to ongoing programs, but can delay new programs or major increases in program activity.

5.2.4 Budget Implementation

The budget implementation process occurs during the current fiscal year and involves establishing and updating the annual Operating Plan, funds control, and establishing, updating, and tracking performance against the monthly Cost Phasing Plan. OSS budget implementation processes are consistent with and parallel the Agency's budget implementation processes, which are described in detail in the *NASA Budget Administration Manual*.

The Annual Operating Plan

The annual Operating Plan encompasses the total amount of New Obligational Authority (NOA) appropriated by Congress. The OSS Operating Plan is established at the beginning of each fiscal year and is updated as required by major budget changes. The flow of activities involved in the process for establishing the Operating Plan is given in Figure 5.2-6 below (from HOWI7410-S016) and the following procedure (numbered steps refer to the figure). (Always check http://www.hq.nasa.gov/hqiso9000/library.htm to ensure use of the most current OWI.)

1. A Code SP Program Analyst develops the OSS Initial Fiscal Year Operating Plan and associated input for incorporation into the NASA Plan. Input includes data that establish the funding controls and specific amounts for each program/project and explain any difference between the President's budget and the Operating Plan.
2. A Code SP Program Analyst submits the OSS Initial Fiscal Year Operating Plan to Code B. (Code B incorporates the input into the NASA Plan and coordinates resolution of issues with OSS and Code L.)
3. A Code SP Program Analyst prepares a request asking Code B to release resource authority to the Associate Administrator for Space Science via NASA Form 506.
4. Following the receipt of release authority from Code B, a Code SP Program Analyst and the Code SP Division Secretary release resource authority to the cognizant NASA Centers via NASA Form 506A.

The OSS Cost Phasing Plan

The OSS Cost Phasing Plan encompasses the planned level of work expected to be completed by each OSS program and project. The Agency establishes an initial Cost Phasing Plan at the beginning of the fiscal year, and usually updates this plan in the April/May time frame. Performance against the monthly Cost Phasing plan is the primary means used by the Agency to assess program and project financial status. The initial monthly Cost Phasing Plan is requested as part of the Program Operating Plan (POP) data call. The plan is generated by the NASA Centers and sent to the institutional program offices at NASA Headquarters, which distribute the data to the appropriate Strategic Enterprises and functional offices. The flow of activities involved in the process for establishing the Cost Phasing Plan is given in Figure 5.2-7 below (from HOWI7410-S017) and the following procedure (numbered steps refer to the figure). (Always be sure to check http://www.hq.nasa.gov/hqiso9000/library.htm to ensure use of the most current OWI.)

1. The Code SP Program Analyst assesses the NASA Center plan input, adjusts the NASA Center Monthly Cost Phasing Plan, and presents information to the Associate Administrator for Space Science regarding funds utilization with respect to the OSS Monthly Cost Phasing Plan.
2. The Code SP Program Analyst submits the OSS Monthly Cost Phasing Plan to Code B for incorporation into the NASA Plan.

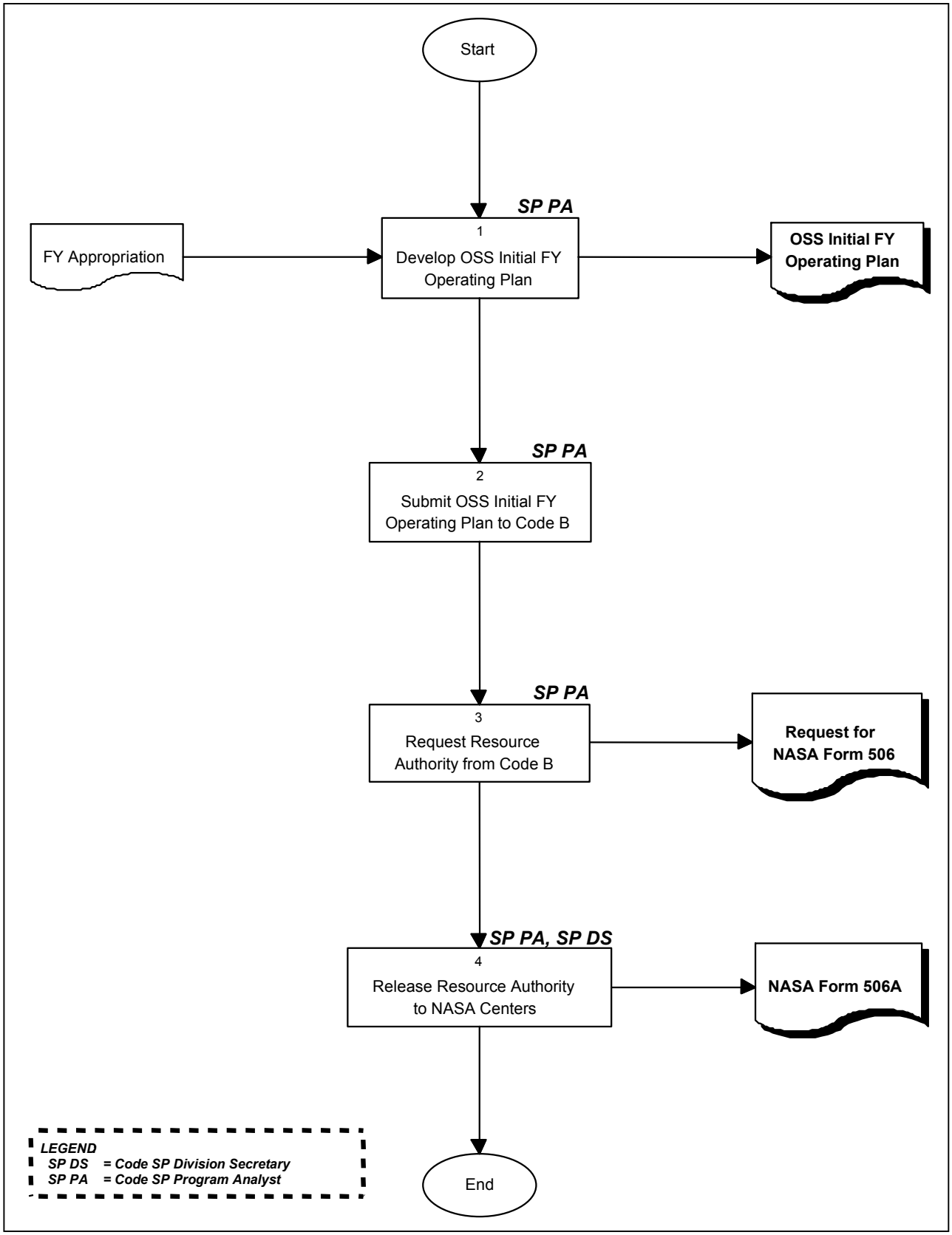


Figure 5.2-6 Establish Operating Plan

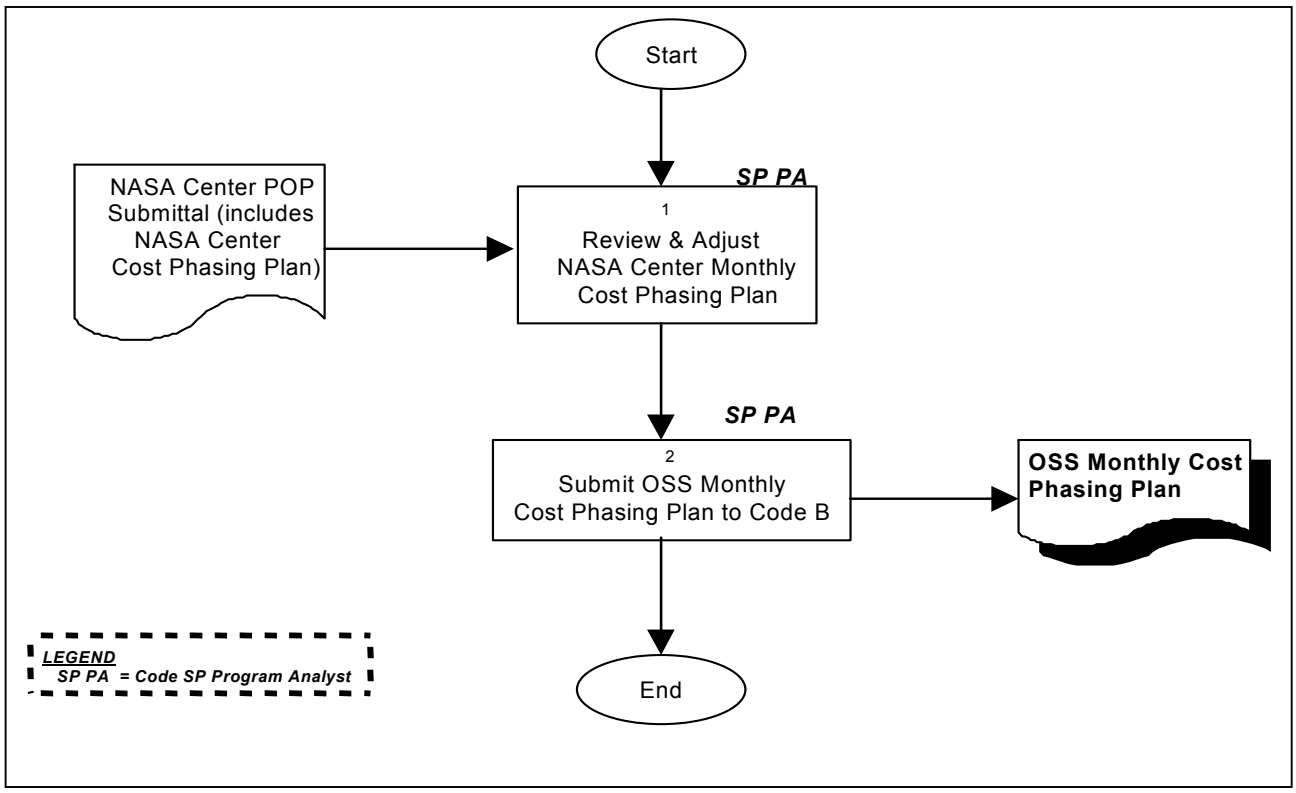


Figure 5.2-7 Establish Cost Phasing Plan

Updating the Cost Phasing Plan

Depending upon financial performance, external requirements, policy direction, and other factors, the Agency may request an update to the Cost Phasing Plan. This is often done in the middle of the fiscal year, in order to provide a better prediction of the Agency's financial status at the end of the current fiscal year. The process used to obtain data to update the Cost Phasing Plan is essentially the same as the process used to establish the initial plan, except that where the request for the initial phasing plan is included with the POP, the request for an updated plan is sent out as a separate action.

Assessing Financial Status

The Resources Management Division is responsible for developing monthly assessments of OSS program and project financial status, and presenting these assessments to the OSS AA during the OSS Monthly Program Review. Although this assessment emphasizes performance against the cost plan, other financial metrics, such as rates of commitments and obligations, are also tracked. Monthly commitment and obligation rates are examined in order to ensure the timely use of OSS resources, and to identify any areas where there may be flexibility to redistribute funds to areas with higher priority needs.

Monthly obligation rates are assessed for both current year and prior year funding. This is due to the fact that OSS funds are "two-year money," i.e., funds appropriated to OSS by Congress expire in two years, which means they must be obligated either during the fiscal year for which they are appropriated, or before the end of the following fiscal year. Any funds not obligated by that time must be returned to the Treasury. Therefore, the obligation of prior year funds is monitored very closely, to ensure that all available funds are applied to program needs. Monthly cost performance is assessed through a plan versus actuals analysis, with variance explanations provided where appropriate. In addition, cost rate projections are used to estimate end-of-year status. On the basis of this assessment, potential corrective actions are recommended to the OSS AA in those areas where financial performance varies significantly from plans and/or where it does not conform to applicable funds utilization metrics.

6. RESEARCH PROGRAM MANAGEMENT

6.1 OVERVIEW

The science divisions in OSS - Sun-Earth Connection (Code SS), Solar System Exploration (SE), Astronomy & Physics (SZ) - select and support basic space science research. They plan and implement a national space science research program consistent with scientific and programmatic priorities established by the Office of Space Science (OSS). They support the formulation of new space science concepts, and their test and verification in the laboratory and with both suborbital flight and space flight. When a science concept has matured to the mission study stage, project planning begins.

Once a mission concept has matured to the point where it is ready to be formulated into a project, and appropriate budget authority is assured, the science divisions develop and issue an Announcement of Opportunity (AO) to solicit the payload for the mission, or for the complete mission in the case of Explorer and Discovery flights. In parallel with this solicitation, the science divisions conduct pre-project planning activities.

During the development period, the Program Scientist works closely with the Program Executive and the program budget analyst to monitor and direct the progress of implementation of the instruments, the spacecraft, and the mission. The science divisions must ensure that the mission always remains capable of delivering the science return intended when the mission was selected.

After launch and in-orbit checkout (for Earth-orbiting missions), or arrival at the primary target or final science orbit (for deep-space missions), the primary science operation phase begins. The science divisions oversee science data collection and interpretation through mission completion. The science insights obtained during this phase give rise to new lines of scientific inquiry, and the science mission cycle begins again.

Responsibilities

The responsibilities for research program management are carried out by Program Scientists, Discipline Scientists, and sometimes Program Executives. Responsibilities include:

- Develop and issue Announcements of Opportunity (AO's) to solicit proposals for specific, large OSS flight missions or research opportunities, and NASA Research Announcements (NRA's) to solicit proposals for on-going, generally lower cost technology or laboratory-based OSS research opportunities.
  - For AO's, develop selection recommendation for OSS Selection Committee and Associate Administrator
  - For NRA's, evaluate and select proposals for funding.
- Serve as Program Scientists for OSS flight missions, and members of OSS Integrated Science Teams.
- Serve as Discipline Scientists to manage the OSS Research and Analysis program.
- Serve as PE to manage the Mission Operations and Data Analysis for operating OSS flight missions.
- Manage science data archives.
- Disseminate scientific results to the public and to the education and scientific communities.
- Coordinate scientific programs with international and other Federal agencies.
- Maintain close coupling with the scientific community through discipline Management Operations Working Groups (MOWG's) and Science Working Groups (SWG's), and appropriate Subcommittees of the NASA Advisory Council.
- Provide the rationale and justification to support the annual OSS budget request for the space science research program.

6.2 RESEARCH MANAGEMENT ELEMENTS

The OSS research programs encompass four key program elements that lead to the development and test of new space science concepts and the scientific analysis of the data resulting from space science missions.

Research and Analysis (R&A) provides the foundation of the OSS program and support for the formulation of new scientific questions and strategies.

Mission Operations and Data Analysis (MO&DA) supports the operation of OSS missions and the analysis of the resulting data.

Suborbital Research Carriers, which are high altitude balloons and sounding rockets, are used for developing flight experiments and for scientific research.

Science Data and Computing Technology provides science data management, scientific computing and networking, and applied information systems research and technology.

6.2.1 Research and Analysis

Program Goals

The goals of the Space Science Research and Analysis (R&A) program are to: (1) enhance the value of current space missions by carrying out supporting ground-based observations and laboratory experiments, (2) conduct the basic research necessary to understand observed phenomena, and develop new theories to explain observed phenomena and predict new ones, and (3) continue the analysis and evaluation of data from laboratories, airborne observatories, balloons, rocket experiments and spacecraft data archives. In addition to supporting basic and experimental astrophysics, space physics, and solar system exploration research for future flight missions, the program also develops and promotes scientific and technological expertise in the U.S. scientific community. The R&A program carries out its goals and objectives by providing grants and contracts to U.S. universities and to nonprofit and industrial research institutions, as well as by funding scientists at NASA Centers and other Government agencies. More than 2000 grants are awarded each year.

Program Elements

The OSS Research and Analysis program supports research tasks across the entire breadth of all of the space sciences, including all aspects of stellar and galactic astronomy and astrophysics, astrobiology and cosmochemistry, the origins and existence of extra-solar planetary systems, theoretical and experimental cosmology, the atmospheres and geology of the solar system planets (other than the Earth), solar physics, heliospehric physics (including interplanetary space, comets, and asteroids), and the physics of the ionospheres, thermospheres, and magnetospheres of the Earth and planets. Such tasks incorporate the full range of scientific techniques, including laboratory and suborbital rocket and balloon payload experiments, modeling, basic theory, development of new technologies and instruments, corroborative ground-based observations, and the analysis of archival space data (especially those from NASA missions). In all cases, a prime factor for support of these tasks is the relevance that they have to past, current, and/or future NASA missions and programs. The exact names for, and/or grouping together of, related subdisciplines will vary and evolve in keeping with the changing emphasis of NASA's programs and priorities. Therefore, careful attention is warranted to the stated objectives of the OSS NASA Research Announcements as they are released.

In 1999, the various subdiscipline program elements were organized into clusters. The cluster content will evolve as R&A programs are introduced or suspended in response to changes in space science research and the OSS strategic goals. The cluster structure will be evaluated regularly. A recent cluster structure (from 2000) follows:

- Cross-Theme Theory and Data Analysis
  - Sun-Earth Connection Theory
  - Sun-Earth Connection Guest Investigators
  - Living with a Star Targeted Research and Technology
  - Astrophysics Data Analysis
  - Long-Term Space Astrophysics
  - Astrophysics Theory
- Solar and Heliospheric Sciences
  - Heliospheric Physics
  - Solar Physics
  - Solar Sounding Rockets
- Geospace Sciences
  - Magnetospheric Physics

  - Ionosphere, Thermosphere, Mesosphere Physics
  - Plasma Sounding Rocket
- Origin and Evolution of Solar System Bodies
  - Cosmochemistry
  - Planetary Geology and Geophysics
  - Origins of Solar Systems
  - Mars Data Analysis
  - Lunar Data Analysis
  - Joint U.S.-Russian Research in Space Science Program
  - Discovery Sample Return Lab Instrument and Data Analysis
- Planetary Systems Science
  - Planetary Astronomy
  - Planetary Atmospheres
  - Near Earth Object Observations
  - Jupiter System Data Analysis
  - Planetary Suborbital Research Carriers
  - Keck and IRTF Support
- Astrobiology and Planetary Instrumentation
  - Exobiology
  - Evolutionary Biology
  - Astrobiology/Astrochemistry
  - Astrobiology Science and Technology
  - Astrobiology Institute
  - Planetary Instrument Definition and Development
- Space Astrophysics Research and Analysis
  - IR/Radio Astronomy
  - UV, Visible and Gravitational Astrophysics
- High Energy Astrophysics
  - X-ray and Gamma-ray Astrophysics
  - Cosmic Ray Astrophysics
  - Cosmic Balloons and Low Cost Balloons

Management Process

R&A program participants are selected through a broadly advertised, open, competitive process. R&A proposals are solicited, usually annually, through NASA Research Announcements developed by the Discipline Scientist responsible for the particular program element. Starting in 1998, the Office of Space Science introduced an "omnibus" NRA, the Research Opportunities in Space Science (ROSS) NRA, that encompasses nearly every on-going R&A, guest investigator, suborbital, and information systems program. Proposal due dates are staggered throughout the year to enable orderly proposal processing and review. Participation is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA Centers, and other Government agencies. Minority and disadvantaged institutions are particularly encouraged to apply. Proposers are also encouraged to include an education/public outreach component in their proposals. (ROSS 2002, for example, can be found at http://research.hq.nasa.gov/code_s/nra/current/NRA-02-OSS-01/index.html.)

Each proposal is peer reviewed for scientific and technical merit, usually by both mail-in reviewers and peer review panels assembled by the Discipline Scientist.

The Discipline Scientist develops a program implementation plan based on the peer review results and programmatic considerations, including program balance (described in detail in Subsection 6.3.2). This plan is reviewed with the Selecting Official designated in the NRA and the appropriate OSS discipline Division Director(s).

The Discipline Scientist continues to track the progress of the funded research through visits to the funded organization, telephone calls to the Principal Investigators (PI's) responsible for the research, review of papers submitted by the PI's to meetings, symposia, or refereed journals, progress reports, etc. Discipline Scientists verify that the work under grant or contract is being (or has been) performed.

6.2.2 Mission Operations and Data Analysis

Program Goals

The goal of the Mission Operations and Data Analysis (MO&DA) program is to maximize the scientific return from NASA's investment in spacecraft and other data collection sources. The

MO&DA program is fundamental to achieving OSS goals because it funds spacecraft operations during the performance of the mission, and analysis of data during and after the usable life of a spacecraft. Funding also supports long-term data archiving and data base services.

Program Elements

The four-way breakdown of the MO&DA program, described below, is designed to group major elements or functions together. This categorization aligns with functions carried out by developers, engineers and scientists at the Centers, under the direction of Program Scientists and Program Executives at NASA Headquarters. The MO&DA program also aligns with the three budget categories into which NASA casts its budget: (1) development, (2) operations, and (3) research, investment, and technology. Within the MO&DA budget breakdown, the first two groups below are development and operations budget categories, respectively. The third and fourth MO&DA groups are classified as research, investment, and technology.

Some elements can occur in any of the groupings listed below. They include project management and accounting, managing reserves and contingency relative to risk; public outreach and education, hardware maintenance (primarily computers and networks), and sustaining support for operations (primarily updating and modifying procedures).

Development

a. Instrument development for future instrument replacements (e.g., HST)
b. Servicing mission planning, implementation, and training, astronaut training, and development of flight software and ground systems for servicing (e.g., HST)
c. Development of MO&DA elements for "Great Observatory" class missions prior to launch (e.g., Chandra)
d. Development of multi-user ground segments for planetary missions
e. Post-launch development of flight software and ground systems
f. Software sustaining engineering (e.g., fixing software errors, development of new capability)
g. Development of tools and command sequence templates for later use in science operations. (e.g. Cassini during cruise)

Mission Operations

Control center functions include:

a. Prepass and postpass tracking operations
b. Spacecraft command uplink and real-time telemetry operations, including radiometric data collection
c. Real-time health and performance monitoring of the spacecraft, instruments, and ground system
d. Real-time scheduling of shared facilities, including voice and data links
e. Real-time pass scheduling/coordination
f. Hardware maintenance of operational systems
g. User Planning System operations (e.g., HST)

Science Operations

Sequence generation, science planning and data processing functions include:

a. Science events planning, integration, and optimization
b. Science and engineering activity generation
c. Resource constraints analysis (e.g., spacecraft power, data storage, telemetry rates, TDRSS, DSN usage)
d. Non-real-time spacecraft, instrument, and ground system data analysis and trend prediction
e. Activity requests conflict resolution
f. Instrument and observation performance analysis
g. Mission science center; services for guest observers/guest investigators
h. Science team products for science data processing
i. Generation of quick-look and common pool data sets
j. Standard data processing
k. Mission data archiving (performed by mission science center)

l. Spacecraft trajectory/orbit and attitude planning and determination
m. Planetary, satellite, comet, and asteroid ephemeredes determination
n. Long-term scheduling of shared facilities -- tracking stations, voice, data links, including project support to these activities

Science Data Analysis

a. Customized data processing
b. Science data calibration/physical unit conversion
c. Data products distribution to co-investigators for analysis
d. Planetary gravity modeling
e. Analysis activities
f. Presentation and publication of scientific results
g. Data archiving (performed by PI teams)
h. Education and public outreach (if executed by science teams or outside scientists)
i. Inputs to AO's and NRA's, and guidance for proposers

Management Process

MO&DA management processes follow the four-element structure shown above. The level of NASA Headquarters management control varies with each of the elements. The OSS MO&DA program provides budget justification and distribution for OSS MO&DA funds. NASA Headquarters also oversees and ensures the timely development and adequacy of Project Data Management Plans and development of mission unique MO&DA elements.

Developmental items listed above are identified and approved by NASA Headquarters with implementation carried out at the appropriate NASA Center. For example, HST-related items are implemented by GSFC.

Mission operations and science operations are generally conducted under the auspices of the relevant project management office at a NASA Center, supported by the NASA control and data acquisition networks. This can mean mission control at the Center itself, or at an off-site contractor's facility. In some cases of Principal Investigator missions, spacecraft operations are located at a University or industrial partner, often the spacecraft implementing organization. In conjunction with the appropriate program and project offices and tracking and data acquisition organizations, SSE MO&DA personnel develop requirements, budgets and priorities for allocating tracking and data acquisition resources. These must conform to overall OSS budget guidelines and to priorities defined by the SSE Strategic Plan. Coordination of operations among program offices, NASA Center operations offices, and foreign space operations agencies is usually required for the successful conduct of MO&DA missions. NASA Headquarters expedites this coordination.

Science data analysis is carried out under the Research and Analysis program. Data analysis support is open to all organizations. Proposals for support are solicited by OSS NRA's. Solicitations follow the same management processes as employed for the Research and Analysis program (see Management Process in Subsection 6.2.1).

6.2.3 Suborbital Research Carriers (Balloons and Sounding Rockets)

Program Goals

The goal of NASA's suborbital balloon and sounding rocket operations is to provide low cost, frequent access to space where (1) diverse scientific problems can be addressed in a wide range of scientific disciplines, including astronomy and fundamental physics, solar and heliospheric physics, and the geospace sciences; (2) new technology and techniques can be flight-tested relatively inexpensively; and (3) students can be trained on time scales commensurate with their graduate studies. The payloads are funded independently of the flight operations, and the Principal Investigator (PI) is nominally responsible for the mission, although some reliability and quality assurance oversight is provided by NASA.

Sounding rocket and balloon investigations are especially suited to the university research environment. They are characterized by diversity in the number and types of scientific investigations. In a single year, typically over 200 scientists from more than 60 different institutions are involved in balloon and sounding rocket missions. These suborbital missions are the primary source of new experimental scientists, so they form the

foundation of the NASA space science orbital missions.

Program Elements

Balloon Flight Operations

Balloon flight operations are delegated to the Goddard Space Flight Center's Wallops Flight Facility (GSFC/WFF). Currently, flights are available for payloads up to 6000 pounds at altitudes greater than 37 km for 1 - 30 days. Balloons provide a cost-effective way to make scientific observations in the near-space environment, where the atmospheric overburden is 0.3–0.5 % of the Earth's atmosphere. Balloons frequently offer the only viable flight opportunity for large instruments, cost constrained experiments, or in the absence of other suitable vehicles. They provide the primary flight-test and calibration opportunities for space-based astronomy and physics missions.

Flight operations are implemented via a prime contractor, who operates the National Scientific Balloon Facility in Palestine, Texas. Balloon flight support is provided to other NASA offices, non-NASA agencies, and foreign users, at various levels of reimbursement and users' fees. In conjunction with the GSFC/WFF management office, the prime contractor also supports a balloon R&D engineering effort to improve balloon materials, design, and operations.

Sounding Rockets Operations

Sounding Rocket operations are also delegated to the GSFC/WFF. Currently, launches are available for payloads up to about 500 kg and flight duration of 5–10 minutes at altitudes up to 1000 km or more. Sounding rockets are uniquely suited to measuring vertical variations of many atmospheric parameters. They are also used to study the Earth's magnetosphere and near space environment; incoming energetic particles and solar radiation, including the production of the aurora and the coupling of energy into the atmosphere; and radiation from the Sun, stars, and other celestial objects. In addition, sounding rockets are used to flight-test and calibrate instruments and experiments being developed for future orbital missions.

Sounding rocket operations are implemented via a prime support contractor selected under the NASA Sounding Rocket Operations Contract. Launches are conducted from permanent rocket ranges at WFF (Virginia), Poker Flats (Alaska), Andoya (Norway), and Kiruna (Sweden), as well as from mobile launch sites throughout the world.

Undergraduate Space Launch Opportunity

In an effort to broaden the education opportunities using experiments built by students and flown on sounding rockets and stratospheric balloons, an Undergraduate Space Launch Opportunity program has been established for U.S. institutions of higher learning. This program offers students an opportunity to work on a complex project from its inception through its end, in a timeframe consistent with their academic careers. This program is expected to continue at about three flights per year, shared approximately equally between balloons and sounding rockets.

Management Process

Management responsibilities include oversight of launch vehicles, as well as liaison with other program users, including the Office of Earth Science, the Office of Biological and Physical Research, other Government agencies such as the National Science Foundation and the Department of Energy, and the scientific community through program advisory committees. The OSS Astronomy and Physics Division has budget authority for balloon operations, while the Sun-Earth Connection Division has budget authority for sounding rocket operations. Day-to-day NASA Headquarters management is carried out by the Program Executive and respective Program Scientists. A Balloon Working Group (BWG) and a Sounding Rocket Working Group (SRWG) provide user community inputs to the respective WFF program offices. Each working group, which meets twice a year, is chaired by a Project Scientist, who is appointed by the Director of the Goddard Space Flight Center.

Payloads for sounding rocket and balloon missions are selected by NASA Headquarters via discipline-oriented NRA's. Funds for payload development are included as part of the R&A budgets. Individual payloads are selected in competition with other uses of the R&A allocation, and are managed by the corresponding Discipline Scientists.

The Explorer Program "Mission of Opportunity" category allows balloons to be proposed as launch vehicles for long-duration balloon missions. Explorer payloads are selected via an AO, and they are managed by the Explorer Program Office at GSFC. NASA Headquarters Discipline Scientists serve as Program Scientists for these missions.

6.2.4 Science Data and Computing Technology

Program Goals

The Science Data and Computing Technology program provides multidisciplinary science support in the areas of science data management, scientific computing and communications, and advanced information technology. The program fosters strong collaborations involving the science community, NASA Centers, and industry.

Program Elements

Science Data Management

This activity provides a coherent and coordinated OSS-wide data environment to improve quality, accessibility, and usability of NASA's space data holdings for scientists, educators, and the general public. The National Space Science Data Center (NSSDC) provides multidiscipline data and information services, including a 20 terabyte data repository from 1400 experiments on 420 spacecraft, along with directories, catalogs, and access to widely distributed science data resources. The NSSDC is also responsible for long-term archiving and preservation for all space science data. NSSDC works closely in federation with the other OSS-sponsored discipline data centers.

This program element also supports the OSS-wide policies and standards efforts to enhance interoperability, compatibility, and sharing, including international collaborators. Consultation is provided to OSS missions with guidelines, best practices, and lessons learned for developing Project Data Management Plans to ensure expedient flow of mission data to archives for broad availability to the community. This program element also evolves the OSS data and information infrastructure by infusing advanced technologies and enhanced services, achieving economies and efficiencies of scale across the OSS data architecture.

Scientific Computing and Communications

This element supports application of high-performance computing and communications technologies to meet space science needs, increasing the performance available, interoperability, and portability of applications and systems software for space science missions. Science applications include theoretical modeling and simulation, mission data analysis and exploration, and data assimilation to compare theory and observations. Benefiting science disciplines include solar and heliospheric physics, geospace magnetohydrodynamics codes, numerical relativistic astrophysics, origin and evolution of solar and planetary systems, and space weather.

Applied Research & Technology

This element applies new developments in computer science and information technology to benefit OSS missions and research programs. Advanced software tools, algorithms, computational methods, etc. are selected through open, peer-reviewed solicitations, and promote strong collaborations involving the space science community, the computer science community, data systems engineers and technologists, and academic and private sector technology innovators.

Tools and capabilities developed under the program are broadly disseminated through the space science data and computing infrastructure and/or inserting directly to missions. More visible examples of this include: the use of Cosmic Microwave Background Analysis Tools (COMBAT) for the extremely computationally intensive and complicated analysis of BOOMERANG and MAXIMA balloon experiments; insertion of a Micro-Helm cluster display array for visualization of the myriad of operations data including trajectory, footprint, Mars clock, Earth clock, instrument simulation, etc, in the Mars Odyssey '01 operations; Science Expert Assistance (observation planning tool); WebWinds (a distributed objective visualization spreadsheet environment); and the just-in-time application of visualization technologies for the near-real time distribution of images from Mars Pathfinder around the world.

6.3 RESEARCH MANAGEMENT RESPONSIBILITIES

6.3.1 Discipline Division Directors

The Directors of the Sun-Earth Connection, Solar System Exploration, and Astronomy & Physics Divisions are responsible for the planning and conduct of a scientific program encompassing the scientific themes and disciplines within OSS, consistent with priorities established by the SSE Strategic Plan and the Associate Administrator for Space Science. These themes include exploration of the solar system, the study of Sun-Earth relationships, the search for extra-solar planetary systems, and studies of the structure and evolution of the universe. The program involves theoretical and laboratory research, ground-based observations, suborbital, Earth orbital, and deep space flight missions, and the analysis and archiving of observational data.

The discipline Division Directors are usually the Selecting Officials for all OSS NRA's, and manage budgets and resources in support of the space science program. They are responsible for all aspects of personnel and organizational management in their respective divisions. They serve as liaisons with the scientific community through advisory committees and other groups. The discipline Division Directors and the Executive Director for Science (EDS) serve on the OSS Selection Committee, which makes recommendations to the SSE AA among multiple, cross-disciplinary candidates for instruments and missions. (See Subsection 6.5 for details of Selection Committee responsibilities.)

6.3.2 Discipline Scientists

The major responsibilities of the Discipline Scientists are to manage their respective R&A programs; to serve as the NASA interface to their respective communities, both in this country and abroad; to serve as Program Scientists on NASA missions; to ensure the general health and well being of their disciplines; and to represent their respective disciplines and the international science communities to NASA upper management. Discipline Scientists maintain currency in their areas of specialty so as to act as knowledgeable resources for NASA and the Administration. They also identify new mission requirements needed to maintain the scientific vitality of their disciplines, and work with the OSS science divisions and advisory committees to gain support and acceptance of new mission concepts.

R&A Program Management

The Discipline Scientist is responsible for soliciting research proposals for his or her program through the NRA process, and for managing proposal evaluation, program planning, and selection. When proposals are received, they are assigned by the Discipline Scientist to appropriately qualified and unbiased reviewers within an acceptable level of conflict of interest, and reviewed for scientific merit by the external reviewers, and for management and cost acceptability by the OSS Selecting Official. The Discipline Scientist then recommends the selection or rejection of each proposal to the Selecting Official.

The Discipline Scientist develops a Program Plan based on the peer review results and programmatic considerations, including program balance. This plan includes a listing of all proposals submitted in response to the current NRA recommended for selection or rejection, along with all prior commitments, including those for existing multiple-year awards, and the required funding for each. The total funding required must be within the annual allocation for the particular discipline. The science program plan should include:

a. A spreadsheet (in a standard format) which includes the following:
    1. All proposals (including Education and Public Outreach (E&PO) proposals) submitted in response to the current NRA recommended for selection or rejection, along with all continuing multi-year tasks awarded in prior years, and the required funding for each.
    2. All research tasks to be supported by the discipline during the current year, including grants, tasks at the NASA Centers supported through Research and Technology Objectives and Plans (RTOP's), contracts, cooperative agreements, and interagency transfers.
    3. Both science and E&PO efforts to be funded.

4. Where applicable, indication (e.g. in the "comments" field) of recommended "new starts", including name of PI, task, and institution.
5. Where applicable, indication (e.g. in the "comments" field) of PI's who were put on "warning" or phase-down funding, or received partial funding, indicating the reason.
6. Total required funding falling within the annual allocation for the particular discipline.

b. A brief description of the solicitation and review processes that were followed.

c. A histogram showing the distribution of recommended grant funding levels, including those for existing multiple-year awards: (7 standard histogram bins (by thousands of dollars of first grant year awards) of 0-19.9, 20-39.9, 40-59.9, 60-99.9, 100-199.9, 200-499.9, and 500 and larger).

d. A breakdown of program funding by institution type. The award mechanism should match the type of institution, so that grants flow to universities and non-profit private institutions, contracts to for-profit private sector, RTOP's to NASA Centers, and interagency transfers to other government agencies.

e. A breakdown of program support (FTE labor) by type of persons supported: senior researcher and other science and technical professionals, post-doctoral fellows, graduate and undergraduate students, K-12 students, and K-12 teachers.

f. A discussion of any significant program trends or concerns, including any relevant program-specific metrics.

This program plan is reviewed with the Selecting Official designated in the NRA, typically a Division Director. Following the Selecting Official's approval, the Discipline Scientist sends out selection and rejection letters, prepares procurement actions, and arranges the debriefing of proposers. (Guidelines for debriefing are given in Appendix E.8.)

Once proposals have been selected, the Discipline Scientist generates the appropriate documentation to recommend funding of the selected proposals through various award mechanisms. He or she then tracks the progress of funding actions using the OSS, GSFC and/or WFF financial planning and tracking tools. When a question is raised by a member of the science community with respect to the status of a funding action, it is most frequently directed to the appropriate Discipline Scientist for response.

The Discipline Scientist is also designated as the Contracting Officer's Technical Representative (COTR) if a contract rather than a grant is used as the funding instrument, and as technical officer when grants or NASA Center tasks are used. As such, he or she has formal responsibilities for verifying that the work under contract is being or has been performed, and for advising procurement personnel and NASA management regarding the status of deliverables in a grant, contract, or funded NASA Center task.

Discipline Scientists participate in planning and defending their R&A budgets as part of the NASA budget formulation process. They report on the content and status of their programs to a number of different audiences, including meetings of internal and external advisory groups, division-level and OSS-level reviews, and Congressional inquiries. When a particularly interesting result or discovery is obtained by a funded investigator, the Discipline Scientists present briefings on the result or discovery to NASA upper management.

6.3.3 Program Scientists

The Program Scientist is the senior NASA scientist responsible for the science content of a flight mission program or project to carry out an OSS science investigation. In this regard, the Program Scientist supports the Associate Administrator for Space Science (OSS AA) in establishing program requirements and strategy, allocating research budgets, establishing science priorities, developing research campaigns, and interfacing on behalf of the OSS AA with the Project Scientist to monitor science management and program execution.

Responsibilities During Pre-Phase A and Formulation Phase A

In the earliest phases of the program, the Program Scientist and cognizant OSS discipline Division Director form a Science Definition Team (SDT) to help define the scientific goals and requirements of the project and to identify strawman payloads and performance specifications to guide the project's study efforts. If the mission is expected to involve significant new technology development, the SDT may be a Science and Technology Definition Team (STDT). The Program Scientist takes into consideration the advice of this group and of other qualified bodies (for example, National Academy of Sciences committees and the appropriate SScAC subcommittee), and of the Project Scientist, to develop the program scientific goals, objectives and policies. These goals and objectives and their associated technology implications are balanced against cost and schedule considerations. Once optimum scientific goals and objectives are determined, the Program Scientist works with the cognizant Program Executive to translate them into the Level 1 scientific and technical requirements, which govern the program.

Typically the SDT consists of senior members of the scientific or user community who have sufficient scientific or technical expertise to help define the scientific objectives of the program and to translate these objectives into performance specifications and Level 1 requirements. Since the members of the SDT typically also wish to respond to the Announcement of Opportunity for participation in the program, the SDT is disbanded before the AO is issued.

During the solicitation and selection of scientific investigations for the program, lead responsibility is taken by the Program Scientist, with support from the Project Scientist, the Program Executive, and the Project Manager. The Program Scientist has specific responsibility for:

- Writing and issuing the AO (an example AO Table of Contents is given in Appendix E.2)
- Managing the proposal peer review process
- Presenting results of the peer review to the Categorization Subcommittee of the Space Science Steering Committee (SSSC)
- Developing the investigation selection recommendation
- Presenting the recommendation to the SSSC and then to the OSS Selection Committee and the SSE AA
- Preparing the selection press release
- Preparing acceptance and rejection letters
- Debriefing proposers

Responsibilities During Formulation Phase B

Once the selection is complete, the Principal Investigators and other scientists selected to participate in the program become members of the Science Working Group (SWG). This group, under the chairmanship of the Project Scientist, continues to develop detailed scientific and technical trades and options in support of project-level management decisions. The Program Scientist continues to provide the group with guidance on science policy issues and serves to adjudicate issues that cannot be resolved at the project level.

Once the program enters Phase B of Formulation and through Implementation (Phases C and D), the Program Scientist continues to be responsible for the administration of the program's Level 1 scientific requirements and science policies. The Program Scientist provides staff support to the Program Executive as a member of the program management team. The Program Scientist provides advice when technical, cost, or performance tradeoffs may necessitate changes in the scientific content of the program.

The Program Scientist works closely with the Program Executive in reviewing the progress and results of the Phase B studies and in developing trades and options that may influence the scientific capability of the program. The Program Scientist works with the PE to establish descope options for later use if technical, cost, or performance tradeoff's necessitate changes in the scientific content of the program. When significant changes must be made to the scientific capabilities of a mission (for example, if a science instrument is to be dropped from the payload), the Program Scientist prepares the justification and documentation to carry out the change. In addition, the Program Scientist keeps all relevant external entities informed about the program. The Program Scientist, with advice from the Project Scientist and

SWG, decides on the form and level of funding to seek for any guest investigator program.

Prior to the start of Implementation (Phase C) the Program Scientist, working with the Project Scientist and members of the SWG, oversees development of the draft Project Data Management Plan (PDMP). The PDMP deals with data rights during the operations phase of PI's, Co-I's, interdisciplinary scientists, guest observers, and other members of the science community; timing of data release to the community at large; and requirements for data archival, including types (or level) of data, data format, archival schedule, and designation of the archive.

Responsibilities During Implementation (Phases C and D)

Once the program has been approved for development, the Program Scientist remains an active part of the program. He or she continues to monitor the evolution of the design of the various elements of the program to ensure that the scientific capabilities are maintained. When budget, schedule or technical problems threaten the Level 1 requirements, and hence the program's scientific capabilities, the Program Scientist must work with the Program Executive and the discipline Division Director to resolve the problem. The Program Scientist also regularly keeps NASA advisory bodies informed of program progress and of any scientific trades or changes in program capability that are being contemplated.

As launch approaches, the duties of the Program Scientist increase. Agency management must be briefed on the scientific capabilities of the program and on its method of operation. Other advocacy groups and the press may request special pre- or post- launch briefings for which the Program Scientist may be responsible and/or contribute. The Program Scientist plays a key role in education, public outreach and public affairs functions as launch approaches. The Program Scientist also plays a key role in the final reviews of the mission prior to its launch, to ensure that the Level 1 science requirements have been satisfied and that the program is ready to enter the operations phase.

When necessary, the Program Scientist prepares the necessary documentation requesting the OSS AA's approval for a change in PI or Co-I.

Responsibilities During Phase E

Space flight data are to be placed in a publicly-accessible archive as soon after being obtained as possible. A brief (usually not more than six months) period for data validation and calibration is allowed. The Program Scientist ensures compliance by the project science teams with the provisions for data sharing and delivery to the archive as contained in the Project Data Management Plan.

A number of vehicles are used to enhance the scientific productivity of OSS missions by providing opportunities for data acquisition and analysis to the broad scientific community. These include Guest Observer programs, Participating Scientist programs, and open Data Analysis programs. The Program Scientist is responsible for developing and issuing the solicitation for flight program science investigations and for guest observer proposals for the program's operational phase. He or she is also responsible for organizing and conducting the peer review of the proposals received in response to such solicitations and for reporting the results and recommending the selections to upper NASA management, specifically to the Selecting Official. The Program Scientist also plays a key role in education, public outreach and public affairs activities during science operations, including support for public affairs events such as Space Science Updates.

6.4 SOLICITATION OF INVESTIGATIONS

6.4.1 Introduction

One of the most important activities of a science manager in OSS is the solicitation and selection of research investigations for NASA funding. Such investigations may be proposed as a part of the OSS R&A program, as a guest investigation on an operational spacecraft, as part or all of the payload on a future space flight mission, or as a special project, such as development of a ground-based telescope. OSS solicits proposals for basic research investigations using a variety of Broad Agency Announcements (BAA's). The most

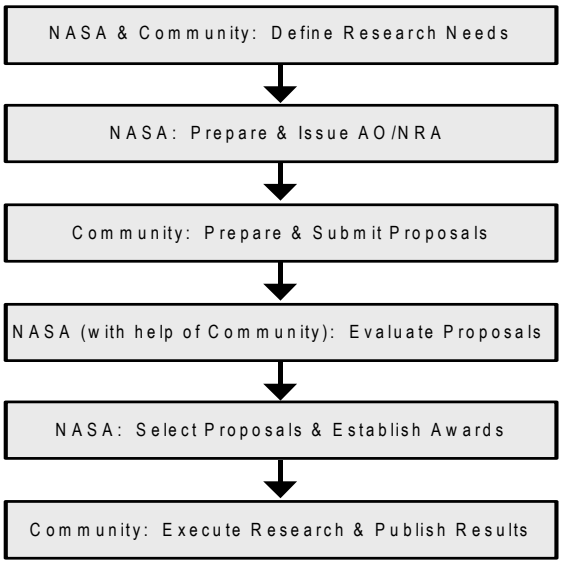


Figure 6.4-1 AO/NRA Process

common BAA's are the AO and NRA (see Figure 6.4-1 for the overall process flow), while less frequent are the NASA Cooperative Agreement Notice (CAN) and OSS Announcement (AN).

The distinguishing characteristic of all NASA BAA's is that they solicit ideas for basic research investigation, the end result of which is new knowledge and sometimes data that are to be made publicly available at the conclusion of the investigation. Basic research investigations do not lend themselves to specific performance or engineering specification. Consequently, standard requests for proposals (RFP's) are not used to solicit OSS research proposals. Some investigations may require the provision and operation of a hardware experiment on a space flight mission or a suborbital carrier on a rocket or balloon, while in other cases a BAA may result in investigations whose product is the publication of new research based on theoretical or experimental developments.

The Announcement of Opportunity (AO) is used to solicit and competitively select basic research investigations characterized as having a well-defined purpose and end product, for example science investigations with hardware responsibility for a unique space flight mission, a program of flight missions (e.g., Explorer and Discovery), or unique but large-cost non-flight programs (e.g., NASA support of the Keck Telescope). The AO can also be used for selection of a science team for a flight mission, with responsibility only for data analysis and mission operations. Investigations selected by AO can range in cost from a few hundred thousand dollars to several hundred million dollars. The key features of the AO process are: (a) the opportunity is relatively unique, (b) the supporting budget is usually a unique line item authorized by Congress, and (c) it is both a program-planning system and an acquisition system in one procedure.

The NASA Research Announcement (NRA) solicits relatively low cost (typically $50-200K) supporting Research and Analysis (R&A) investigations characterized as being of high relevance to NASA's program interests, where a specific end product or service is not well-defined but left to the creativity of the proposer. NRA's are typically used to solicit and competitively select proposals for repetitive programs (although some may be singular in nature, e.g., a data analysis program), funded by NASA's on-going R&A budget. R&A support is used to help understand natural space phenomena and their related technologies, including theoretical studies and ground-based laboratory developments. Most OSS NRA's are for basic research of a continuing nature in the science areas cited in Section 6.2.1.

The Cooperative Agreement Notice (CAN) is used to solicit and competitively select proposals to support NASA program interests that require a high degree of cooperation between the Agency and the selected institution (e.g., the NASA Astrobiology Institute). The scope of activities solicited by a CAN may be as modest as those through an NRA or as extensive as those through an AO.

The Office of Space Science Announcement (AN) is used to competitively select program participants for which no funding is provided. Most typically the AN is used to competitively distribute observing time to acquire new data from an operating space mission.

All OSS BAA's must conform to high standards for completeness, clarity, and style, and must comply with applicable Federal Acquisition Regulations (FAR) and the NASA FAR Supplements (NFS). They must be publicly announced in *Federal Business Opportunities* (FBO) 15 cal-

endar days in advance of their formal release (a FAR requirement), and must be openly available to the public (the currently accepted venue is through the NASA home page on the World Wide Web) on their advertised release date. All BAA's typically request a Notice of Intent (NOI) to propose that is typically due about 30 days after the release date but is not binding on the proposer.

A BAA remains open for the submission of proposals for typically 90 days (although this may vary owing to special circumstances), with proposals to be delivered to an address specified in the Announcement. The BAA requests complete proposals for investigations that will be subjected to full peer review for scientific, technical, fiscal, and programmatic merits (including education and public outreach), which will result in a selection of qualified proposals of merit by the Designated Selecting Official within the limits of the available program budget. The OSS Executive Director for Science oversees the preparation, approval, and release of all OSS BAA's.

6.4.2 The Announcement of Opportunity (AO) Process

The document that describes in considerable detail the Announcement of Opportunity process is NASA FAR Supplement Part 1872.0, entitled *Acquisition of Investigation*s, which is complete and fully applicable; its provisions are not repeated here. All OSS AO processes must be conducted in accordance with NFS 1872. (Further guidance for the AO process can be found in Appendix E.1.) As a central element in building education and outreach into all OSS missions - particularly Principal Investigator-developed missions - education and public outreach programs are required components of all proposals submitted in response to OSS AO's. Program Scientists are responsible for ensuring that AO's contain appropriate education and public outreach language that has been coordinated with the OSS Education and Public Outreach Director.

An overview and typical timeline for the AO process are shown in Figure 6.4-2, from HOWI8310-S019. The flow of activities involved in the process by which the OSS generates and issues AO's and reviews and selects submitted proposals is found in HOWI8310-S019, and in Appendix F.1 to this Handbook. (To ensure use of the most current OWI, always check http://www.hq.nasa.gov/ hqiso9000/library.htm.)

6.4.3 The NASA Research Announcement (NRA) Process

The NRA is used to solicit basic research that is characterized as being relatively low-cost and not conducted by a science flight investigation on a free-flying (orbital) spacecraft. Examples include data analysis of existing space data, development of new experiment hardware, or basic theory and modeling. NRA's may be used to solicit basic research from technology flight investigations. The EDS oversees the development and issuance of an NRA by aiding its preparation and internal OSS reviews, leading to its external concurrence. Codes G, H, and I review the NRA for adherence to NASA legal and procurement regulations, and NASA policy regarding international cooperation. Following their concurrence, the appropriate OSS officials (usually one or more of the OSS discipline Division Directors) approve and sign the NRA.

Proposals submitted in response to an NRA are reviewed for their individual strengths and weaknesses by peer review, but NRA proposals are not categorized as are proposals to an AO. The applicable Program Scientist or Program Executive develops the selection recommendation from the strengths and weaknesses reports and budgetary and programmatic considerations, and makes a recommendation for selection directly to the Designated Selecting Official.

Two key documents have been developed to standardize the NRA process, many elements and provisions of which are equally applicable to a CAN or AN. The draft *Handbook for Writing NASA Research Solicitations for the Office of Space Science* provides complete, detailed guidance to OSS staff for the preparation and release of a standard OSS NRA; the handling, peer review, and recommendation for selection of submitted proposals; and the procedures for submitting the selected proposals for procurement action. The *Guidebook for Proposers Responding to a NASA Research Announcement (NRA)* provides complete, detailed guidance for proposers to follow in order to prepare and submit a standard

Figure 6.4-2 AO Overview Flowchart

formatted proposal in response to the standard OSS NRA. (Note: this *Guidebook* also includes background material on the entire NRA process, including the proposal review and selection processes, as well as an overview of activities involved in the implementation and management of NASA research awards.)

These documents were developed in accordance with NASA FAR Supplement Part 1852.235-72 *Instructions for Responding to NASA Research Announcements for Solicited Basic Research Proposals*. They accommodate long-established practices for NRA proposals that have been followed by NASA's various science discipline communities, and identify ancillary materials and information not specified in the referenced NFS that OSS now requires (for example, the option for an Education and Public Outreach proposal) and/or that OSS has found useful for the handling and review of submitted proposals. These documents establish standard practices for the electronic submission of certain elements of proposals submitted to an OSS NRA. An overview and typical timeline for the NRA process are shown in Figure 6.4-3, from HOWI8310-S018.

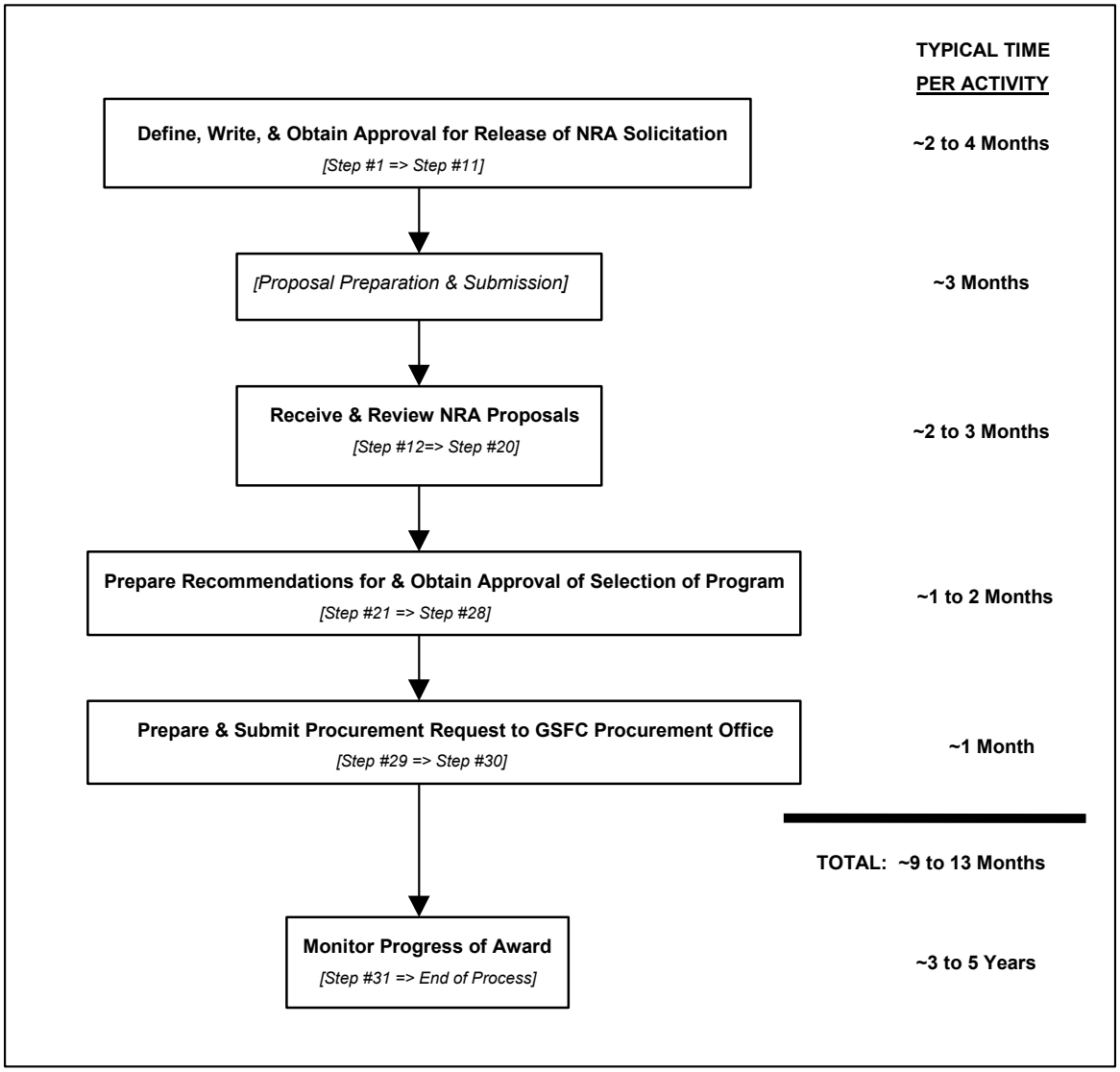


Figure 6.4-3 NRA Overview Flowchart

The process by which the OSS generates and issues NRA's, reviews and selects submitted proposals, and monitors and manages the resulting financial awards through to the end of their periods of performance is specified in HOWI8310-S018, and in Appendix F.2 of this Handbook. (To ensure use of the most current OWI, always check http://www.hq.nasa.gov/ hqiso9000/library.htm.)

6.4.4 Unsolicited Proposals

Consistent with the NASA Far Supplement (NFS 1815.6, Unsolicited Proposals), Guidance for the Preparation and Submission of Unsolicited Proposals, and the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1), OSS allows the receipt of unsolicited proposals (USP's). However, their actual selection for award is usually an exception since the necessary financial resources rarely exist for their support outside the scope of formal OSS program announcements (AO's, NRA's, etc.) to which the very large majority of USP's could be submitted. The most common type of USP that is accepted is for support of a meeting or symposium, and even these are most easily handled if they are proposed as an augmentation by someone already holding a research grant that can be easily supplemented.

It is very important that NASA program personnel refrain from saying anything that may be interpreted as soliciting or encouraging a USP (this is what is meant by the NFS 1815.6 language that says a USP shall "...not...be prepared under Government supervision"). However, it is permissible and appropriate for a Discipline Scientist to describe NASA policy and program interests should a potential proposer ask if such a channel is available outside of formal program announcements. If a USP is ultimately recommended for funding, a Justification for Other than Full and Open Competition (JOFOC) is usually required by the Procurement Office.

Any USP received by Science Division personnel is brought to the attention of the OSS Executive Director for Science. If the USP is not relevant to NASA, the EDS will handle it as technical correspondence (i.e., not as a proposal that requires review and a selection decision) and return it to the sender without further review. If the USP is relevant to NASA but to a Program Office other than OSS, the EDS will forward it thereto under cover of a copy of a letter that informs the proposer of that action. If the proposal is relevant to OSS, the EDS will verify that it is a valid USP according to applicable acquisition guidelines, namely, that it: (i) falls within the domain of NASA's programs and interest; (ii) proposes a specific, unique or innovative project with sufficient technical and cost information to permit meaningful evaluation; (iii) is signed by an official authorized to commit the submitting organization; (iv) is not prepared under Government suvision (meaning that the proposer, not a NASA employee, should originate the idea and scope of a proposal); (v) does not propose something for which an OSS program announcement (AO, NRA, or CAN) already is open for the submission of proposals, or is expected to be released in the near future, to which the USP could be submitted in open competition with other efforts; and (vi) requests a budget that could, at least in principle, be accommodated within available resources if it is eventually recommended for selection.

If the USP is disqualified by any of the above reasons, the EDS will handle it as technical correspondence and return it to the sender without further review.

For a USP that satisfies the above criteria, the EDS will assign it to an appropriate Discipline Scientist to conduct an appropriate peer review (at a minimum, by NASA-only inspection; at a maximum, full external mail-in and/or panel review). The EDS provides written notice to the proposer of the receipt of the proposal and the schedule for its review and disposition.

The responsible Discipline Scientist will, within eight weeks, conduct appropriate science, technical, and programmatic reviews and present a recommendation for selection or rejection to the discipline Division Director, as the Designated Selecting Official. After the selection decision, the Discipline Scientist prepares correspondence to the proposer conveying that decision (with a copy to the EDS to allow close out of the USP log), and in the case of selection, ensures that an appropriate funding action is initiated.

6.5 SELECTION AND PROGRAM DECISIONS

Figure 6.5-1 is a matrix of OSS selection, decision and review processes occurring at key lifecycle gates. It covers both single-discipline and cross-discipline selections and reviews, identifying decision-making responsibilities. Cross-disciplinary programs include Explorer, Discovery, and New Millennium. Examples of single-disciplinary programs include Living With a Star (LWS), Solar-Terrestrial Probes (STP), New Frontiers, and Mars Exploration. (Note: Mars Exploration projects require coordination between the Mars Program Director and the Solar System Exploration Division Director.) The key motivation is to identify only the required participants in order to facilitate scheduling for our many selections and reviews. Responsibilities are designated to some combination of Enterprise Program Management Council (EPMC), Selection Committee, Front Office, and Division/Office Director.

Figure 6.5-2 provides additional detail on participants, processes and documentation for each level of decision responsibility.

Topic		**Decision Making for cross-disciplinary programs**	**Decision Making for single-discipline programs**
AO Selections for Phase A	Initial Mission or hardware selection; approval to go to Phase A	Selection Committee	Division/Office Director is responsible for presentations to Front Office**
Phase A-to-Phase B approval or downselection for 2-stage selection	If lifecycle cost is <$150M	Selection Committee	Division/Office Director is responsible for presentations to Front Office**
	If lifecycle cost is > $150M: Comptroller must certify independent lifecycle cost estimate.	Selection Committee plus Front Office**	Division/Office Director is responsible for presentations to Front Office**
Phase B - to - Phase C Transition Review (=Approval for Implementation)	For all new programs or first projects over $150M	EPMC - Enterprise Program Management Council	EPMC - Enterprise Program Management Council
	For second or later projects in mission lines	Division/Office Director is responsible for presentations to Front Office**	Division/Office Director is responsible for presentations to Front Office**
Annual Reviews within Phase C/D	For Projects subject to NPG 7120 where GPMC is at HQ	EPMC - Enterprise Program Management Council	EPMC - Enterprise Program Management Council
	For Projects where GPMC is not at HQ	Division/Office Director is responsible for presentations to Front Office**	Division/Office Director is responsible for presentations to Front Office**
Mission "Termination" or "Cost Cap" Reviews		Division/Office Director is responsible for presentations to Front Office**	Division/Office Director is responsible for presentations to Front Office**
Mission Readiness Briefing for upcoming launches		Division/Office Director is responsible for presentations to Front Office**	Division/Office Director is responsible for presentations to Front Office**
Mission Extensions beyond Prime Phase		Division/Office Director's Decision	Division/Office Director's Decision
** "Front Office" consists of AA, DAA, ED/Science and ED/Programs, and DD/Resources Management			

Figure 6.5-1 Responsibilities for Cross-Disciplinary and Single-Disciplinary Programs and Projects

Responsibility	Persons Involved**	Process and Outcome	Documentation
EPMC - Enterprise Program Management Council	"Front Office" consisting of AA, DAA, ED/Science and ED/Programs, DD/Resources Management - Directors for Strategic & Int'l Planning and Technology - Appropriate Division/Office Directors, - representatives of AE, B, H, I and Q	Presentation by Independent Review Team. Response by Project. Executive Session to make decisions, assign actions	Plan as specified in EPMC Charter. Published minutes of meeting. Actions to be tracked in HATS.
Selection Committee	The Selection Committee consists of the Exec. Director for Science plus the Division/Office Directors (or single designated alternates) for A&P, SSE, and SEC.	Presentation to AA and Selection Committee; Committee votes on acceptance/rejection or alternatives, and presents results to the AA/OSS who is the selecting official.	When approved, AA/OSS signs selection statement; PE/Science issues "memorandum for the record" with backup information as appropriate.
Division/Office Director is responsible for presentation to "Front Office"	"Front Office" consisting of AA, DAA, ED/Science and ED/Programs, DD/Resources Management	Division/Office Director (or designated alternate) for A&P, SSE, Mars, or SEC formulates selection; Division/Office Director and/or Project Scientist/Project Managers make presentation to "Front Office". Front Office approves or disapproves the selection.	When approved, Division/Office Director signs selection statement and issues "memorandum for the record" with backup information as appropriate.
Division/Office Director's Decision	No Front Office participation, Division/Office plus staff of his/her own choosing	To be determined by Division/Office Director	To be determined by Division/Office Director
** Other persons may be invited to attend by the convener of each selection or review; those attendees would be non-voting participants.			

Figure 6.5-2 Definitions of "Decision Makers" and Related Processes

7. FLIGHT PROGRAM MANAGEMENT AND ASSESSMENT

7.1 OVERVIEW

Flight programs for the Space Science Enterprise (SSE) are initially developed as candidates for funding from multiple advanced concepts for science mission investigations that have a common purpose. Selected concepts are then packaged into candidate programs as budget augmentation units, and submitted to the Space Science Enterprise Associate Administrator (SSE AA) for potential funding as part of an upcoming President's budget. If successful, the programs then enter a Formulation subprocess after the Formulation Authorization Document for the Program is written and signed. Formulation of the first project in the program begins after the goals and commitments for the program have been established. Program/Project management follows the approach defined in NPD 7120.4 and NPG 7120.5. Projects are defined in a Formulation subprocess and pass through an Approval gate into Implementation. The Office of Space Science (OSS) has defined Formulation for a project to consist of two parts, Phases A & B, while Implementation consists of Phases C, D and E. The fourth 7120 component, the Evaluation subprocess, provides for independent assessments by teams external to the project. The relationship of the NPG process to the traditional phased program/project approach was fully described in Subsection 2.2.4 and in Figure 2.2-2. Flight program management process flow is illustrated in Figure 7.1-1.

The SSE AA delegates flight program authority and responsibility to Division Directors within OSS. The Division Directors rely upon the Program Executive (PE) to carry out the flight program responsibilities allocated to the Enterprise Associate Administrator (EAA) in the "7120" documents, including program and project formulation, implementation oversight, and per-

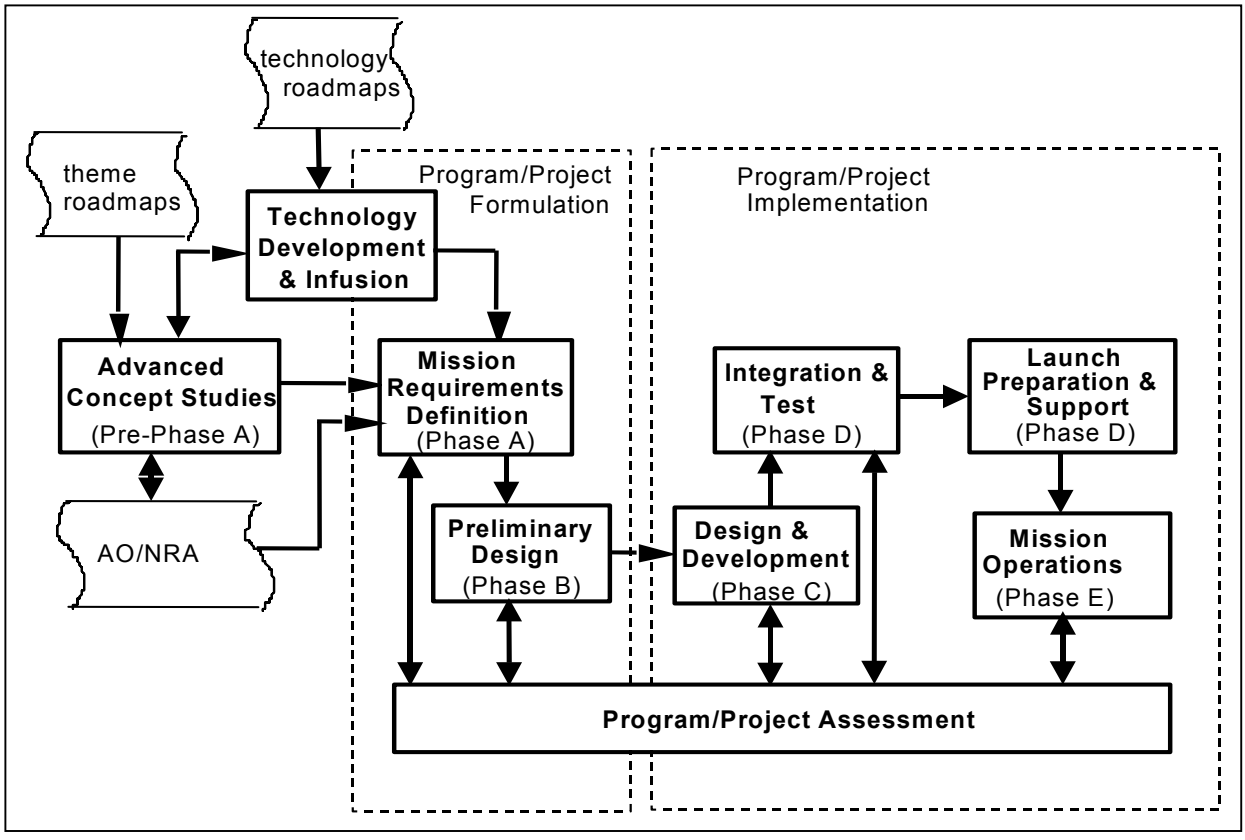


Figure 7.1-1 Space Science Flight Program Management Process Flow

formance assessment. For a high-visibility program, a Program Director may be designated to provide overall direction to the program at NASA Headquarters and Field Centers. Much of the Program Executive's work is associated with providing policy guidance to NASA Centers, generating top-level requirements, managing agreements (interagency, inter-Center, and international), and evaluating program and project performance against requirements. The Program Executives' responsibilities are performed under the oversight of the Deputy AA (DAA) for Space Science.

SSE manages four different kinds of flight programs; these are distinguished in subsequent discussions in this chapter. They are as follows, with current examples:

a. Single-project programs: SIRTF, NGST, Cassini, GLAST
b. Multi-project Roadmap-initiated series: Mars Exploration, Living With a Star, Solar-Terrestrial Probes
c. Multi-project Announcement of Opportunity (AO)-initiated series: Discovery, Explorer, Mars Scouts, New Frontiers
d. Technology programs: New Millennium, In-Space Propulsion, Nuclear Systems Initiative

All programs and projects are required to have clearly defined objectives, to be consistent with the NASA and Space Science Enterprise Strategic Plans, and to have a comprehensive definition of cost, schedule, and technical commitments. These commitments, and the associated agreements and acquisition strategy, are controlled throughout the project lifecycle, from Formulation through Implementation. They are the principal focus of the Evaluation subprocess, and are documented in a Program Commitment Agreement and a Program Plan.

SSE activities occurring prior to the Formulation subprocess are discussed in Subsection 7.2, and those during each subprocess are described in Subsections 7.3 through 7.6. The respective roles of the key program management positions are discussed in Subsection 7.7, particularly those of the Program Executive and the Program Manager. The latter is a role delegated to a NASA Center, involving day-to-day oversight and management of the implementation of the program and the projects within the program. Finally, Section 7 ends with discussions of the tailoring of requirements and of financial control.

7.2 PRE-FORMULATION (PRE-PHASE A)

NPG 7120.5 specifies that the Formulation subprocess for a new program begins at the approval of a Formulation Authorization Document (FAD). However, the Program Executive's responsibility in developing the content of a candidate program begins well before a program obtains an approved FAD. For SSE programs, this occurs during a period known as Pre-Formulation, or Pre-Phase A.

The PE's role in Program Pre-Formulation is to support the introduction of future programs and associated technology requirements into the SSE roadmap and budget. This is achieved by supporting the discipline Division Directors, scientists and technologists in the development of revised science mission roadmaps, which are discussed specifically in Subsection 7.2.3.

Each SSE Division (including such Offices as for the Mars Program) appoints a Division Technologist, who is a senior member of each Division, to represent the Division Director with regard to technology requirements, priorities, policies, plans, and practices. The PE is responsible for coordinating with these Division Technologists and with NASA Center Theme Technologists to ensure that the technology requirements associated with the revised science mission roadmaps are incorporated into the revised SSE technology roadmap. The PE also supports the science Themes in the grouping and advocacy of sets of mission concepts into new budget initiatives, which, if successful, transition into new programs. This is often facilitated by science workshops held to refine requirements and obtain science community advocacy.

For Project Pre-Formulation, the Program Executive supports Advanced Concept Studies (Subsection 7.2.1) and promotes the maturation of advanced concepts into pre-concepts (Subsection 7.2.2) using Science and Technology Definition Teams. The PE is also responsible for the identification, oversight, and advocacy of mission-specific technology development necessary to

support the advanced concepts selected for inclusion into the science mission roadmap. OSS uses the Announcement of Opportunity (AO) process for procurement of basic research investigations, including full missions, instruments only, or science teams. The various types of AO's are described in Subsection 6.4.1.

7.2.1 Advanced Concepts

Advanced concepts for future science investigations are derived from three distinct sources:

- Independently-funded publications in peer reviewed journals and presentations at science conferences,
- NASA-funded Research Announcements for new mission concepts, and
- Management direction to a NASA Center.

Several advanced mission concepts to support gathering and analysis of science data (i.e., investigation) may be developed independently for a narrow area of space science.

If the advanced concept studies are funded outside of SSE funding authority, no Program Executive action is required, other than to remain cognizant of study results for synergy or to avoid duplication. If a science division determines to issue a NASA Research Announcement (NRA) for new mission concepts, the PE works with the Program Scientist to issue the NRA and serves as the Contracting Officer's Technical Representative (COTR) for the resultant grants. The discipline Division Directors and their Program Scientists in OSS select the winning proposals. The PE interacts with the NASA grants office to implement and extend the grants, and distributes the final reports to the Program Scientists and discipline Division Director.

If the NASA Administrator, SSE AA or a Division Director determines that a Center should develop an advanced concept, the PE prepares a letter of direction and a task statement, and facilitates the funding of the task using funds indicated by the SSE AA or discipline Division Director. This letter is signed by the SSE AA, or a discipline Division Director in OSS. The Center then issues the NRA and appoints the COTR.

The science community melds various advanced concepts, focused on a narrow area of science investigation, into a consensus concept during workshops supporting the development of a science mission roadmap (refer to Subsection 7.2.3) for the Theme. The science community may or may not accept the consensus concept for inclusion into the roadmap.

7.2.2 Pre-Concept Definition

If the consensus concept is accepted as a new mission in the science mission roadmap, the discipline Division Director appoints the science participants for Science and Technology Definition Teams (STDT) to mature the concept from an advanced concept into a pre-concept. If new technology is not a significant requirement for a particular mission, this may be just a Science Definition Team (SDT, see Subsection 6.3.3). The Program Executive, and the Centers involved in Theme activity, support the STDT's with spacecraft concept studies, costing, engineering analysis, and technology support. The STDT product, a report, is coordinated with the science community using the science advisory bodies, and contains the following information as a minimum:

- Science objectives,
- Operations concepts,
- Mission design architectures,
- Spacecraft concepts,
- Cost, schedule, and risk, and
- Identification of required new technology.

Several STDT's may be constituted to update or mature the pre-concept before a pre-concept becomes part of a program or before an AO for mission instruments is released. All STDT's are dissolved before the issuance of an AO for mission instruments, because the presence of an STDT during an instrument solicitation may be viewed as giving one investigator a competitive advantage over another. When the AO is issued, the PE and Program Scientist (PS) are firewalled from the proposers to also avoid the appearance of giving a competitive advantage for one investigator. Thus the PE and PS should answer no questions from proposers nor participate in the development of any instrument proposals.

During the evaluation of proposals submitted in response to the AO, the PE ensures that the ap-

plicable Program Office and project for the mission support the instrument proposal evaluations led by the Program Scientist and evaluation panels. This is done to gain an understanding of the cost, schedule, and technical assumptions inherent in the selections for comparison later in the project. Participation also provides the PE an assessment of the technology readiness of the instruments as well as the schedule and technology development needed to incorporate the instruments into the mission.

The PE works with the discipline Division Director and Program Scientist for the mission to determine whether the spacecraft and instrument technology is sufficiently mature to transition the project to Formulation for Concept Definition (Phase A) at the time of instrument selection. If the technology is not sufficiently mature, the PE leads the development and coordination of an integrated technical, cost, and schedule plan to attain the maturity. This technology development is treated as mission-specific technology, and the associated costs are included in the total mission costs. If the technology is sufficiently mature, the PE prepares the applicable Formulation Authorization documentation to begin Phase A. The specific documentation varies depending upon whether or not the mission is the first project in the program and, if not, the requirements of the approved Program Plan.

7.2.3 Roadmap Development

Science Mission Roadmaps

The goals and objectives for space science are documented in the SSE Strategic Plan, a document traceable to the NASA Strategic Plan. The implementation strategy to support the SSE Strategic Plan is described in the SSE science mission roadmaps which are updated every 3 years. The science community participates in a series of workshops to update the roadmaps. The PE observes this development through interfaces with the Program Scientists and technologists to gain an understanding of the emphasis for potential new programs, for future technology capability requirements, and to determine the required content for program documentation. Recent roadmaps have been organized in a nested outline by Theme, then by quest, campaign, and mission. All projects in Formulation and Implementation are included and, depending upon the consensus of the science community, missions in pre-concept definition and advanced concepts may be included. Key technology requirements are briefly mentioned in the context of their science goals.

Technology Roadmap

The Division Technologists, coordinating with the Theme Technologists and PE, maintains oversight of the development of the SSE technology roadmap. The development of the SSE technology roadmap is led by the SSE Technology Director using the Technology Steering Group (TSG) as a coordinating forum. The Division Technologists, Theme Technologists and Program Manager for the New Millennium Program are members of the TSG. This forum is also used to identify cross-mission and cross-Theme technology requirements that are candidates for funding by the SSE technology activities.

7.2.4 Technology Development

The Technology Development activity supports the SSE effort to contain mission life-cycle costs and develop innovative technologies to enable new kinds of missions. SSE technology includes three major elements: Focused Technology Development, Core Technology Development, and Flight Validation. These three elements are designed to satisfy the roadmap and mission-specific technology needs unique to the SSE. Note that Technology Development spans the Pre-Formulation/Formulation boundary, as many activities are specifically associated with technology development within existing formulated programs or projects. The Technology Readiness Level, or TRL, is a designation that identifies the maturity, and therefore the implementation readiness, of a given technology. See Appendix E.11 for TRL descriptions.

The SSE has established a Senior Technology Council (STC), chaired by the Technology Director and composed of the Division Technologists, to coordinate Enterprise-wide technology priorities, planning, analyses, and assessments, and the interaction with other technology providers. The Center Theme Technologists have observer status in the Senior Technology Council. The STC also

coordinates annual publication of a comprehensive report describing the technology requirements of the Enterprise, as well as publication of the SSE technology 'roadmap' and the Technology Implementation Strategy, technology policies and principles for the Enterprise.

Focused Technology Development is dedicated to high priority technologies needed for specific science missions. These technologies provide essential capabilities, without which program-specific or project-specific objectives could not be met. Development activities can range from basic research (low TRL) to technology infusion into science missions (high TRL). Focused Technologies are often identified as a result of Advanced Concept Studies, in which the technology tall poles for new roadmap missions are specified. Focused Technologies are managed by the specific program requiring use of that technology. Accordingly, any technology developed in this manner is authorized by that program's FAD, and is subject to the authority of that program's PCA and Program Plan. PE's work closely with Program Management to ensure that the focused technology development is appropriately represented in these documents. Progress is measured against the program's implementation plan, and is reported during monthly SSE management reviews. The PE is also responsible for reviewing the program's or project's Technology Development Plan to ensure that a reasonable level of risk management has been established for the technology under development. While the PE is not a signatory on the Technology Development Plan, his/her concurrence (or lack thereof) factors into the outcome of the Mission Definition Review or its equivalent.

The Core Technology Development and Flight Validation elements of SSE technology are designated as Cross-Theme based on their applicability to multiple science Themes and missions. Core Technology covers a broad range of fundamental (typically low to mid-TRL) capabilities that support multiple applications. Technologies within this category are advanced to the point that they are ready for infusion into a Focused program, or selected as a candidate for Flight Validation. Core technologies are generally products of the technology roadmap that have relevance across multiple SSE science Themes and programs. Cross-Theme technology developments are managed separately from the programs or projects that will eventually use them, and must therefore independently comply with NPG 7120.5 requirements for the Formulation, Approval, Implementation and Evaluation subprocesses. Core Technology Development efforts must be either initiated with a FAD, or authorized within an existing program that so allows. The PE's involved with core technology conduct periodic reviews with the participating Centers and stakeholders to evaluate progress against the implementation plans. Stakeholders typically consist of the program scientists and representatives from projects dependent on that technology. Reviews are conducted either in person or via video or telephone conferences. Official correspondence is transmitted for corrective action in problem areas. Significant accomplishments are presented to SSE management during monthly reviews.

The Flight Validation element provides a path to flight-validate key mission-enabling or enhancing technologies, thereby retiring the risk of first use for future space science missions. The New Millennium Program has been formulated to develop and flight validate mid-TRL technologies in order to facilitate technology infusion into science missions. Flight Validation activities are formulated, approved, and implemented as projects within the New Millennium Program (NMP) in accordance with the processes prescribed by the NMP Program Plan. Although Flight Validation is designated as a Cross-Theme component of SSE technology, this does not preclude other candidate technologies from consideration. Any technology validation need that has a demonstrated multi-Theme or multi-mission applicability and meets the NMP criteria for TRL may be considered for Flight Validation. Technologies are selected from the SSE's technology needs inventory for NMP flight validation through a competitive peer review process. PE's who support science Themes or missions requiring flight validation of a new device or concept should work closely with the Division Technologist(s) and Theme Technologist(s) to make sure that the need is accurately represented.

PE's involved with technology should meet with the Division Technologists several times a year to coordinate SSE technology requirements

and ensure that the technology roadmaps are consistent with and supportive of the science mission roadmaps. It is the responsibility of the members of the TSG to coordinate technology assessments with other Enterprises and to be aware of technology investment priorities within them. They have access to Agency-wide technology inventory databases comprised of technology products and programs from a wide range of providers, includeing the Small Business Innovation Research (SBIR) Program, and Agency and university-sponsored Research and Development (R&D) programs. This gives them the unique ability to offer insight into complementary development efforts that may facilitate the technology activities represented by the PE.

7.2.5 Initiation of New Programs

New programs are proposed as funding candidates when a set of science investigations or technology capability requirements can be packaged under a common set of goals and objectives. The Program Executive supports the discipline Division Director in developing the candidate science initiatives and leads the development of candidate technology initiatives coincident with the yearly development of the Agency's budget (that transitions into the President's budget the following winter). The SSE AA reviews the candidates and may select only some of them. For those selected, the PE supports the development of technical, cost, and schedule information, largely without input from sources outside Headquarters, because new initiatives are usually embargoed within Headquarters. The PE's requirement for support of the candidate continues if the candidate successfully passes through reviews by the Enterprise, Capital Investment Council, and the Office of Management and Budget.

7.2.6 Transition to Formulation

Formulation Authorization entails placing the definition of a newly formed program, including objectives and how it supports the SSE Strategic Plan, into a Formulation Authorization Document. The appropriate program/project assignments are made to the Managing and/or Implementing Centers via either a Program Delegation Letter or a Project Authorization Letter.

7.2.6.1 Formulation Authorization Document

The SSE AA authorizes the transition of a program from a new initiative into Formulation, and the authorization is documented in a Formulation Authorization Document (FAD). The FAD is drafted by the Program Executive and documents the purpose of the Program (that is traceable to the SSE Strategic Plan), the terms of reference, the funding, and the participants. It may be required for a new project, if the project's Program Plan so states. The authorization is independent of any particular design solution for science or technology and is stated in terms of functional capabilities. The FAD content must comply with NPG 7120.5, Appendix E.1. A sample FAD is shown in Appendix E.12 of this Handbook.

7.2.6.2 Program Delegation Letter

For a new program, the signed FAD is sent to a NASA Center Director, under cover of a Program Delegation Letter issued by the SSE AA, assigning program management responsibility. In response to this delegation, the Center is instructed to respond with a proposed Program Plan for executing this responsibility, describing how the Center proposes to manage and implement the program. This letter also provides authority for establishment of a Program Office at the Managing Center.

The PE is responsible for generating the Program Delegation Letter for SSE AA signature for all new programs. The letter must have a signature block for concurrence by the Administrator of NASA, to be obtained prior to the letter being issued to the Managing NASA Center. A sample Program Delegation Letter is shown in Appendix E.13.

7.2.6.3 Project Authorization Letter

For new projects within existing programs, a Project Authorization Letter is issued by the SSE AA to the Center Director for the project and to the Program Manager at the Managing Center, authorizing Phase A work on the new project to commence. A FAD will accompany this letter if one has been required. The PE is responsible for generating the Project Authorization Letter for SSE AA signature. A sample Project Authorization Letter is shown in Appendix E.14.

7.3 FORMULATION SUBPROCESS (PHASES A & B)

The responsibility for Program Formulation has been assigned to the Space Science Enterprise Associate Administrator, although the SSE AA delegates to others within the Enterprise specific activities comprising the overall Formulation subprocess. Flight program responsibility is chiefly delegated to the Program Executives and Program Scientists within the OSS. The SSE AA also relies on the advice and recommendations of NASA-chartered panels and scientific advisory committees, which in many cases represent customers of the SSE.

The purpose of the Formulation subprocess is to refine mission concepts in order to define an affordable program and plan to meet mission objectives or technology goals specified in the NASA and SSE Strategic Plans. The Formulation subprocess includes developing advanced concepts, conducting trade studies, defining technology development goals, exploring implementation options, establishing internal management control functions, performing cost and performance analyses on concepts deemed to have a high degree of technical and operational feasibility, and identifying reserves associated with program risk management and other estimated project reserves.

For programs and projects which are anticipated to report to the Agency PMC or the Enterprise PMC (EPMC) as the governing PMC, the PE will work with the NASA Chief Engineer and the Independent Program Assessment Office (IPAO) at LaRC in Phase A to establish an Independent Review Team (IRT). In general, OSS will establish an IRT for the program, and this single team will review each project within the program as it occurs. This team becomes the official independent review team for all aspects of the program. However, an IRT may be established for individual projects at the discretion of the Division Director. The IRT conducts reviews as required throughout the program or project life cycle. This includes the Independent Implementation Review (IIR) and such reviews as requested by OSS. It reports to the EAA for special topic assessments, IIR's and IA's, to the Agency PMC for the NAR, and to the EPMC during Implementation.

7.3.1 Phase A Mission Requirements Definition

Phase A of Formulation concentrates on defining mission and system concepts, parameters, constraints and requirements that will allow the project to be developed on a schedule to meet established goals and within a realistic cost. It is accomplished through conduct of studies which examine the trade space permitted within identified constraints, and through continued development of enabling technology toward achieving an acceptable Technology Readiness Level. As the definition of the mission emerges from trade studies, it is important to determine, and continually adjust, the estimated cost of various components of the mission and the ultimate life cycle cost.

7.3.1.1 Mission Studies

Phase A Mission Studies are initiated by issuing a Program Delegation Letter or Project Authorization Letter to a NASA Center. The Center is asked to respond with an implementation plan. The PE reviews the Center's planned study activities, negotiates any required changes, and requests that the Resources Management Division issue a NASA Form 506A budget authority.

The purpose of Phase A Mission Studies is to determine the feasibility and desirability of a suggested new project, and to define the mission requirements and constraints prior to seeking major new funding. In this evaluation of a specific mission, the following should be defined:

- Mission and science requirements
- Project constraints and boundaries
- Alternative design concepts
- Operations and logistics concepts
- Feasibility and risk analyses
- Advanced technology requirements
- Environmental impact requirements
- Identification of needed tools and models
- Formulation subprocess letters of agreement
- Detailed cost and schedule estimates
- Education and outreach possibilities

These studies need to demonstrate that credible, feasible mission designs exist within allowed

budgetary cost estimates. Phase A mission studies involving new technology concentrate on technology development with a TRL of 5 or less. The phase ends with a successful Mission Definition Review or its equivalent.

7.3.1.2 External Agreements

International Agreements

With the stringent enforcement of the International Traffic in Arms Regulations (ITAR) by the United States in dealings with foreign persons and organizations, the defining and securing of approved international agreements for work performed in conjunction with foreign partners becomes critically important to a project. If technical discussions between the project and its foreign partners are required during the study phase, the PE must work with a newly formed project during or before Phase A to define the content of a study phase Letter of Agreement (LOA). He/she must also consult with the Office of External Relations to determine whether a LOA or a Memorandum of Understanding (MOU) will be needed, and initiate and execute the activities necessary to generate these. MOU's and sometimes LOA's require approval by the U. S. State Department. An agreement in which there is an exchange of funds for services provided (for example, for tracking services), known as a reimbursable agreement, requires coordination with and approval by the Office of the Chief Financial Officer (Code B). Foreign procurements using contract mechanisms are not treated as reimbursable agreements, as they are subject to different rules and generally would not need Code I involvement. Early consultation with these Agency offices is essential.

The PE provides technical agreement content to the Office of External Relations (Code I) to begin the drafting of the formal agreements, whether they be LOA, MOU or reimbursable agreements. The mechanism for doing this is an entry into the on-line Space Science Pending International Agreements Database (SSPIAD), a task database jointly maintained by OSS and Code I. (See http://ossim.hq.nasa.gov/intl/.) This database and the process of prioritizing development of agreements in it are managed by the OSS Strategic and International Planning Director, who can help program staff coordinate with Code I. LOA's are signed by Code I, and MOU's by the NASA Administrator.

Interagency Domestic Agreements

Partnerships with other agencies may be documented in a Memorandum of Agreement (MOA). MOA's are typically done for major collaborations or when there is significant reimbursement for a service performed. The PE must coordinate with the Director of Interagency Relations (Code IC). The PE, with advice from relevant Headquarters support offices, including Office of the General Counsel, and support from the project, negotiates the collaborative agreement. No external approvals, such as from the State Department, are required for domestic agreements. The cooperative agreement is signed by the involved Enterprise AA's. A reimbursable agreement requires coordination with and approval by Code B. It is not always necessary to have a Formulation MOA done for domestic collaborations, as for foreign collaborations, because technology transfer and cross waiver of liability are not issues. However, if it is a major collaboration, with significant contributions from the other agency needed for the successful implementation of the mission, a Formulation MOA is highly desirable to ensure both agencies are in early agreement on the collaboration. MOA's are to be drafted and ready for signature by the time the project is ready to seek approval to enter Implementation.

7.3.1.3 Initiation of Program Commitment Documentation

During Phase A of Formulation, program-level requirements are determined and drafted. Program-level requirements are those requirements levied by the Enterprise (defined as Level 1) on the implementing organization, which the project will use to generate lower level requirements to be implemented. NASA Headquarters will use these program-level requirements to evaluate the performance of the project during Implementation. For single-project programs, these requirements will ultimately be inserted into the Program Plan. For new projects in multi-project programs, the requirements will be attached to the Program Plan as a project-specific appendix. Program-level requirements on the multi-project program itself will be documented in the body of the Program Plan. The PE is respon-

sible for generating this material through coordination with the Program Scientist, the Principal Investigator and/or the Project Scientist, and the Program Office and project at the Center.

For new programs, the Program Plan and Program Commitment Agreement also need to be started in this phase. The PCA will contain the subset of the Level 1 requirements that define the commitment for the program between the Enterprise AA and the Administrator, and can be considered Level 0 requirements. New projects should begin their Project Plans in Phase A.

7.3.1.4 Mission Definition Review

The project review that marks the end of Phase A and the beginning of the transition to Phase B is the Mission Definition Review (MDR), as defined by the NASA Systems Engineering Handbook (SP-6105). This review obtains preliminary agreement on mission definition parameters. For both flight and ground components, it covers the preliminary requirements at Levels 1 and 2, preliminary mission design, very preliminary systems design with margins, procurement strategy, operations concept, significant risks and mitigation strategies, a preliminary schedule and initial life cycle costs estimates. This review, or its equivalent, must be successfully accomplished before a transition from Phase A to Phase B of Formulation can be accomplished through an Initial Confirmation Review with the SSE AA. If a Confirmation Assessment board or an IRT has been chartered, it may participate in the MDR.

7.3.2 Phase A to B Transition

The Program Executive coordinates the development of required program and project documentation with the Center. Through reviews of the project conducted during Phase A and reviews of project documentation, the PE assesses whether or not the project has completed the Phase A objectives and continues to indicate a viable development within the anticipated cost and schedule. If, through this analysis, and after coordination with the Division Director and Program Scientist, the PE determines the project is not ready, he/she will direct the project back to the Center for further Phase A formulation.

With a decision to proceed, the PE initiates and coordinates the Phase A-to-B confirmation activity required of all projects. This generally will consist of a Confirmation Assessment (CA) by an independent review board, a Center-organized Confirmation Readiness Review (CRR) for the Center Program Management Council (PMC), and finally, an Initial Confirmation Review (ICR) with the SSE AA and his/her Selection Committee (see Figure 6.5-1 and 6.5-2). The PE coordinates establishment of the CA board and its review charter with the project. For projects in programs for which the GPMC is the Agency PMC or the EPMC, the IRT performs the CA functions. Determination of governing PMC is made prior to entering Phase B (see Subsection 7.3.5.1) The CA board will attend the MDR and hold discussions with the project as necessary, in order to assess whether or not the project has completed the Phase A objectives and is ready to proceed to Phase B. The board will make its recommendation first to the project and the Center PMC.

The PE schedules the ICR with the EAA and the Selection Committee and ensures all presenters can support it. At the ICR itself, the chair of the CA presents the board's findings and recommendations. The project presents a project status summary, the results of the CRR and the recommendations of the Center PMC. The Selection Committee hears the recommendations and assesses the prospect of the mission being able to meet the science objectives on schedule and within budget. The Committee votes on acceptance, rejection or alternatives, and presents the results to the EAA, who is the selecting official. With a positive decision by the SSE AA, and if all required documentation is complete, the project is confirmed for Phase B. Authorization to proceed is subsequently issued in a confirmation letter drafted by the PE for SSE AA signature. A “No Confirmation” decision by the SSE AA can direct the project back to the Center for further Phase A formulation or it can terminate any further effort.

Life cycle cost estimates must be provided by the NASA Comptroller to Congress before any Phase B funds may be allocated to a project estimated to have total NASA project costs exceeding $150M. If there is an Independent Review Team (IRT), it generates the Life Cycle Cost estimate

and presents it to the EPMC. If the project is being reviewed as part of a downselect process for AO-initiated missions, the Life Cycle Cost estimate is validated by independent cost analysis based on the Concept Study Report from Phase A. It is provided to the NASA Comptroller upon mission selection.

This A-to-B transition occurs in the middle of the Formulation subprocess and is partially dependent on the readiness level of the technology needed for implementation of the project. For projects that contain significant technology requirements, OSS prefers to have a longer Phase A to ensure technology readiness before a project enters Phase B. This is to reduce the overall risk to the project affecting cost, schedule, and technical performance inherent with unproven technologies.

7.3.2.1 Phase A to B Transition Point for New Technology

At the time of the ICR, all projects will be required to demonstrate that no major outstanding technology readiness issues remain, otherwise they will not receive approval to enter Phase B. This includes domestic and international collaborations where NASA is participating in a non-NASA led mission. Based upon the results of Center and partner reviews, and if missions requiring enabling technology have that technology at a TRL of 5 or higher, the project may enter Phase B. This TRL restriction does not necessarily apply to technology flight demonstrations.

Flight Validation projects, such as those of the New Millennium Program, may allow a different transition TRL than other projects because of their technology demonstration focus. Unlike science focused missions, technology development of TRL 5 or lower may occur during Phase B. The project must successfully pass TRL 5 as part of the requirements to move to Implementation, which must be accomplished in Phase B. Because a NMP mission may be the validation of a technology in a relevant environment, unlike other projects, it may not have achieved TRL 6 by the time of the Non-Advocate Review or Phase C Confirmation Review.

7.3.2.2 Programmatic Requirements for Phase A to B Transition

For all projects, the Program Executive is responsible for ensuring that the following tasks are completed during Phase A before the start of Phase B can be approved. While the PE is responsible for ensuring accomplishment, most of these tasks must involve significant input from the Program Scientist, the relevant Division Director(s), the Program Analyst, and the program/project at the Center. The first five are actually led by the Program Scientist.

<u>Tasks led by Program Scientists with support from PE:</u>

1. Determine whether it is a Principal Investigator (PI) or facility-class mission.
2. Issue an AO and select instruments, the PI and science teams.
3. Establish policies for forming the science teams and their participation.
4. Establish location and responsibility for the science data center.
5. Begin development of policy guidelines for data rights, access to data, and funding for Guest Observers.

<u>Tasks led by PE with support from others:</u>

6. Verify that the governing PMC has been determined.
7. Establish preliminary budget cap for project.
8. Develop performance metrics for Phase B.
9. Develop a plan for independent assessments.
10. For programs, develop draft program-level requirements for inclusion in Program Plan.
11. For projects, develop draft Program-Level Requirements for incorporation in the project-specific Appendix to the Program Plan, ensuring all required contents are addressed.
12. Ensure that all enabling technology required has reached a TRL of at least 5 (except for NMP).
13. Organize Phase B Confirmation Assessment board, develop charter, ensure review is conducted and findings are presented to project, Center PMC and OSS.

14. Ensure the JPL Phase B task plan is written, if applicable.
15. Identify need for environmental assessment or impact studies.
16. Write study phase LOA's for non-NASA domestic and international partners.
17. Establish and document understanding of collaborations with partners, as a basis for writing the MOU's and MOA's for non-NASA partners (domestic and international).

Tasks led by Center under PE oversight:

18. Develop estimates of life cycle costs for the mission (through Phase E, including tracking and data archiving).
19. Complete Phase A systems trades and optimization studies with appropriate documentation.
20. Develop guidelines for mission operations: flight, ground, and science, and preliminary Operations Concept. Obtain an assessment from the intended provider of tracking services (e.g. the DSN) concerning the capacity and capability of the service to support the project's estimated needs.
21. Develop draft Program Plan. This applies to single-project programs, and to programs where the first project is transitioning from Phase A to B.
22. Finalize launch vehicle performance requirements.
23. Identify telemetry, tracking and commanding requirements and strategy.
24. Decide whether an environmental assessment (EA) or environmental impact statement (EIS) is required, and develop draft preliminary environmental assessment or environmental impact study reports.
25. Identify areas of anticipated risk and define risk mitigation strategies.
26. Develop an acquisition strategy, and obtain NASA Headquarters approval (if required).
27. Prepare contracts for issuance to start Phase B work.
28. Establish preliminary document tree.
29. Develop a draft education and public outreach plan to utilize 1 to 2% of the project budget, in concert with program-level plans.

7.3.3 Phase B Preliminary Design

Phase B of Formulation concentrates on applying results of mission studies and trades completed in Phase A to generate preliminary mission, instrument and spacecraft designs that satisfy the identified constraints and requirements, and that will allow the mission to be developed on a schedule to meet established goals within a budgeted cost. It is a time for finalization of the requirements and establishment of the cost caps that will become firm requirements at confirmation. Costs that should be detailed in Phase B, whether or not they are a part of the controlled cost cap, include the usual spacecraft development and test activities, and also launch vehicles, external reviews, full mission operations (including tracking requirements and space operations management costs), and data analysis, including data archiving and science center operations. Schedules are defined that will allow mission and spacecraft development to meet the desired launch date with adequate margin. Risks are identified and risk mitigation plans developed.

7.3.3.1 Project Reviews

Various projects may call for different system-level reviews during Phase B, according to differing Center policies. There are two that support the space science program structure presented in Subsection 2.2.4 of this handbook and are consistent with good engineering practice. The first of these is the Systems Requirements Review (SRR), which evaluates the completeness, consistency, and achievability of mission, system, subsystem and assembly requirements necessary to fulfill the mission objectives and requirements, and the traceability of the requirements flowdown. The SRR should occur early in Phase B and should cover mission, project, science, operational, flight system and ground system requirements. (Some projects may choose to combine the SRR with the MDR at the end of Phase A.)

The project review that marks the end of Formulation Phase B and starts the transition process to Implementation Phase C is the Preliminary Design Review (PDR). The PDR assesses

the compliance of the preliminary design against the applicable requirements and evaluates the readiness of the project, system, subsystem or assembly to proceed with detailed design.

7.3.3.2 Policy Decisions/Actions Made by NASA Headquarters During Phase B

While there are many activities performed by the project at the Center during Phase B leading to a mission preliminary design, the purpose of this handbook is not to describe what occurs at the Center, but to describe what the Headquarters Program Executive should be doing during this timeframe. The next several subsections (through 7.4) describe much of what needs to be done, particularly in the way of documentation, review support, program/project assessment and the process of approval to achieve transition to Implementation. All of this requires significant work by the PE in Phase B. However, there are certain key decisions and actions that the PE needs to make in Phase B to enable the process to efficiently play out. These are as follows:

- Decide which of the requirements need to be placed into the Program Commitment Agreement (PCA).
- Decide what mission cancellation criteria are to be placed into the Program Plan.
- Determine and obtain agreement on a firm cost cap for project, which is a program-level requirement.
- Decide what technology can be used for the project, based on critical need, TRL and mission criticality.
- Select final launch vehicle and work with Code M to get the mission onto the manifest.
- Update the draft environmental assessment (EA) or environmental impact statement (EIS) as required.
- Initiate establishment of the ad-hoc Interagency Nuclear Safety Panel, if required.
- Decide if risk mitigation plans are sufficient for the mission as planned, and if not, investigate actions to modify.
- Decide with Code I, or other agencies as appropriate, on the external agreement mechanism (LOA vs MOU vs MOA) and how many are required.
- Decide on telemetry, command and tracking needs, e.g., DSN, NASA's ground network, TDRSS, independent or commercial ground stations.
- Decide, in consultation with the IRT chair and the Project Manager, which project activities require participation of IRT members.
- Determine if planetary protection work will be required.
- With the Program Scientist, develop data archiving policies.
- Decide if project education and outreach activity will be done at the project or program level and if cross-program activity will be supported.

7.3.3.3 Preparation for Approval (NAR or CA)

For a single-project program, or a project of sufficient cost or visibility, NASA will require a Non-Advocate Review (NAR), initiated by the NASA Chief Engineer's Office and executed by the IRT. The PE works with the IRT chair and the project to schedule meetings with the project and Enterprise prior to an approval meeting with the Agency PMC (chaired by the Associate Deputy Administrator). This is the full NPG 7120.5 process. The NAR role in Approval for Implementation is discussed in Subsection 7.4.

For smaller projects that do not report to the Agency PMC, the PE must work with the project to organize and conduct the Confirmation Process, which is a 7120-tailored substitute for the NAR for space science projects. In preparation, the PE coordinates the development of required project documentation with the Center. Through reviews of the project conducted during Phase B and reviews of project documentation, and upon project request, the PE assesses whether or not the project has completed the Formulation objectives and continues to indicate a viable development within the anticipated cost and schedule, to the point of readiness to begin detailed design. If, through this analysis, and after coordination with the cognizant Division Director and Program Scientist, the PE determines the project is not ready, he/she will direct the project back to the Center for further formulation.

With a positive decision, the PE initiates and coordinates the Confirmation activity. This consists of a process very analogous to the Phase A-to-B confirmation process described in Subsection 7.3.2: Confirmation Assessment by an independent review board, a Center-organized Confirmation Readiness Review (CRR) for the Center PMC, and finally, a Confirmation Review with the SSE AA. The PE coordinates establishment of the CA board and its review charter with the project. For projects in programs for which the GPMC is the Agency PMC or the EPMC, the IRT performs the CA functions. The CA board will attend the PDR and hold discussions with the project as necessary, in order to assess whether or not the project has completed Formulation objectives and is ready to proceed Implementation. This process is further detailed in Subsection 7.4.

7.3.3.4 Completion of Formulation Documentation

Phase B of Formulation is the time for generation of key program commitment documents at both the program and project level. Detailed instructions to the PE for preparation of these documents are given in the next subsection.

7.3.4 Program Commitment Documentation

The Program Commitment Agreement is the agreement between the NASA Administrator and the EAA that documents NASA's commitment to execute the program requirements within established constraints. The Program Plan is the agreement between the EAA, the Center Director and Program Manager that relays this commitment to the NASA Center. These documents ensure that NASA Headquarters and all supporting organizations understand the programmatic, technical, and management systems requirements and commit to providing the necessary resources.

7.3.4.1 Program Commitment Agreement

Baseline Program Commitment Agreements (PCA's) are written in Formulation, as defined in Subsection 2.1 of NPG 7120.5. They are drafted when the first project in the program is in Phase A and finalized when it nears the end of Formulation Phase B. The PCA approval process occurs during the program Approval subprocess, which occurs simultaneously with approval for the first project in a multi-project program. An approved PCA is required for approval of the first project for Implementation, as defined in Subsection 2.2 of NPG 7120.5. PCA's are subject to annual revision, review, and revalidation as necessary. Required PCA content is defined in Appendix E.2 of NPG 7120.5. PCA's are brief documents. In writing the initial PCA, the PE should address specifically the topics listed in Appendix E.2 and avoid the temptation to add detail.

In the PCA, program requirements for a single-project program may include such items as: number and type of instruments, instrument performance, orbit, lifetime, and any special requirements associated with calls for proposals. The program requirements for a multiple-project program (a mission series, for example, Discovery) address the program, rather than the individual projects. The requirements may include items such as how often AO's are released, how new projects are managed, how they report, length of development time, and requirements for approval by Confirmation Review. The PCA is tailored to reflect the uniqueness of each program. Tailoring identifies the process and requirements that have been revised and identifies the unique approaches to be approved by management.

The PE is the person responsible for developing the PCA, although he/she should consult with the cognizant Division Director or Program Scientist, as applicable, and may receive help from the Program Manager at the Center. The flow of activities involved in the development of a PCA is given in Office Work Instruction HOWI7120-S006. This is the authoritative instruction for performance of this task. To ensure use of the most current OWI, always check: http://www.hq.nasa.gov/hqiso9000/library.htm.

During early Formulation, the PE prepares the initial draft of the PCA from cost, schedule, and program objective information received from the implementing Center, working closely with the Program Scientist. The Program Operating Plan, prepared annually by the Managing Center, and the Program-Level Requirements provide reference material for the PCA. The PE coordinates a review of the draft PCA among key elements within OSS (e.g., the Program Scientist, the Program Analyst, Division Director(s), and others as

appropriate for the content of the specific PCA). With input from the project at the Managing Center, the PE modifies the PCA in accordance with comments and inputs received and ensures that the PCA format satisfies the requirements specified in Appendix E.2 of NPG 7120.5.

The PE then submits the coordinated draft PCA to the Office of the Chief Engineer (Code AE), which responds with comments and requests for revision. The draft PCA is then circulated among other offices as appropriate to the PCA's content.

As the program (or first project) approaches the Approval milestone, the final PCA is generated as an input to the NAR process. This final PCA is submitted for approval by the SSE AA, concurrence by the Office of the Chief Engineer, and signature by the NASA Administrator. Annual review of the PCA, with updates as necessary, is required after the President's budget is released in the spring of each year. There are two types of changes. Major changes represent significant impacts to requirements, schedule, resources, risks, or agreements and must be approved by the Administrator. All other changes are minor and can be approved by the Associate Deputy Administrator. The SSE AA will classify proposed PCA changes as either major or minor.

7.3.4.2 Program Plan and Program-Level Requirements Appendix

A Program Plan is prepared during the Formulation subprocess of a program, and is signed when the program receives approval from both OSS and the Agency PMC to proceed to the Implementation subprocess, as defined in Subsection 2.2 of NPG 7120.5. Except for program-level requirements, the development of the Program Plan is the NASA Center's responsibility, with PE oversight.

The PE, working closely with the Program Scientist, is responsible for generating the program-level requirements so that they are clear, unambiguous, testable and verifiable. Program-level requirements on single-project programs and on mission series programs belong in the body of the Program Plan. Program-level requirements on projects in a mission series are placed in Appendices to the Program Plan.

A single-project program will have a single document Program Plan containing all the top-level requirements on the program. A multi-project program will have a Program Plan with sections specifying the overall requirements on the program and providing general program policies, and a separate Program-Level Requirements Appendix for each project within the program. Mission series projects within a program may be initiated through an AO selection or via the strategic plan roadmap process.

For projects in multi-project programs, a Program-Level Requirements Appendix to an existing Program Plan is prepared during Formulation. It should be drafted in Phase A of Formulation, and be carefully coordinated with all stakeholders such that these top-level requirements are well understood and are specific enough to allow flow-down to lower-level project requirements and subsequent traceability between levels. This appendix is signed by the SSE AA (when the life cycle cost exceeds $150M) or by the designated Division Director when the project receives approval to proceed to the Implementation subprocess, as defined in Subsection 3.2 of NPG 7120.5. All the necessary precursor signatures and concurrences must be obtained in Phase B, well in advance of the approval meeting, whether it is a Confirmation Review or a NAR presentation to the Agency PMC. An example generic Program-Level Requirements Appendix (developed for the Explorer Program) is attached as Appendix E.10 to this handbook.

Program Plans and Program-Level Requirements Appendices are generally not revised after signature. However, if necessary, modifications may be made and documented in a revision to the Program Plan or Program-Level Requirements Appendix if approved by the applicable Division Director and the SSE AA.

The single-project Program Plan or the Program-Level Requirements Appendix identifies the mission, science and programmatic requirements (including funding and schedule) imposed on the project. It covers project-unique policies, and specifies requirements on science data collection, mission and spacecraft performance, prime mission lifetime, budget, schedule, launch vehicle, and any other requirements at Level 1. It identi-

fies the responsible implementing organization for the development and operation of the project. This document will discuss the risk management approach and process (including tools such as Failure Modes and Effects Analysis, Fault Tree analysis, and Probabilistic Risk Assessments), and the use of descope plans. It also identifies the criteria to be used to evaluate whether or not a project should be terminated, if it begins violating its requirements. A sectional outline for a Program Plan, with brief description of each section, is contained in Appendix E.3 of NPG 7120.5. The emphasis in the Program Plan for multi-project programs is on requirements levied on the overall program. The emphasis in the Program-Level Requirements Appendix is on the mission-unique requirements, and should not repeat the program-level requirements already contained in the Program Plan.

A key element of risk management is the definition of Mission Success Criteria, that portion of the Level 1 requirements which define what should be achieved to successfully satisfy the strategic plan objectives addressed by the program, project or technology demonstration. These criteria are established during Formulation to drive requirements, define allowable trade space, and guide risk and safety decisions. Baseline mission success criteria fully satisfy all program objectives. Both baseline and minimum success criteria are defined. The difference between the baseline and minimum mission success criteria, which reflects the science floor of the mission, is addressed in the descope plan. These items must be clearly identified within the Level 1 requirements.

The Program-Level Requirements Appendix serves as the basis for project assessments conducted by NASA Headquarters SSE officials during the development period, and provides the baseline for the determination of the science mission success following the completion of the operational phase.

The Program Office has the overall responsibility for meeting the mission, science, cost and schedule requirements contained in the Program Plan or Appendix. The Program Office delegates to the specific Project Managers all or part of this responsibility. The project is then responsible for all design, development, test, launch and mission operations, and data verification tasks that implement the mission, and coordinates the work of all contractors and science investigators. Changes to program-level requirements require approval by the Office of Space Science.

The Program Plan or Program-Level Requirements Appendix identifies, either explicitly or by reference, any NPG 7120.5 requirements or processes which the project/program does not plan to implement or is substantially modifying. Approval of such tailoring changes is obtained through signature on the Program Plan. Such tailoring of NPG 7120.5 requirements is further documented in Project Plans and lower level documents, or if Center processes allow, in internally controlled project documents. Program-level tailoring of NPG 7120.5 requirements is not necessarily repeated in the Program-Level Requirements Appendix.

The flow of activities involved in the development of a Program Plan or Program-Level Requirements Appendix is given in Office Work Instruction HOWI7100-S005. This work instruction is the authoritative instruction for performance of this task. Always check this web address: http://www.hq.nasa.gov/hqiso9000/library.htm, to ensure use of the most current OWI.

The PE works with the Program Scientist and the Program or Project Manager to generate the program-level requirements during Phase A of Formulation. If the mission was selected via an Announcement of Opportunity (AO), the draft program-level requirements are extracted from the winning proposal or Concept Study Report from Phase A. If the mission was not selected via an AO, the draft program-level requirements are extracted from other relevant sources (e.g., instrument capabilities, mission concept studies, or non-NASA documents if it is a cooperative mission).

The PE negotiates the program-level requirements with personnel at the relevant NASA Headquarters offices and NASA Centers, including the Program Scientist, cognizant Division Director, and Program and Project Managers. Others may include the Project Scientist, the implementing organization (if other than the Managing Center), Principal Investigator(s), OSS Policy Analyst, non-NASA partners, the NASA Head-

quarters tracking office, and the NASA Headquarters launch vehicle provider organization in Code M. When an informal consensus is reached on the content of the program-level requirements, negotiations are completed.

If the requirements are for a program, the Program Manager incorporates the negotiated Level 1 requirements into the draft Program Plan that was requested by the Program Delegation Letter, which follows the content requirements identified in Appendix E.3 of NPG 7120.5. After the PE and the Program Manager agree on the content of the Program Plan, the Program Manager obtains the appropriate signatures at the NASA Center and submits the plan to the PE, who then obtains concurrences and approval by the SSE AA.

If the requirements are for a project, the PE is responsible for creating a draft Program-Level Requirements Appendix to the relevant Program Plan, incorporating the negotiated Level 1 project requirements. The PE must include the content identified in Appendix E.3 of 7120.5, coordinating specific content with whomever necessary to ensure capturing a clear and complete set of requirements at Level 1. After the PE and both the Program and Project Managers agree on the Program-Level Requirements Appendix, the Project Manager obtains the appropriate signatures at the NASA Center and other relevant organizations, and submits the plan to the PE, who then obtains concurrences and approval by the SSE AA.

The Program Plan or Program-Level Requirements Appendix is reviewed on an annual basis, but updated only if needed. If the changes do not affect the program-level requirements themselves, concurrence only needs to be obtained at NASA Headquarters from the Program Executive, Program Scientist, cognizant Division Director and others as appropriate to the nature of the change. If the changes involve changing the program-level requirements, in addition to the above concurrence the SSE AA and Center Director, or their representatives, must re-sign the document signifying approval.

7.3.5 Program/Project Assessment & Reporting

7.3.5.1 Program Management Councils

NASA has established a hierarchy of Program Management Councils (PMC's), as illustrated in Figure 7.3-1, to ensure appropriate levels of management oversight. The Agency PMC at NASA HQ is responsible for evaluating proposals for new programs, for providing approval recommendations to the Administrator, and for assessing existing programs to evaluate cost, schedule, and technical content to ensure that NASA is meeting its commitments. The Agency PMC is supported in this task by the Office of the Chief Engineer, assisted by other organizations such as the PMC Working Group and the Independent Program Assessment Office (IPAO) at LaRC.

Other PMC's are established at Enterprise level, at the assigned project Center and supporting NASA Centers, and at lower levels within each Center as required. Similar to the Agency PMC, these councils evaluate the cost, schedule, and technical content to ensure that NASA is meeting the commitments specified in the PCA, the Program Plan, and the Project Plan. The "governing" Program Management Council for a specific project is the highest-level PMC that

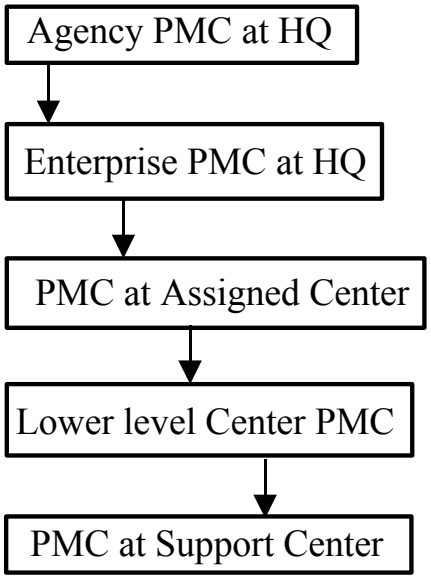


Figure 7.3-1 Hierarchy of PMC's

regularly reviews that given project. In general, new programs begin to report to the Agency PMC as "governing" when their first project achieves SRR in Phase B. All programs continue to report to the Agency PMC unless delegated to a lower level PMC. The NASA Chief Engineer convenes a PMC Formulation Review meeting early in the Fiscal Year to discuss recommendations from the Enterprises on governing PMC assignments for all programs and projects for that year. The SSE then presents the resulting plan for Space Science to the Agency PMC for approval. Usually, the first (or only) project is recommended for Agency PMC as governing and the remaining projects recommended at the Enterprise or Center PMC level. However, the Agency PMC may delegate or elevate governing status as it sees fit, and in practice usually delegates programs to the EPMC after the NAR. The SSE interfaces closely with both the Agency PMC and the Managing Center PMC. The plan for the upcoming fiscal year for governing PMC's is documented in a memo from the Chief Engineer and issued to all Enterprises.

Various independent performance assessments are conducted by external teams throughout the life cycle and reported to the governing PMC. The only types of independent assessments performed within the SSE and reported to the Agency PMC are the Independent Assessment (IA) and NAR. These are typically performed by the IRT. They are fully described under Evaluation (in Subsection 7.6) and will not be addressed here. Confirmation Assessments (CA) are the SSE-specific analogue to the NAR performed on projects in Formulation that report to the EPMC as governing. The IRT can also perform independent assessments at the request of the SSE, reporting to the PE or the EPMC. Also, most projects have a standing review board, chartered by the Center, that performs independent assessment and reports to the Center PMC.

7.3.5.2 Enterprise Review and Reporting

Weekly Reporting

For projects that have passed the Critical Design Review (CDR) milestone (can be earlier for highly visible projects), the Program Executive tasks the project to submit short weekly status reports via the OSS Information Management (OSSIM) file server, located at http://ossim.hq.nasa.gov/ossim/home.htm. These reports capture at a very brief level the most significant project accomplishments for the previous week. Weekly reporting should continue throughout the project's prime operational mission. Reporting during extended missions can be reduced to significant events only. The PE edits the report as necessary, adding Headquarters-unique information as appropriate. The Executive Director for Programs finalizes the OSS Weekly Report as a compilation of the individual status reports, and archives the Weekly Report on the OSSIM server for SSE management access.

Monthly Reviews

Monthly reviews are held at the SSE level with the Deputy AA and the SSE AA. To meet monthly, quarterly and annual oversight requirements, the Program Executive assesses program and project progress and performance against the program-level requirements, cost plan, and development schedule. The flow of activities involved in the Program/Project Assessment process is given in Office Work Instruction HOWI7100-S007. This work instruction is the authoritative instruction for performance of this task. To ensure use of the most current OWI, always check http://www.hq.nasa.gov/hqiso9000/library.htm.

In normal project reporting, the PE receives monthly status and progress reports from Program Office or project. These are accomplished either through visits to the project, videoconferences, or telecons. Presentation material should be in electronic form and placed by the project onto the OSSIM (OSS Information Management) file server, at http://ossim.hq.nasa.gov/sprogrev in the "project" area. The PE then creates monthly project assessment reports for electronic presentation to SSE management, and installs these reports on the OSSIM server in the "program" area. The initial presentation is by the PE to the Deputy AA, the Executive Director for Programs, and cognizant discipline Division Director at the Flight Program Monthly Review, which is closed to non-Headquarters people. This is followed by the SSE Monthly Review to the SSE AA. The Division Directors make this latter presentation, using information provided by the PE. Information presented at the SSE Monthly Review is more sum-

mary in nature, because of the shorter length of the meeting and its open nature.

The PE performs ad hoc assessment and reporting whenever necessary to SSE management for programs or projects that are projected to have high development costs, have unusually high public or NASA visibility, or have other unique features. This reporting often falls outside the normally scheduled cycle.

Quarterly Status Reports to the Agency PMC

If the governing PMC is the Agency PMC or the EPMC, the Executive Director for Programs works with the Program Executives and the Program Analysts in the Resources Management Division to prepare the Quarterly Status Report (QSR) for electronic presentation to the Agency PMC. The presentation is made by the Executive Director for Programs or designee, on a schedule established by the Chief Engineer's Office.

GPRA Metrics

The SSE is required to submit performance metrics and narratives, in response to the Government Performance and Reporting Act (GPRA, see Subsection 2.2.2), to support the proposed new budget for the fiscal year commencing two years hence and the Operating Plan for the coming fiscal year. The PE provides technical information, and schedule and performance milestones, to the appropriate Resource Analyst to support this activity and coordinates the reporting on performance metrics for the past and current fiscal years, supplying performance reports to the Strategic and International Planning Director.

7.3.5.3 Budget Support

The Centers submit a Program Operating Plan (POP, see Subsection 5.2.2) yearly to describe their budget requirements for the coming fiscal year. Their submission is based upon instructions and guidelines issued by OSS. The PE supports the development of these instructions and guidelines by coordinating the development of them with the Resource Analyst, the Program Scientists, and the Division Directors, and the other PE's working on missions or projects in a Theme's programs. The PE also supports the review of Center responses, makes recommendations to the Division Director, evaluates impacts of changes in the POP submit, and determination of final operating plans as described in Subsection 5.2.

7.3.6 Formulation Checklist

During the Formulation subprocess, the following information and decisions are developed and documented. Some of these were discussed in previous subsections, while others are mentioned only here, but all are placed here to provide a checklist for the Program Executive of what needs to be accomplished during Formulation. Some of these products are generated by projects at Centers and provided to Headquarters for approval, but all need to be addressed for successful approval to enter Implementation.

The products of Formulation (Phase B to C Transition) are:

1. A proposed Program Commitment Agreement for new programs, ready for signature, or proposed updates to an approved PCA for new projects, showing life cycle costs and top-level schedule milestones.
2. A signed Program Plan containing program requirements (for new programs).
3. Signed Level 1 appendices with program-level requirements for new projects in multi-project programs, including budget cap, risk management, and performance metrics for Phases C/D/E.
4. Project Plans ready for approval.
5. Science instruments selected and PI's/Co-I's identified.
6. Agreement between the Program/Project Manager and the NASA Headquarters Program Executive on program reporting: method, content, and frequency during Implementation.
7. Definition of Launch Vehicle requirements for NASA or non-NASA Expendables (ELV) or Space Shuttle (STS), including secondary payloads, and draft manifest request (e.g., Form 1628 for STS).
8. An agreement between the project and the provider of the selected tracking service (e.g. DSN) stating the project's tracking requirements and provider's capability to provide the required service. This agreement should spec-

ify costs to the project for providing the needed service including any engineering upgrades that the provider must make in order to meet project requirements.

9. Approved Technology Development Plan, which includes identification of required enabling technology and a verification of its maturation to TRL 6 or beyond (except for NMP).
10. An approved acquisition plan.
11. Signed Formulation Letters of Agreement (LOA) with other NASA and non-NASA organizations whose support is required to achieve program objectives.
12. Draft Implementation LOA's with other NASA and non-NASA organizations, if required.
13. Final drafts of proposed Memoranda of Understanding (MOU) or Memoranda of Agreement (MOA) for domestic and international partners, which may be required.
14. Risk Management Plan, documenting a thorough assessment of technical, cost, and schedule risks. (See Subsection 4.3 of NPG 7120.5.)
15. Descope Plans, for implementation in the event of cost, schedule or technical difficulties.
16. Plan for independent reviews during Implementation.
17. Non-Advocate Review (NAR) or Confirmation Assessment (CA) results.
18. Cancellation review criteria (specified in the Program Plan or appendix for projects in the program).
19. Draft National Environmental Policy Act (NEPA) compliance documentation. (See Subsection 7.5.2.)
20. Draft Orbital Debris Assessment.
21. Draft schedule for Nuclear Launch Safety Approval, if required. (See Subsection 7.5.2.)
22. Notices of Intent for environmental impact. Start environmental assessment process (and planetary protection), if required.
23. Project-level education and public outreach plans to be approved by NASA Headquarters.
24. MO&DA budgets, agreed to by the Program Scientist, Division Directors, and Executive Director for Science.
25. Guidelines for conduct of Mission Operations.
26. Draft Project Data Management Plan, including data archiving and data rights policies.
27. Draft plan for a Science Data Center, if applicable. (See Subsection 6.2.4.)

7.4 APPROVAL SUBPROCESS (PHASE B TO C TRANSITION)

The purpose of the Approval subprocess is to decide whether a project is ready to proceed from Formulation to Implementation, and if so, to effect that transition. The details of the subprocess vary depending upon whether the project is a single-project program or part of a mission series. Mission series programs include the AO-initiated projects such as the Discovery and Explorer programs, and the Roadmap-initiated projects such as the New Millennium and Solar-Terrestrial Probes programs. Some of the reviews mentioned below can appropriately be considered part of the Evaluation subprocess (Subsection 7.6) occurring during Formulation, but are also listed here to help clarify the "Approval" flow.

There are two paths to approval. One is the regular NPG 7120.5 process, a path followed by programs or projects where the governing PMC is the Agency PMC. The second is a 7120-tailored process that achieves approval through a Confirmation Review with the SSE AA. This is the path for projects where the governing PMC is the Enterprise or Center PMC. These transition reviews are illustrated in Figure 7.4-1.

All the items on the Formulation checklist in Subsection 7.3.6 should be completed prior to the approval meeting, but in particular, the approval authority will not approve without a signed Program Plan and/or Program-Level Requirements Appendix and a Program Commitment Agreement either signed or ready to sign. The status of any of the other items on the checklist is subject to being examined for completeness. If not complete, approval may not be given or may be conditional.

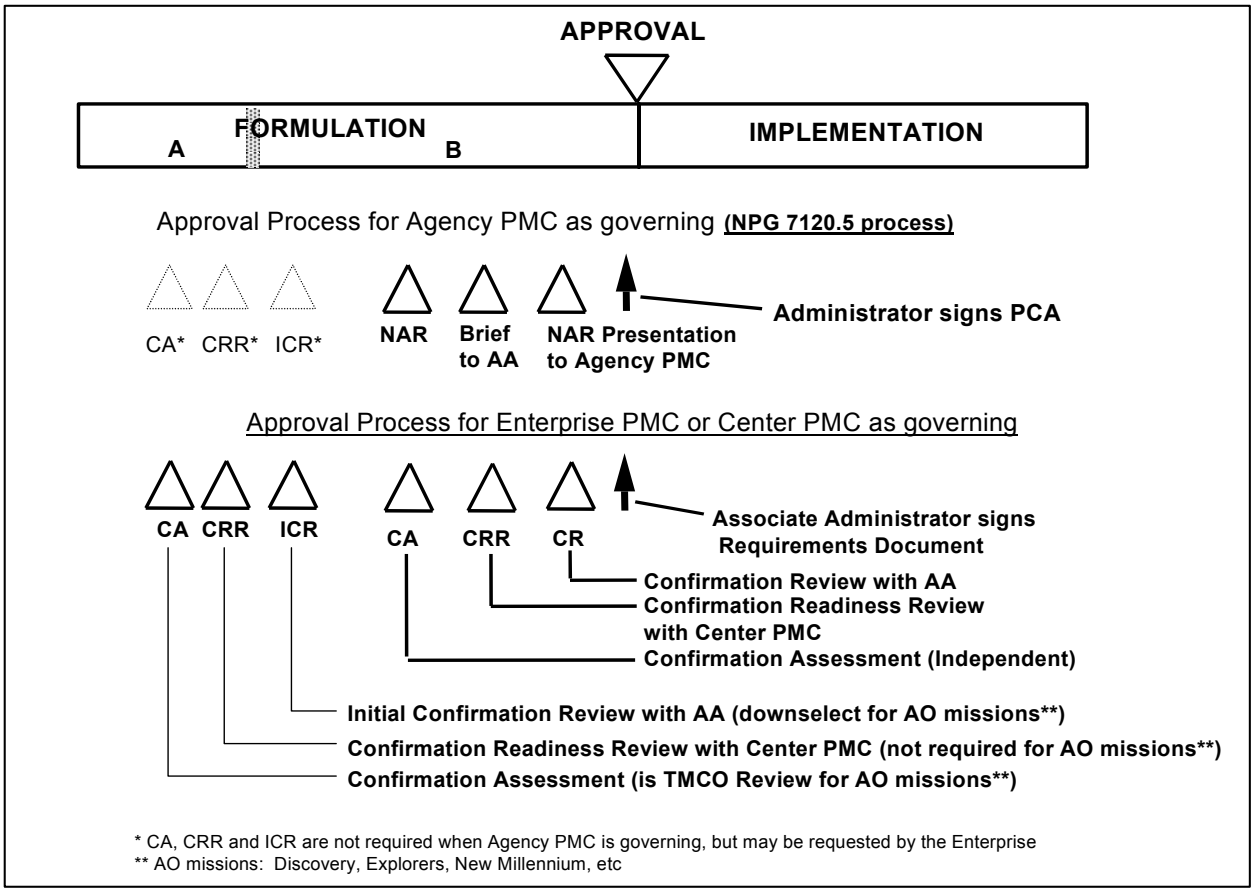


Figure 7.4-1 Approval Process Overview

7.4.1 Approval for Agency PMC-Governed Projects and Programs

For single-project programs, and initial projects in multi-project programs that have been elevated to the Agency PMC, this subprocess involves a set of steps leading to a decision whether or not the project is ready to proceed from Formulation to Implementation, and if so, to then gain the NASA Administrator's approval for implementation of the new program and/or project. If the meeting is for a project within an existing program, the PMC will expect an updated PCA including the new project.

As defined in the proposed PCA and Program Plan, a Non-Advocate Review (NAR) is conducted as a part of the Evaluation subprocess during Formulation. The proposed PCA is coordinated with the PMC Executive Secretary (within the NASA Chief Engineer's Office) to ensure consistency on content and format. The Program Plan is written by the Program Manager, and approved by the Center Director and the SSE AA, including the securing of required concurrences. The Program Executive, with concurrence of the Deputy Associate Administrator for Space Science, the Program Manager and the Executive Director for Programs, works with the NASA Chief Engineer's Office to schedule the Agency PMC, at which approval to enter Implementation for this program is sought.

At the PMC meeting, the Project Manager presents a summary of the program or project, including topics in the Program Plan. A summary of the Risk Management Plan, including a descope plan, is presented. The results and findings of the NAR are also conveyed by the NAR chairperson. The project responds to the NAR findings, and the SSE makes its recommendation to the PMC. If the PMC recommends transition to Implementation, this recommendation goes

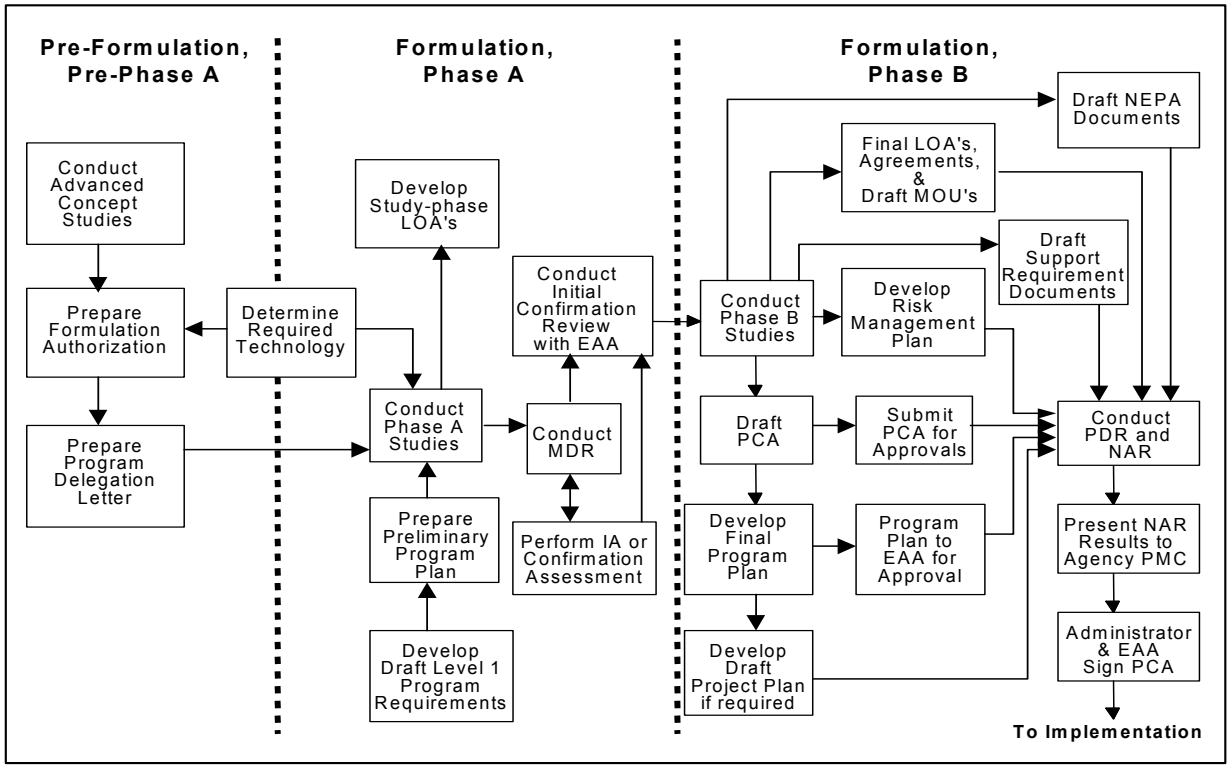


Figure 7.4-2 Agency PMC-Governed Project and Program Formulation Process Flow

forward to the NASA Administrator with the proposed PCA.

A PCA signing meeting with the NASA Administrator, if required, is arranged by the PMC Executive Secretary after the NAR presentation to the PMC. Approval by the NASA Administrator is conveyed to the SSE AA and is reflected in the Administrator's signature, along with that of the SSE AA, on the PCA. For projects in a multi-project program for which a signed PCA exists, the PCA must be modified to include the newly-approved project, and re-signed.

With the NASA Administrator's approval, the SSE AA then authorizes the transition of the program to Implementation, and the Resources Management Division is notified to release the corresponding funding to the project per the approved budget plan. The signed PCA and the Program Plan form the baseline for the Implementation subprocess. The process flow for the program approval process is depicted in Figure 7.4-2.

If the PMC does not recommend transition to Implementation, or if the NASA Administrator does not approve the transition, the program or project returns to the Formulation subprocess, addressing whatever deficiencies are identified as the rationale for not proceeding to Implementation. Changes in budget or in strategic plan criteria used to approve the program/project, or changes within the program/project that violate the original approval criteria, could necessitate reformulation and reevaluation for re-baselining or termination.

7.4.2 Approval for AO- and Roadmap-Initiated Projects

Announcements of Opportunity (AO's) and science mission roadmaps are tools used by multi-mission programs to identify new projects. The subprocess for these projects, other than the first in a mission series, involves a set of steps leading to a Confirmation Review with the SSE AA to decide whether to proceed from Formulation to Implementation. This includes science community-initiated projects selected via response to a competitive AO, and those projects of a mission series initiated by NASA from Theme science mission roadmaps. Figure 7.4-3 illustrates the

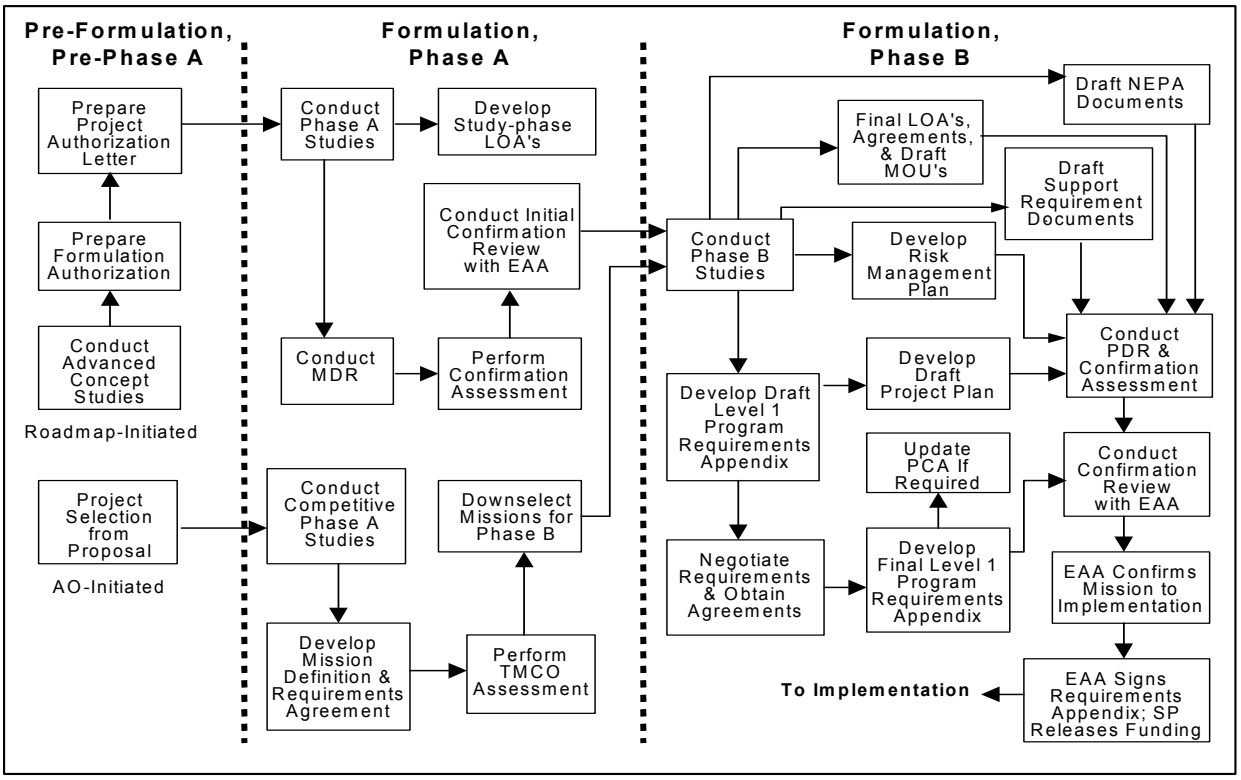


Figure 7.4-3 AO- and Roadmap-Initiated Project Formulation Process Flow

process flow for AO- and Roadmap-Initiated projects.

The Agency PMC may, at its discretion, select a project to undergo an Independent Assessment (IA). If so, the IA would have been conducted during Phase A by the LaRC IPAO to provide validation of the technical approach and cost analysis. Results of an IA, if conducted, are reported to the project and then to the EPMC, and may be required to report to the Agency PMC. Evidence of the project having addressed IA actions will likely need to be presented to gain confirmation.

During the Formulation subprocess, project teams plan normal design and programmatic reviews to allow the implementing Center or organization to judge project readiness to proceed to Implementation. The reviews typically involve a technical design readiness aspect (e.g., a Preliminary Design Review - PDR), and a programmatic readiness aspect (e.g., a Confirmation Readiness Review - CRR). The latter considers the results of the technical design assessment (e.g., the PDR) while also addressing cost, schedule, risk and risk management. The two components need not be done as separate reviews. A review board is established by the project, consisting of members appropriate to the subjects to be reviewed, but not having any direct association with the project. If an IRT has been established for the program, some members may attend the PDR and present to the CRR.

All projects require an independent Confirmation Assessment as a prerequisite to the Confirmation Review (CR). OSS may use the Langley Research Center (LaRC) Space Science Support Office (SSSO), an IRT, or other organization. Selection is made by the PE with consultation with senior SSE management. An effort is made to conduct this assessment with minimal impact to the project flow.

For the Confirmation Assessment, the PE works with LaRC or other organization to utilize the IRT or to form an independent team to perform the assessment. This is conducted typically by the team's attendance at the review(s) estab-

lished by the project as described above, and interaction with project staff. The CA team is chartered by and reports to the SSE AA through the PE.

After completion of these reviews, the chair of the Confirmation Assessment presents their preliminary findings to the Project Manager, the Program Manager, the Program Executive, and the Center PMC. As these findings are modified and finalized, the CA team chair continually communicates them to the Project Manager, Program Manager and the Program Executive.

The PE provides this project's Program-Level Requirements Appendix to the Program Plan, containing the proposed NASA Headquarters-controlled requirements, to senior OSS management, including the DAA, Executive Director for Science (EDS), and Executive Director for Programs (EDP), for concurrence. (Note: All required parties except the SSE AA should have already concurred on this document prior to Confirmation Review.) Also, pre-Confirmation briefings to the DAA by the project and the Confirmation Assessment chair are held, if requested.

Results of the review activities are reported to the PMC at the implementing NASA Center or organization, if they so require in a Confirmation Readiness Review (CRR). The PMC chairman decides if the project is ready to seek confirmation, and whether to recommend to the SSE AA that the project proceed to Implementation. If the PMC does not recommend transition to Implementation, the project recycles through the Formulation subprocess, addressing whatever deficiencies were identified as the rationale for not proceeding to Implementation.

If the PMC recommends that the project proceed to Implementation, the Confirmation Review is scheduled with the EAA. The PE coordinates the establishment and conduct of the Confirmation Review upon project notification of a successful CRR at the Center. At the Confirmation Review (typically about 2 hours duration), the Project Manager and/or Principal Investigator provides a brief summary of the project, including the science the project is expected to accomplish. The chairperson of the CA team presents its findings and recommendations. The Project Manager provides a response to the CA findings, the results of the CRR and the recommendations of their Center PMC. The Project Manager also addresses other important concerns, such as high level risks and mitigation plans, descope plans, and mission success criteria. The SSE AA, the Executive Director for Science and the discipline Division Directors hear all the recommendations, and assess the prospect of the mission being able to meet the science objectives on schedule and within budget. At the conclusion of the Confirmation Review, the SSE AA decides whether to authorize project transition to Implementation.

With a "Confirm" decision by the SSE AA, and if there are no outstanding items in the Program-Level Requirements Appendix, the project is confirmed for Implementation and the Appendix can be signed by the SSE AA at the conclusion of the CR. Authorization to proceed is subsequently issued in a confirmation letter drafted by the PE for SSE AA signature. The Resources Management Division is notified to release the corresponding funding to the project per the approved budget plan. If there are outstanding items in the Program-Level Requirements Appendix, such items should be resolved and then presented to the SSE AA in a subsequent meeting when the document is complete and ready for SSE AA signature. Confirmation may be withheld until this is accomplished, or may be conditionally granted. Implementation funding to the project may be withheld until such issues are resolved.

A "No Confirmation" decision by the SSE AA can direct the project back to the Center for further formulation or it can terminate any further effort. This decision is documented in a letter drafted by the PE for SSE AA signature.

Sometimes projects other than initial projects in multi-project programs are elevated to Agency PMC governance. The formulation process flow for these projects follows Figure 7.4-3 through development of a draft project plan. The PCA is then updated and submitted for approval as in Figure 7.4-2. After approval, the project proceeds through a PDR and a NAR. NAR results are presented to the Agency PMC. If the PMC recommends Implementation, the Administrator and the EAA sign the updated PCA. The EAA then signs the Program-Level Requirements Appendix, and Code SP releases funding to the project.

For all space science projects, the PE should work with the project to close out all actions and recommendations from the Confirmation Review as soon as possible. Some action closeouts may be required before the project receives approval to begin Implementation Phase C. The PE should also work with the Project and Program Office and with OSS Public Affairs to issue a press release for start of Implementation whenever the approval letter is sent to the PI and the Project.

7.5 IMPLEMENTATION SUBPROCESS (PHASES C, D & E)

The Implementation subprocess implements the approved program/project requirements and plans. Implementation includes, in the traditional OSS program management approach, Design and Development (Phase C), Integration and Test, through launch and inflight checkout (Phase D), and Mission Operations (Phase E) (see Subsection 2.2.4). The subprocess focuses on translating the input products that come from Formulation into the production of formal output products and services for the designated customers. During Implementation, the PE needs to ensure the following actions and information, not necessarily all inclusive, are developed and documented:

1. Update Program & Project Plans as required.
2. Baseline the PCA with an annual review and update, if necessary.
3. Finalize Project Data Management Plan(s).
4. Finalize agreements with other NASA and non-NASA U.S. organizations for required support.
5. Finalize tracking and network usage requirements.
6. Finalize international agreements with foreign partners, either LOA's or MOU's as required.
7. Finalize NEPA compliance documentation.
8. Finalize Orbital Debris Assessment.
9. Generate Headquarters Mission Contingency Plans.
10. Perform the Nuclear Launch Safety Approval process (if sufficient nuclear material is present on the spacecraft).
11. Receive Launch Readiness Statement from Center.
12. Conduct Mission Readiness Briefing for EAA, preparatory to launch.
13. Generate any other program and project-unique documentation specifying NASA Headquarters requirements or constraints.

7.5.1 Phase C/D Support to Center Implementation

NPG 7120.5 specifies the Managing Center Director as having responsibility for implementation of missions. This doesn't mean that the SSE AA gives up all interest in projects once they reach the implementation stage. Certainly, having program management located at the NASA Centers means Headquarters does not have day-to-day oversight. However, missions are selected to fulfill specific portions of the SSE Strategic Plan, and the SSE AA has a vested interest in ensuring the Centers carry out their assigned projects in an expeditious and effective manner. The SSE AA assigns primary responsibility to the Program Executive for tracking the performance of a project against the program-level requirements and against the schedule and cost cap. In some cases, the EAA also appoints a Program Director at Headquarters who will provide guidance and instruction to the Program Manager and the PE on the overall direction of the program (see Subsection 3.2.1).

The PE must continue the program/project assessment and reporting tasks during implementation as described in Subsection 7.3.5. These continue throughout the life of the project. Also during Implementation, the PE becomes a primary advocate for the launch vehicle manifesting process with Code M, whether the project is to launch on an Expendable Launch Vehicle or the Space Shuttle. Support of Flight Planning Board and Flight Assignments Working Group meetings are essential to maintaining proper communication. The next subsection describes what the PE must do to ensure approval for launch.

Another key task is to monitor the progress of implementation of international agreements through the system, from collection of negotiated requirements from the projects to the drafting of the agreement in Code IS, to the progress through the various departments and agencies that must provide approvals. One key forum for tracking

agreement progress is the Space Science Pending International Agreements Database (SSPIAD, see Subsection 7.3.1.2), and the associated monthly meetings held with Code I.

7.5.2 Launch Preparation and Support

Required Launch Documentation

The following basic set of documents is required prior to the launch of any given mission: (a) compliance with the National Environmental Policy Act (NEPA) necessitates either an Environmental Assessment (EA) or Environmental Impact Statement (EIS); (b) Nuclear Launch Safety Approval (if sufficient nuclear material is present on the spacecraft); (c) appropriate Contingency Plans; and (d) a statement from the responsible Center Director certifying readiness for launch. The flow of activities involved in the development of these documents is given in Office Work Instruction HOWI8630-S008. This OWI is the authoritative instruction for performance of this task. Always be sure to check http://www.hq.nasa.gov/hqiso9000/library.htm to ensure use of the most current OWI.

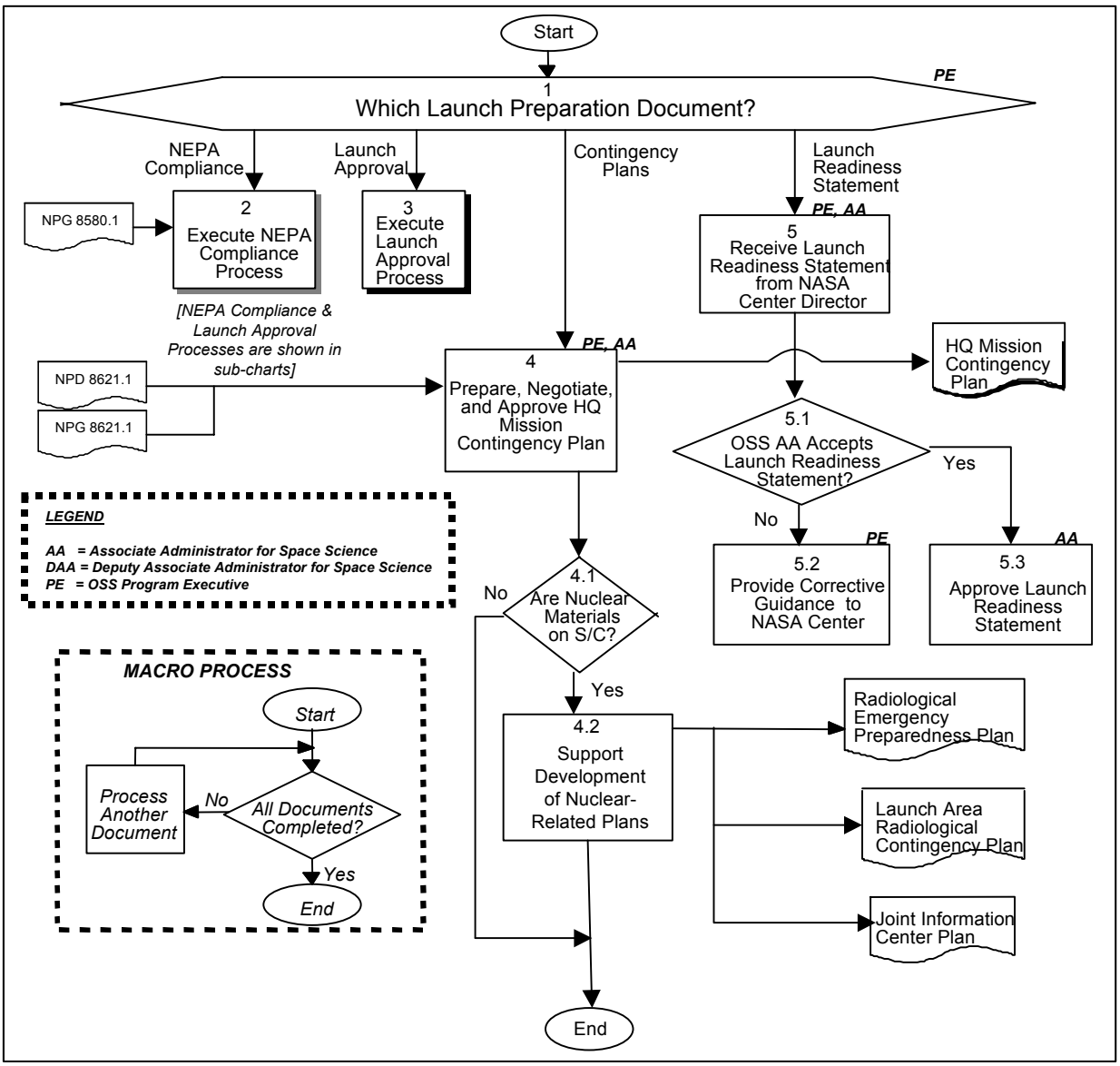


Figure 7.5-1 Launch Preparation Documentation Process

Figure 7.5-1 (from HOWI8630-S008) provides an overview of the required documentation. The PE bases the order of document preparation on the legal requirements and project complexity. In general, NEPA compliance commences in Formulation, with a target for completion prior to the Critical Design Review in Implementation. If sufficient nuclear material is anticipated (as determined early in the NEPA process), the Nuclear Launch Safety Approval process also commences. The PE also determines if there are mission-unique requirements that necessitate the preparation of additional pre-launch NASA Headquarters documents.

The PE executes the NEPA Compliance Process, as specified by HOWI8630-S008. The PE should work closely with the designated NEPA compliance individual within OSS. The PE is responsible for the preparation of the Environmental Assessment or Environmental Impact Statement in accordance with applicable regulations and law. A Notice of Intent is published in the Federal Register prior to preparing the Draft EIS, and when the Draft EIS is complete, a Notice of Availability is published in the Federal Register. Another Notice is published whenever the final EIS is available. The PE prepares the Record of Decision that is approved by the SSE AA.

The PE executes the Launch Approval Process, as specified by HOWI8630-S008. The Project at the implementing Center prepares the Safety Analysis Report (SAR) and delivers it to the Program Executive, nominally 12 months prior to launch. The Interagency Nuclear Safety Review Panel (INSRP) receives and reviews the SAR and prepares a Safety Evaluation Report that is delivered to the PE prior to launch. The PE uses this information to prepare and coordinate the Nuclear Launch Safety Approval Request. The Request is signed by the NASA Administrator for submittal to the Office of the President. The Office of the President renders a Nuclear Launch Safety Approval decision and notifies NASA in writing of the results. A positive Nuclear Launch Safety Approval decision is mandatory for launch.

Approximately one month prior to launch, the PE prepares the NASA Headquarters Mission Contingency Plan in accordance with NPD 8621.1, negotiates concurrences with the appropriate Associate Administrators, and obtains approval from the SSE AA.

At about this time, the responsible Center provides a Mission Readiness Briefing to the SSE AA, coordinated through the PE. This briefing typically includes a brief description of the mission and its science objectives, results of any risk assessment reviews, launch readiness, and a summary of Public Affairs plans for launch.

The SSE AA and the PE receive the Launch Readiness Statement from the responsible Center Director, usually within one month of launch. If the Launch Readiness Statement is acceptable, the SSE AA (or designee) provides approval during readiness reviews at the launch site.

7.5.3 Transition to Science Operations (Phase D to E)

Transition of a flight program from Phase D to Phase E occurs when on-orbit check-out has been completed, typically 30 to 90 days after launch. Earth orbiting missions typically begin science operations after this.

Planetary missions, however, typically have an extended cruise phase, in some cases several years, before the spacecraft is inserted into planetary orbit and checked out, and data acquisition begins. For these missions, Phase E begins with a cruise period where science data taking is minimal or non-existent.

PE responsibilities continue during the MO&DA phase, however a different PE may be designated for science operations. The Program Scientist assumes additional responsibility during Phase E working in close coordination with the PE. Science management elements of Phase E are part of the MO&DA program, and are described in Subsection 6.2.

The Program Executive monitors the activities of the science operations including instrument health and safety. The PE ensures the process by which science data are collected and processed. The PE must carefully track engineering activities, such as spacecraft checkouts; trajectory corrections; attitude reference updates; momentum wheel desaturations; orbit insertions; aerobraking operations; entry, descent and landing activity for

landers; landed checkout and mobility; and budget. The PE also assesses how the program meets Level 1 requirements, including Phase E budget, schedule, and technical and programmatic requirements.

Program management elements of this phase include project management and accounting, managing reserves and contingency relative to risk, and sustaining support for operations. The Program Executive provides oversight of program engineering functions conducted by the project, with elements including:

a. Spacecraft tracking operations
b. Spacecraft command uplink and real-time telemetry operations, including radiometric data collection
c. Real-time health and performance monitoring of the spacecraft, instruments, and ground system
d. Real-time scheduling of shared facilities -- voice and data links
e. Real-time pass scheduling/coordination
f. Hardware maintenance of operational systems
g. Servicing mission planning, implementation, and training, astronaut training, and development of flight software and ground systems for servicing (e.g., HST)
h. Post-launch development of flight software and ground systems
i. Software sustaining engineering (e.g., fixing software errors, development of new capability)

During the prime mission phase, if not before, the PE initiates activities which would lead to consideration for approval for extended mission. These activities including soliciting a proposal from the project and establishing a process for evaluating the proposal. This process may include a Senior Review, or establishing a peer panel, to evaluate the merits of the proposal. The PE will work with the Division Director to accept, modify, or reject the proposal and establish new budget authority for operating in the extended phase. Upon approval for extended mission, the PE takes steps to update international or interagency agreements.

7.6 EVALUATION SUBPROCESS

The Evaluation subprocess as discussed by NPG 7120.5 deals with program evaluation only by external teams (e.g. IA, NAR, IIR, etc). The purpose of Evaluation is to independently assess the continuing ability of the program to meet its technical and programmatic commitments and to provide value-added assistance to the Program Manager and recommendations to the EAA, as required. This subprocess is in addition to internal reviews and evaluations, such as the Project's Standing Review board. However, where practical, reviews can be combined to reduce their total number and cost. The Evaluation subprocess consists of the planning and conducting of these reviews and independent assessments during Formulation and Implementation of a program.

Evaluation of space science programs and projects is accomplished through various status reviews and independent or external independent readiness reviews. Typically, the single-project programs are required to report to the Agency PMC through and including the NAR timeframe, and subsequently report to the EPMC. For programs that report to either the Agency or Enterprise PMC, an Independent Review Team (IRT) is established.

In general, the projects of a mission series report to the Center PMC as governing and transition through the Confirmation Review process, which subjects them to Confirmation Assessment as discussed in Subsection 7.4.2. Multi-project programs may, however, be subject to an IIR (Independent Implementation Review) at the program level, and in reality, the program IRT may choose to evaluate a specific project within the program. Also, the Agency PMC may choose to elevate any specific project to their authority as governing, thus making them subject to other external reviews.

The Center PMC includes a representative of the SSE AA, a representative from involved supporting Centers, the functional office directors at the Center, and others as named by the Center Director. The governing PMC reviews the status of all programs and projects on a regular basis (normally monthly) including those that report to the Agency PMC as governing.

7.6.1 Program Executive Responsibilities for Evaluation

The PE is responsible for initiating the appropriate independent performance assessment per guidance of Subsection 2.4 of NPG 7120.5. For an IA, CA, NAR, IIR, or special topic assessment, the PE works with the LaRC IPAO to define and build an Independent Review Team (IRT) to conduct these reviews. This involves selecting team members that have the correct expertise for the specific project to be reviewed, and establishing the charter for the IRT for reviews throughout the life cycle of the program. The PE assembles a list of prospective candidate chairpersons and presents it to the SSE AA for a selection. When selected, the PE drafts a letter for signature by the EAA to the Chief Engineer requesting his concurrence on the IRT Chair selection. The PE then works with the IRT Chair and the IPAO co-chair to develop the team membership. Approval of Team membership and charter is then obtained from the IPAO, EAA, and Chief Engineer's Office. In supporting conduct of the reviews, the PE ensures the scheduling of meetings, establishment of agendas, and writing of minutes, and follows up on action items, ensures publication of the review findings, and prepares charts for a summary presentation to the Agency PMC of IRT results presented to the EPMC.

For all independent reviews, the PE monitors the assessment performed by the review team and the presentation of its findings to the governing Program Management Council and/or the SSE AA. The PE also supports the project in implementing any approved findings from the independent assessment.

7.6.2 Independent Evaluation Reviews

The IA, CA, NAR, IIR, and special topic assessments are independent reviews, each addressed below. A single team generally performs the functions of all of these external reviews. This team is called the Independent Review Team (IRT, see Subsection 7.3) and reports simultaneously to both the Chief Engineer and the SSE AA. IRT's are ordinarily established at the program level, with sub-teams to review individual projects. Under special circumstances, IRT's may be established for individual projects.

Independent Assessment (IA)

At the request of the governing PMC, the SSE AA or the Associate Deputy Administrator, the Chief Engineer (Code AE) directs an Independent Assessment of a program. IA's are technical and life cycle cost (LCC) assessments of a project in the early stages of Formulation and are performed only for a few selected, high interest projects.

An IA:

- Is performed in support of the Agency PMC oversight of programs/projects that are early in the Formulation subprocess.
- Is conducted by the IRT, a team composed of knowledgeable specialists from organizations outside of the advocacy chain of the program/project.
- Provides the Agency PMC with an in-depth, independent validation of the advanced concepts, program or project requirements, design concept integrity, system/subsystem trades, life cycle cost, realism of schedule, risks and risk mitigation approaches, and technology issues.
- Provides suggestions of alternative system and/or subsystem design approaches which offer potential for reduced costs and risks or improved system performance.

Confirmation Assessment (CA)

A Confirmation Assessment is required for transition both from Phase A to B, and from B to C. In the former case, the CA is followed by a CRR leading to an ICR with the SSE AA (see Subsection 7.3.2). For AO-initiated projects, down-selection occurs at the Phase A-B transition, and the TMCO review of the Phase A Concept Study Report serves as the CA. Selected missions are confirmed for Phase B, while those not selected are not confirmed.

All projects also require an independent Confirmation Assessment in order to proceed from Phase B to Phase C (see Subsection 7.3.3.3). For projects that report to the Agency PMC as governing, the NAR takes the place of the CA. Generally the CA is conducted by the IRT, although a separate team may be utilized in some circumstances. Otherwise the CA precedes the Confirmation Review with the SSE AA, preparatory to

transition from Phase B to C. The CA assesses the feasibility of the project implementation plan, especially in terms of cost, schedule, technical content, and risk management, and reports results to the EPMC. Consulting with the EPMC members, the EAA makes the confirmation decision.

Non-Advocate Review (NAR)

All new programs are subject to a Non-Advocate Review in order to obtain approval to enter Implementation. The role of the NAR in the Approval subprocess is shown in Subsection 7.4.1. The NAR evaluates the program/project against the proposed Program Commitment Agreement and Program Plan to assess the state of project definition in terms of its clarity of objectives and the thoroughness of technical and management plans, technical documentation, alternatives explored, and trade studies performed. The NAR also evaluates cost and schedule estimates and the contingency reserve in these estimates. The findings of the NAR are presented to the Agency PMC in order to obtain approval for the project to begin Implementation.

If the new Program is a multiple-project program, the NAR will be applied at the point the first project in the new program will be ready for Implementation. The NAR, however, will evaluate both the program and the project, so that when approval is sought from the Agency PMC, it is for both the specific project and for the overall program. If they are thus approved, subsequent projects in the program will not be subject to a NAR, unless specifically requested by the PMC.

Independent Implementation Review (IIR)

All programs and projects subject to Agency PMC evaluation are reviewed regularly after entering Implementation by the IRT in an Independent Implementation Review. The intention is to combine the IIR with standard project reviews in order to reduce the impact to the project. The IRT chair and the PE coordinate details of the reviews with the program and/or project manager and the SMO at the Center.

An IIR is intended to provide a validation of conformance to the Program Commitment Agreement and Program Plan. An IIR is to perform the following tasks:

- Assess progress and milestone achievement against original baseline.
- Review and evaluate the cost, schedule, and technical content of the program over its entire lifecycle.
- Assess technical progress, risks remaining, and mitigation plans (including descope plans).
- Determine if any program deficiencies exist that result in revised projections exceeding predetermined thresholds.

IIR findings are presented first to the project and/or program at the Center, then to the Center PMC, then to the EPMC at NASA Headquarters, then to the Chief Engineer's Office and last, if required, to the Agency PMC.

Special Topic Assessments

For programs with exceptional risk, higher cost, high visibility, or unique aspects, the SSE AA (or the PE for the SSE AA) may choose to ask the IRT to conduct a special review to validate the program's performance against specific program-level requirements and objectives set forth in the Program Plan, or to investigate a specific technical issue within the project. The IRT will report findings to the SSE AA (and/or senior staff), and only at the request of the SSE will they reports the results to the governing PMC. Such special topic assessments are performed in support of the SSE AA's oversight of approved programs and projects. If necessary because of the special nature of the program, highly knowledgeable specialists from organizations outside of the advocacy chain of the project may be added to the IRT for these special reviews.

Systems Management Office (SMO)

The Systems Management Office (SMO) at a NASA Center reports to the Center Director and GPMC, and provides program/project management resources for system engineering, risk management, verification and validation, systems review, requirements management, resource planning and control, and independent cost estimation. The SMO establishes the project standing review board at the Center, including developing the charter, selecting team members, organizing reviews, and publishing results. SMO standing re-

view boards and IRT's work closely together to ensure efficient and effective conduct of the various reviews.

7.7 PROGRAM MANAGEMENT RESPONSIBILITIES

For each project, whether it be a single project-program or one project in a mission series, three positions make up the Headquarters management team. The team consists of the Program Executive, the Program Scientist, and the Program (Resource) Analyst for the project. Each member of this team must be aware of major decisions to be made relative to the project and be a key voter on options to resolve issues. They must work together to present a united stance to the assigned Center and its Program and Project Managers.

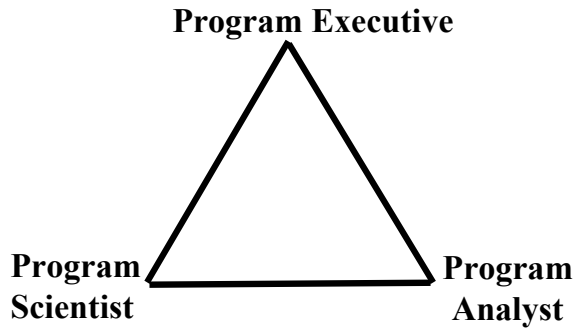


Figure 7.7-1 HQ Project Management Team for a Given Science Project

Figure 7.7-1 represents this relationship as a triangle. The Program Analyst in Code SP works with the others in the Science Divisions to manage the project's budget.

The Program Scientist is an integral part of the program management team, closely involved in program and project formulation and development. Program Scientist responsibilities are discussed in detail in Subsection 6.3.5. Technology development projects such as those in the New Millennium Program do not have a science focus, and do not have a Program Scientist during development and operation of the prime mission. However, in these cases a Program Technologist may be involved and occupy the third vertex of the triangle. Also, a Program Scientist may be assigned if the mission is extended to perform a science objective after accomplishment of the primary mission.

There are other positions, not represented by the triangle above, that are also involved in project management. Each science project is assigned to a science theme, which is lead by a discipline Division Director. Flight programs may also be led by a Program Director. These Directors exercise full authority over content and budget of their programs and projects. Theme Integrators may coordinate the overall division support for the theme, and Theme Technologists may coordinate the technology development activities for the theme. The Executive Director for Programs provides overall coordination for flight program management across the divisions. And last, but by no means least, are the Program and Project Managers at the NASA Centers, who supply critical direct management of the overall program. Without these positions, projects would never get off the drawing board.

7.7.1 Role of the Program Executive

The SSE Associate Administrator is responsible for providing strategic stewardship for the Enterprise. It is the EAA's responsibility to manage Program Formulation according to the NASA Strategic Management Handbook. The EAA designates individuals at NASA Headquarters to sponsor specific programs in accomplishing his/her duties. In accordance with the responsibilities of an EAA as defined by NPG 7120.5, Appendix D, the SSE AA has delegated (through the Division Directors) the following responsibilities to the Program Executive during Formulation and Implementation of the program. These responsibilities are time-phased into four groups beginning with initializing programs, then documenting the Formulation subprocess, monitoring the Implementation subprocess, and overall assessment of program and project performance. References are given for the subsections in this Handbook in which topics are discussed more fully.

Initializing Programs:

- Initiate studies to define new missions and determine their feasibility and desirability (7.2.1).

- Represent Theme or Program interests on working groups having a charter to define classes of future missions and generate science mission roadmaps (7.2.3).
- Establish working groups to determine the advanced technologies necessary to enable future space science missions (7.2.3).
- Maintain working relationships with NASA Centers as required to have a sound foundation in recommending Center program responsibilities.
- Understand the scientific relevance of both current and future space science programs to the SSE Strategic Plan.
- Provide liaison with the launch vehicle provider organization in Code M.
- Develop and maintain key peer-to-peer working relationships with established NASA partners in order to facilitate the negotiation of new working agreements for cooperative programs.
- Work with the LaRC Space Science Support Office and Program Scientists as required during AO activities up through formal release. Typically this entails representing program management issues from the NASA Headquarters perspective, answering questions from proposing organizations, especially in the area of NASA Headquarters policy, representing NASA Headquarters programmatics at pre-proposal conferences, and helping resolve policy issues (7.2.2).
- Work with the Program Scientist, the Program Analyst, and the relevant Division Director to establish a target for the budgetary cost cap (7.3.3.2).
- Identify need for environmental impact or assessment and define level of activity (7.3.2.2).
- Perform as liaison between project and Code I to initiate and achieve international agreements (7.3.1.2).

Documenting Formulation:

- Write the Formulation Authorization Document and negotiate approval (7.2.6.1).
- Write letter of assignment to selected Center for Program Delegation (7.2.6.2).
- Write Project Authorization Letters for newly selected projects (7.2.6.3).
- Develop plans for Independent Assessment, including terms of reference for programs that will have an IRT (7.3).
- Develop appropriate LOA's and MOU's for external partners (7.3.1.2).
- Write the Program Commitment Agreement and negotiate approval (7.3.1.3, 7.3.4.1).
- Working with the Center, facilitate development of the draft Program Plan (7.3.4.2).
- Formally establish program objectives, requirements, and metrics. Prepare Level 1 requirements and negotiate approval (7.3.4.2).
- Ensure preparation of required NEPA documentation (7.3.6).
- Recommend the level of governing PMC for each program or project (7.3.5.1).
- Recommend and review establishment of program/project budget.

Monitoring Implementation:

- Monitor and review NASA Center establishment of program/project budget and staffing.
- Monitor and review program/project development of baseline schedule.
- Monitor and review program/project management of risk.
- Review implementation of key agreements and contracts for launch services, spacecraft acquisition, science instruments, and other mission critical items specific to the program.
- Provide planning and oversight of mission operations and data analysis (MO&DA) projects during the post-launch or post-encounter phases of space science missions.
- Monitor and review program/project implementation of technical requirements.

Assessing Performance:

- On a regular basis, assess program performance against requirements, schedule and budget, providing NASA Headquarters insight as required.
- Establish working relationships with senior management in provider organizations.

- Attend and report on Center-level status program reviews (e.g., governing PMC).
- Attend and report on selected project reviews, such as Mission Definition Review (MDR), Systems Requirements Review (SRR), Preliminary Design Review (PDR), Critical Design Review (CDR), and Flight Readiness Review (FRR).
- Provide advocacy and program support in NASA Headquarters.
- Address issues requiring NASA Headquarters actions for resolution, and facilitate NASA Headquarters actions as required.
- Review findings from major reviews. Consult with Center Program Management to develop actions and decision requirements for NASA Headquarters. Facilitate and monitor NASA Headquarters response.
- On a regular basis, report assessment of program/project status to OSS senior staff.
- On an annual basis, each PE provides an assessment of JPL performance on their program or project, as an input to the annual NASA Performance Evaluation of the JPL contract.

Theme Integration

A Program Executive and Program Scientist in each science Theme are appointed by his/her Division Director to perform the function of Theme Integration. Theme Integrators provide focal points for support and communications across OSS for each science Theme. The primary responsibilities in support of a discipline Division Director are as follows:

- Support definition of future mission options, including integrating the programmatic, technological and budgetary planning.
- Support development of science and technology Theme requirements and roadmaps.
- Integrate Theme project status and review documentation, including budget status and projections, for Division Director presentations.
- Ensure effective coordination of Theme communications with supporting Program Executives and Program Scientists.

The Theme Integrator also has responsibilities in support of the Executive Director for Programs and the Executive Director for Science, to ensure that OSS policy and process for program/project management and science management is consistent across all divisions.

7.7.2 Role of the Program Manager

The Program Manager is the senior person at the Managing Center who interfaces with the PE and the Program Director, if one exists, in matters of program content and direction affecting cost, schedule and technical scope of work, and who implements the policy and guidelines received from OSS. The Program Manager may have one or more Project Managers reporting to him/her, depending on the structure of the specific program. A single-project program may have separate individuals performing these roles, or both may be invested in a combined Program/Project Manager. The Program Executive depends on the Program and Project Managers at the Center to carry out the following responsibilities:

Initializing Programs:

- Support NASA HQ in conducting mission studies to develop mission concepts and determine feasibility.
- Support NASA HQ in new start approval activities.
- Develop launch vehicle requirements and launch windows and work with the PE to obtain manifested dates.
- Develop project performance metrics that are accepted by the NASA HQ PE.
- Conduct trade studies to develop a viable project architecture that will be approved by OSS. This involves conducting technical/cost/schedule tradeoffs.
- Ensure a technology plan is developed and executed in a timely fashion so all technology developments are completed before approval to enter Implementation is requested.

Documenting Formulation:

- Support NASA HQ in program planning, including recommending program objectives, Level 1 requirements, mission success crite-

ria, implementation guidelines, and top-level budget and milestones.

- Support NASA HQ in the preparation of any domestic and/or foreign agreements (MOU's, MOA's and LOA's) needed for collaboration. Develop working-level domestic/international agreements after these top-level agreements are negotiated.
- Negotiate inter-Center support agreements.
- Prepare Program Plans and Project Plans.
- Support NASA HQ in the development of PCA's.
- Develop Risk Management Plans and work with the PE to determine risk mitigation strategies. Determine single point failure criteria.
- Develop and obtain appropriate approvals for the project-level documentation required to get ready for implementation (e.g. project plan, Work Breakdown Structure (WBS), detailed budgets and schedules, make/buy decisions, statements of work, and requests for proposals).

Implementing Programs:

- Meet program milestones on time, within cost, while meeting the Level 1 requirements.
- Allocate budget and staffing to elements of the programs.
- Manage program/project contingency funds.
- Manage program/project risk according to Risk Management Plan.
- Oversee the execution of the Program Plan.
- Control program/project changes.
- Approve Project Plans and associated changes to these documents.
- Integrate the planning and execution of individual projects or programs comprised of multiple, inter-dependent projects.
- Ensure compliance with applicable Federal law, regulation, executive order, and Agency directives.

Assessing Performance:

- Review and report program/project performance to Center management and the PE in a timely way, meeting the guidance given by the PE.
- Provide support to IRT activities.
- Provide POP budget responses.

7.8 PROGRAM/PROJECT TAILORING

Provide Aerospace Products and Capabilities (PAPAC) processes and requirements in NPG 7120.5 provide managers the framework to tailor approaches for formulating and implementing NASA's increasingly diverse programs and projects. In particular, managers of mission series such as Discovery, Solar Terrestrial Probes, and New Millennium can tailor approaches consistent with program or project characteristics such as size, complexity, cost, flight frequency and risk. Approved PCA's, Program Plans and Project Plans document the tailoring decisions.

For example, the Discovery and Explorer Programs have adopted streamlined program management structures, with NASA oversight and reporting requirements limited to those which are essential to ensure agreed-upon science return in compliance with committed cost, schedule, and performance requirements. Investigator teams are allowed to use their own processes, procedures, and methods to the fullest extent practical, and are encouraged to develop and implement new ways of doing business when cost, schedule, and technical improvements can be achieved and mission risk is not compromised. The intention is to contain total life cycle cost for highly cost-constrained missions, and improve performance through the use of new technology, strict cost control, requirements control, and more efficient management. Increased responsibility can be given to the Principal Investigator when satisfactory capability for management and control of flight experiments can be demonstrated.

Each project of the Discovery and Explorer Programs, chosen through competitive Phase A downselect, is subject to a Confirmation Assessment and Confirmation Review with the SSE AA for approval to enter Implementation (Phase C). This Confirmation process is a tailored process that takes the place of the Non-Advocate Review (NAR), and subsequent meeting with the Agency PMC, referenced in NPG 7120.5. Confirmation Review Data Packages, tailored to meet NPG

7120.5 requirements, may in some cases take the place of the mission's Project Plan, if specified in the Program Plan.

Tailoring may take the form of modifications to special requirements documented in Subsection 4.0 of NPG 7120.5, such as Earned Value Management (EVM). While EVM is the NASA standard, some projects may be able to justify not using this paper-intensive system if other controls are in effect. Tailoring actions that increase risk to project success will be looked upon with disfavor unless the project demonstrates alternate risk mitigation strategies. The Program Executive must be familiar with the content of NPG 7120.5 so that deviations from it can be properly documented and implemented.

Program tailoring must be documented in the Program Plan. This includes any specific tailoring that applies to all projects in a mission series. Project-specific tailoring will be documented in the relevant mission-specific Program Requirements Appendix to the Program Plans and in individual Project Plans.

7.9 BUDGET CONTROL & DESCOPING

One of the roles of a Program Executive is budget control, working in close coordination with the Division Director, the Program Scientist and the Program Analyst. This includes:

- Formulating the baseline budget,
- Determining the cost cap, which is incorporated into the PCA and Program Plan/Project Appendix,
- Supporting the POP process, as described in Subsections 7.3.5.3 and 5.2.2,
- Working with program and project offices to understand budget categories and provide guidance to them on acceptable expenditures, and
- Assessing the execution of the program, which includes monitoring costs, risks and their mitigation strategies.

Cost caps are determined during Phase B of Formulation. The rigidity with which cost caps will be enforced during Implementation depends upon what type of project it is. Projects that have been selected via a competitive AO will find their cost caps enforced stringently for two reasons. First, the assumption is that because of a funded, competitive Phase A, the proposing team will have made a thorough estimate of the projects ultimate cost. And second, since the selection was through competition, if NASA were to augment a project's cost due to poor estimating or underbidding, it would send a message that the Agency stands ready to "bail out" any projects that overrun, and lead to more underbidding in order to win. This is not cost-effective management. The intention for all projects is to hone the total life cycle cost during Phase B so that when the level 1 requirements are ready to be finalized, the project, program, Center management, and OSS are ready to mutually commit to the cost necessary to achieve the stated requirements.

Provided that the requirements are preserved and due consideration has been given to the use of budgeted contingency and planned schedule contingency, the project will pursue scope reduction and risk management as a means to control cost. A descope plan must be prepared during Phase B, and presented at the Confirmation Review for Implementation. The Project Plan should define these potential scope reductions and the time frame in which they could be implemented. The NASA Center(s) and OSS must agree to any scope reductions affecting the program-level requirements. This accomplished done by the project requesting a waiver to the Level 1 requirement.

During Implementation, the project will develop the mission within the established performance, schedule and cost requirements identified in the documents. If at any time during development the PE believes that the project is unable to achieve the requirements, or that the project cost cap might be exceeded by more than an amount specified in its PCA and/or Program Plan, he/she can recommend to the SSE AA that a cancellation review be conducted. A cancellation review is not required if the SSE AA agrees to change the requirements or if the project is able to demonstrate that cost growth is above and beyond their Center's control or if they can descope the mission concept/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.

At the cancellation review, the project presents to the EPMC: (1) the status of the project with respect to requirements, (2) rationale for relief from the requirements, (3) actions already taken to regain meeting the technical, cost, and schedule requirements, and (4) proposed further actions, and associated risks, to return the project's life cycle cost to within the cost cap. At the end of the review, the SSE AA decides, after consultation with the EPMC, whether the project may continue development with approved changes to the requirements, if appropriate, or to cancel the project and to communicate the decision in writing to the governing PMC and Managing Center. If the governing PMC is the Agency PMC, the SSE AA submits a recommendation for cancellation to the Agency PMC, which makes the final decision. Any approved changes to the requirements are documented in a revised PCA and Program Plan/Project Appendix.

The Chief Financial Officer (Code B) may also call a cancellation review if Code B believes the project will exceed its baselined development cost cap by an excessive amount. In general, Code B will only be reviewing those projects/programs that report to the Agency PMC. If Code B recommends cancellation at the conclusion of its review, the final decision will be made by the Agency PMC.

8. EDUCATION AND PUBLIC OUTREACH

8.1 OVERVIEW

The Office of Space Science (OSS) employs several crosscutting processes to accomplish its goals and objectives. One such key process is education and public outreach. Consistent with education being one of the core missions of NASA, education at all levels and enhanced public understanding of science are integral parts of all space science missions and research programs. Throughout its history, OSS has played a strong role in supporting graduate and postgraduate professional education. This role has been expanded to emphasize actively involving the space science community in pre-college education and activities directed towards increasing public understanding and appreciation of science and technology. As a consequence of the policy decisions that have been made, OSS now has under way one of the largest programs in astronomy and space science education ever undertaken.

OSS education and public outreach policies are described in the March 1995 OSS Education and Public Outreach Strategic Plan *Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA's Space Science Programs*. The November 1996 report *Implementing the Office of Space Science Education/Public Outreach Strategy* outlines the approach OSS has taken to put these policies into practice. This report provides overall guidance concerning the conduct of OSS-sponsored education and public outreach programs. Answers to frequently asked questions concerning OSS's approach to incorporating education and public outreach into its missions and research programs are given in the "Explanatory Guide" that is posted on the Education section of the OSS Homepage (see Appendix D). A summary together with the most recent statement of OSS education and public outreach goals and objectives is also given in the *Space Science Enterprise Strategic Plan*.

8.2 MANAGEMENT OF THE OSS EDUCATION AND PUBLIC OUTREACH PROGRAM

Education and public outreach are embedded throughout all OSS missions and research programs. One consequence of this approach is that education and public outreach (E&PO) are the collective responsibility of all levels of OSS management and of all the participants in the space science program. OSS Division Directors, Discipline Scientists, Program Executives and Program Scientists are responsible for advocacy, planning, providing resources for and rewarding contributions to education and public outreach just as conscientiously as they do for other aspects of their programs. Science and mission managers at the NASA Centers also have such responsibilities in addition to their direct responsibilities to define and implement program and project E&PO activities. Within this broadly distributed general responsibility, certain specific responsibilities and functions have been established within OSS in order to ensure that programs are developed in a consistent way, policies are carried out, and continued progress is made towards achieving OSS's education and public outreach goals and objectives.

The Education and Public Outreach Director (E&POD) is the OSS focal point for all issues concerning education and the public understanding of science. The E&POD is responsible for overall policy development, generation of program objectives and requirements, and general oversight, coordination and evaluation of OSS education and public outreach programs. He or she is the OSS liaison with other offices inside and outside NASA for OSS education and public outreach programs.

OSS Division Directors, Discipline Scientists, Program Scientists, and Program Executives must ensure that Announcements of Opportunity (AO's) and NASA Research Announcements (NRA's) contain appropriate language concerning education and public outreach. They must ensure that adequate resources are available to support the education and public outreach aspects of research programs and flight investigations and, in the case of proposals submitted in response to AO's, that the education and public outreach components of flight proposals are properly considered as part of the overall evaluation and selection process. Resources allocated for education and public outreach must be consistent with the

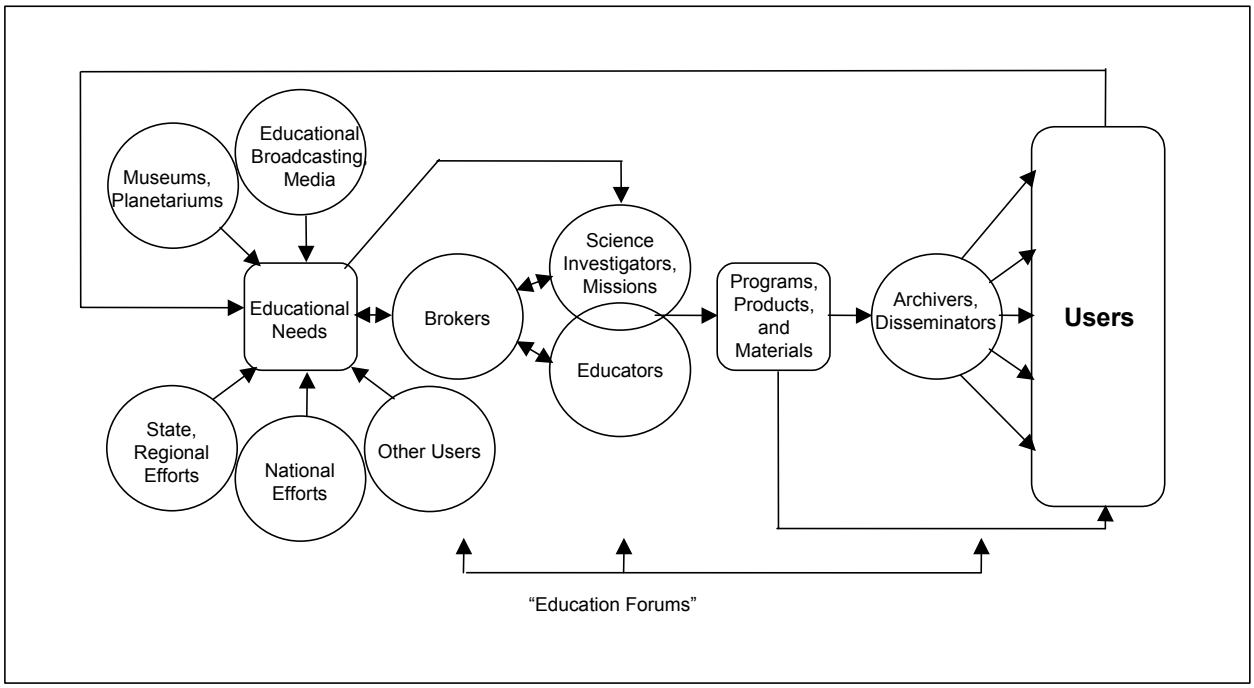


Figure 8.2-1 OSS Education Program Formulation and Development: Process and Interactions

general guidance contained in the OSS Education and Public Outreach Implementation Plan. NASA Center Program and Project Managers must ensure that education and public outreach are integral elements of the planning, budgeting and implementation of every flight mission or program. Further details are given in Section 8.3.

OSS has established an education and public outreach support network to facilitate the involvement of space scientists in education and public outreach, and to identify appropriate opportunities for such involvement (see Figure 8.2-1). The support network also aids in coordinating and synthesizing the education and public outreach programs undertaken by flight missions and individual researchers, and in arranging for the widest possible dissemination of OSS-sponsored education and public outreach programs and products. It assists NASA in the evaluation of the effectiveness of OSS education and public outreach programs. The support network consists of a set of centers for space science education (called Education Forums, aligned along the themes in the OSS Strategic Plan), a set of regional Broker/Facilitators, (referred to as Brokers), and an external evaluation group. The Brokers work with the education and space science communities to identify suitable opportunities for space scientists to participate in education and public outreach, and to help arrange collaborations between space scientists and educators.

This support network has been developed to provide a range of services to both educators and the space science community, as well as to provide an educational resource for OSS and NASA Center management. OSS Discipline Scientists, Program Scientists and Program Executives should be aware of this network and encourage their programs and projects to consult with the Forums and the Brokers concerning the development of educational opportunities for their communities or to obtain assistance in planning, implementing, and evaluating mission education programs. Services provided by the OSS support network are available to NASA Center Program and Project Managers, and Project Scientists. Further information describing the basic functions of the Education Forums and the Brokers is contained in the OSS Education and Public Outreach Implementation Plan. The OSS Education Homepage contains specific institutional and contact information for each Forum and each Broker (see Appendix D).

The OSS Education and Public Outreach Council coordinates educational and outreach programs across OSS and with other NASA offices. It helps develop and track progress on a number of OSS-wide education and public outreach initiatives, provides a mechanism for reviewing progress of all components of the OSS support network, and identifies issues affecting the implementation of OSS's Education and Public Outreach strategy as a whole. The E&POD chairs the Council. Members include the Brokers, the Forum Directors, the external evaluator, and representatives from the OSS science divisions, the Office of Human Resources and Education, the Office of Equal Opportunity Programs, and other appropriate NASA Offices. The Council meets several times a year.

The OSS Education and Public Outreach Program is one component of a larger NASA-wide effort involving contributions from and requiring coordination with a number of other NASA offices. The Education Division of the NASA Office of Human Resources and Education determines overall NASA policy for education, carries out a number of NASA-wide education programs, and ensures Agency-wide coordination of NASA's education programs. The E&POD is the principal OSS point of contact with the NASA Education Division. He or she works with this division to ensure that OSS-sponsored education activities are consistent with overall Agency policies and plans and are coordinated with ongoing Agency education programs. He or she ensures that OSS interests are appropriately reflected in NASA Education Division planning and policy development, that Education Division capabilities (such as the Education Offices at the NASA Centers) are available to support OSS education and public outreach programs, and that unique OSS capabilities are available to support Agency-wide education programs as well.

The Minority University Research and Education Division (MURED) of the NASA Office of Equal Opportunity Programs leads Agency efforts to fully involve minority institutions in NASA-sponsored research and education programs. MURED is responsible for policy development, planning, coordination, and oversight of Agency efforts dealing with minority universities. The OSS Education and Public Outreach Director is the principal OSS point of contact with the MURED. The E&POD works with MURED to ensure that: OSS-sponsored education and public outreach activities support and are consistent with overall Agency policies and plans and coordinated with ongoing MURED programs; OSS interests are appropriately reflected in MURED planning and policy development; and MURED capabilities (such as well-established linkages with minority universities) can be used in support of OSS education and public outreach programs that contribute to meeting broad Agency goals in this area.

The E&POD is the principal point of contact for coordinating OSS education and public outreach programs with other NASA Enterprises and with other Government agencies, such as the Department of Education and the National Science Foundation, and for establishing joint programs where appropriate. In consultation with the Director of the NASA Education Division, the E&POD is also responsible for coordinating OSS-sponsored education and public outreach programs with national education organizations, such as the National Science Teachers Association and the National Council of Teachers of Mathematics, and for developing possible opportunities for collaboration between OSS and such national organizations. The Education Forums and the Brokers are responsible for establishing linkages and collaborations at regional, state, and local levels. Coordination of national and regional efforts is carried out through the OSS Education and Public Outreach Council.

8.3 EDUCATION AND PUBLIC OUTREACH PROGRAM ELEMENTS

Flight Programs

Education and public outreach are required components of all OSS flight missions. Program and Project Managers and Project Scientists at NASA Centers, are responsible for developing Education and Public Outreach Plans for each mission and for designating key individuals who are responsible for leading the planning, implementation, reporting and evaluation of mission, in coordination with Program Executives and Program Scientists at NASA Headquarters and with the OSS E&PO Director. They are also responsible for designating key individuals who are re-

sponsible for leading the planning, implementation, reporting and evaluation of mission education and public outreach programs. They must ensure that adequate funds (consistent with the guidance contained in the Education and Public Outreach Implementation Plan) are budgeted to support mission education and public outreach plans, that there is appropriate oversight of program implementation, and that flight programs utilize the OSS education tracking and reporting system (see below) to provide information on the activities and accomplishments of mission education and public outreach programs.

As a central element in building education and public outreach into all OSS missions -- particularly Principal Investigator-developed missions -- education and public outreach programs are required elements of all proposals submitted in response to OSS AO's. For cases where a science selection is made in two stages (as has been the case for recent Explorer and Discovery missions), submission of an E&PO element may be deferred until the second stage of the selection process if it makes sense to do so. Such a determination will be made by the E&POD in consultation with the Program Scientist. Program Scientists must, in consultation with the E&POD, ensure that AO's contain appropriate language concerning education and public outreach, and that the results of professional reviews of the education and public outreach components of proposals are appropriately incorporated into the overall evaluation and selection process. Where appropriate, requirements for education and public outreach in AO's may be specifically tailored to fit the nature of the opportunity. Program and Project Managers are also responsible for providing regular reports on education and public outreach progress and results to the Program Executive and the E&POD.

To support the AO review and evaluation process, OSS has developed an education and public outreach review process that draws upon a large cadre of science and educational professionals. The results of the reviews of the education and public outreach components of flight proposals are reported to the Program Scientist, and other key individuals involved in the overall review of the proposal, for use in subsequent stages of the selection process.

The education and public outreach aspects of OSS flight missions are expected to be conducted according to the same professional standards, rigor, and discipline, as are the scientific and technical aspects of those same missions. Many of the activities associated with individual missions can be expected to produce education and public outreach programs having regional or national scope and involving the expenditure of substantial funds. To ensure rigor and discipline, each mission is expected to develop a comprehensive Education and Public Outreach Plan to be submitted to OSS in conjunction with the overall approval process required for that mission to proceed into development.

This process ensures consistency with the general guidelines contained in the OSS Education and Public Outreach Implementation Plan. NASA Center Program and Project Managers (or Principal Investigators in the case of PI-class missions) are responsible for the development and submission of such plans, which will subsequently be reviewed for approval by the Program Executive and Program Scientist for each mission and by the E&POD. Progress in the definition and implementation of each mission's or program's education and public outreach program must be reviewed at least once a year.

The Education Forums help coordinate and synthesize education and public outreach activities carried out by missions or programs in their theme areas, and work with each mission to facilitate archiving and dissemination of educational products produced by that mission. Program and Project Managers (or Principal Investigators in the case of PI-class missions) must designate a point of contact for each mission or program to work with the appropriate Education Forum.

Research Programs

OSS policy is directed towards fostering the broad involvement of the space science research community in education and public outreach through as many different avenues as possible. In particular, as stated in all OSS NRA's, space scientists whose research proposals have been accepted for funding are strongly encouraged to propose a supplemental E&PO program to their research proposal, or to become involved in E&PO in a number of other ways.

A variety of pathways are open for space scientists to participate in E&PO. Many members of the space science community supported through the research programs are already heavily involved in E&PO activities in their local communities as volunteers. OSS values and applauds these efforts and, consistent with overall OSS policy concerning allocations of funding for E&PO, will allow a few percent of these individual's research support to be used for such activities. In order for such activities to be both formally acknowledged by OSS and included in the total picture of OSS-sponsored E&PO programs contained in the E&PO Annual Report, OSS strongly encourages space scientists to provide information on such voluntary activities through the E&PO tracking and reporting system (described below). Other members of the space science community have indicated their willingness to participate in established OSS E&PO programs now underway in communities across the country. Information on such ongoing programs may be obtained from the appropriate regional Brokers described earlier or from the "Menu of Opportunities for Scientists in Education" accessible through the OSS Homepage. Members of the OSS E&PO Support Network are available to assist space scientists in establishing appropriate contacts. The Annual Education and Public Outreach Report (which includes contact information on every reported OSS E&PO program) is also a useful resource for such information. Finally, OSS-supported scientists interested in carrying out their own funded E&PO programs may propose such programs as supplements to their research grants. Guidelines for such grants and proposal submission instructions can be accessed through the Education Link on the OSS Homepage.

Under the overall direction of the E&POD, proposals for E&PO supplements to research grants will be reviewed by panels of qualified science and education professionals. Decisions to fund such efforts will be made on the basis of those reviews by the Education and Public Outreach Director in close consultation with the Discipline Scientist responsible for oversight of the relevant research discipline. A funding pool - administered by the E&POD - has been established to support such E&PO efforts, and funds for such work will be added as supplements to the parent research grants. The E&POD is responsible for establishing and maintaining a master list of all E&PO work supported through supplementary funds to research grants and for developing, in close consultation with the OSS Executive Director for Science, an overall multi-year plan for the allocation of E&PO supplementary funds across science divisions and disciplines.

Science divisions and individual Discipline Scientists within those divisions are responsible for ensuring that appropriate language concerning the role of E&PO in OSS research programs is included in all NRA's and for working with the E&POD concerning the selection of E&PO supplements to be funded. Where appropriate, Discipline Scientists and managers are encouraged (and have the latitude) to support particularly outstanding or unique individual education and public outreach projects as part of their discipline research programs. Decisions concerning the support of such efforts should be coordinated with the E&POD. In accord with the importance that OSS has placed on E&PO as a critical element of and justification for the total OSS program, Discipline Scientists are also responsible for working with their scientific communities to encourage them to become more effectively involved in education and public outreach and, to facilitate such involvement, to become familiar with and utilize the services of the Support Network described earlier.

The Education Forums coordinate the education and public outreach programs being carried out by individual investigators in their theme area, and, along with the Brokers, work with individual investigators to facilitate the archiving and dissemination of educational products produced by these programs that are suitable for regional or national distribution. To assist the Support Network in carrying out these roles, the E&POD supplies the Education Forums (and the Brokers) with lists of the education and public outreach activities that have been selected and supported through supplements to research grants.

Other OSS Education and Public Outreach Programs

In addition to the education and public outreach aspects of flight missions and research grants, OSS has established a number of other channels for the support and dissemination of

education and public outreach programs and products.

The Initiative to Develop Education through Astronomy and Space Science (IDEAS) program is directed towards fostering experimentation by the space science community with new approaches to education and public outreach. The Space Telescope Science Institute (STScI) administers the IDEAS program for OSS. The STScI issues an annual call for proposals, conducts the proposal reviews, makes selections (with the concurrence of the E&POD), issues grants, and reviews the progress of ongoing activities. OSS Discipline Scientists, Program Executives, and Brokers should refer space scientists interested in education and public outreach to the IDEAS program as another possible source of support for their activities. To facilitate integration of IDEAS-funded activities into the overall OSS Education and Public Outreach Program, the STScI is also responsible for informing other Education Forums of selected IDEAS projects that are relevant to their theme areas.

In order to take advantage of unique opportunities that may arise from time to time, OSS provides partial support for a very small number of high profile education and public outreach projects directed towards national audiences. These projects usually receive the bulk of their funding from outside OSS. OSS support is used as a catalyst to take advantage of such external resources. The E&POD is the focal point within OSS for the consideration of such projects. As noted earlier, OSS Discipline Scientists and managers are also encouraged to consider supporting especially outstanding individual education and public outreach projects as part of their research programs. Decisions to support such efforts should be coordinated with E&POD in order to avoid duplication of effort, to optimize the use of available resources, and to facilitate integration of these projects into the total OSS Education and Public Outreach Program.

The E&POD coordinates OSS participation and provision of exhibits and displays at national education and public outreach conferences (such as the National Science Teachers Association annual national meeting and the biennial meeting of the American Association of Retired Persons). In order to effectively manage resources and provide clear guidance concerning participation in such national conferences, the E&POD develops an annual plan specifying the national conferences in which OSS will participate and the nature of the participation.

Reporting and Evaluation

OSS has deliberately chosen a decentralized approach to implementing its education and public outreach strategy. It literally supports hundreds of different types of education and public outreach programs ranging in scale from purely local to genuinely national efforts. They are carried out by many different kinds of institutions in communities of all types across the country. In order to have a coherent picture of the total ensemble of efforts constituting the OSS Education and Public Outreach Program, an organized effort is required to capture and aggregate what each individual program is doing and whom it is reaching, and measure its quality and impact. It is also necessary to evaluate the effectiveness of the overall OSS approach to achieving its education goals and objectives. To achieve these ends, the E&POD has worked with the Education Forums, the Education and Public Outreach Council, and an external evaluator to develop a comprehensive approach to the reporting and evaluation of OSS education and public outreach programs.

An Internet-based tracking and reporting system is now in place as the vehicle for collecting information on OSS-sponsored education and public outreach activities. Individuals responsible for the education and public outreach programs being carried out through missions and research programs are required to use this system to provide periodic reports on the nature and results of their work. The Education Forums are responsible for working with both missions and the education and public outreach leads on research grants to implement these reporting requirements. On the basis of this information, an annual OSS Education and Public Outreach Report is produced and widely disseminated. The first such Report was released in January 2001. The Space Science Education Resource Directory developed by the Education Forums (and now maintained by the STScI) also provides information on and access to resources and products resulting from OSS-

sponsored education and public outreach programs.

Evaluation is a critical component of every OSS-sponsored education and public outreach activity. Major flight programs and missions are expected to have a formal evaluation effort included as an integral element of their work. In the case of smaller efforts (those undertaken through research grants, for example), a simplified approach to evaluation may be more appropriate, and templates are available through the Evaluation Consulting Service at the STScI to facilitate such work. OSS also works with an external evaluator to examine the effectiveness of its education and public outreach processes and programs, and regularly makes adjustments in its processes in response to such external feedback. Other mechanisms (including external reviews) for obtaining feedback on program quality are also employed.

APPENDIX A NASA HEADQUARTERS OFFICES

Code A The Office of the Administrator consists of the Administrator, Deputy Administrator, two Associate Deputy Administrators, and several Agency-wide leadership positions. The Administrator and immediate senior staff provide overall strategic direction and policies for the organization, and establish the Agency's relative priorities, associated budget guidelines, and performance assessment. The Chief Engineer ensures that development efforts and mission operations are planned and conducted on a sound engineering basis with proper controls and management of technical risks. The Chief Technologist is the principal Agency advocate for an Agency-wide investment strategy for advanced innovative technology. The Chief Scientist, working with the Associate Administrators for Space Science, Earth Science, and Biological and Physical Research, develops and oversees NASA-wide science policy, and coordinates science priorities and planning across the Strategic Enterprises. The Chief Information Officer establishes Agency-level information technology policies, plans and standards.

Code B The Chief Financial Officer is the NASA interface with the Office of Management and Budget and other Administration and congressional offices for NASA budgetary and financial matters. Within OSS, the Administration and Resources Management Division is the focal point for matters concerning Code B.

Code C Office of Headquarters Operations has responsibility for NASA Headquarters institutional management, including most administrative functions, such as security, information technology and telecommunications, printing, travel and personnel ceiling allocations, training, audits, and the NASA Headquarters library.

Code E The Office of Equal Opportunity Programs is the focal point for policy formulation, implementation, coordination, and management of the NASA civil rights, equal opportunity, affirmative employment, workforce diversity, and minority research and educational programs.

Code F The Office of Human Resources and Education coordinates all NASA programs and activities (e.g., the NASA World Wide Web educational site, Spacelink) to meet national educational objectives and needs. Code F is also responsible for NASA-wide personnel and training.

Code G The Office of the General Counsel establishes and communicates Agency-wide legal policy. It is the authoritative resource on issues such as intellectual property, and reviews proposed agreements and research solicitations for their legal ramifications and adherence to legal policy.

Code H The Office of Procurement prescribes policies and procedures governing the acquisition of goods and services. Code H provides authoritative coordination on NASA Headquarters AO's and NRA's. Code 210.H at Goddard Space Flight Center provides procurement services for contracts, grants and cooperative agreements for NASA Headquarters offices.

Code I The Office of External Relations coordinates major NASA international policies and agreements, and programs with other domestic Federal agencies (e.g., NIH, DOE, and DOD). It is an authoritative resource for foreign participation on AO's and NRA's, and for NASA participation in foreign solicitations and programs.

Code J The Office of Management Systems is the focal point for policy formulation, coordination, and management of Agency logistics, industrial relations,

facilities, environmental management, aircraft management, NASA Employee Exchanges, management systems and controls, and the NASA Directives Management System (i.e. NODIS).

Code K The Office of Small and Disadvantaged Business Utilization provides a special emphasis focus within the NASA contracting effort to promote the utilization of small and disadvantaged business (including women-owned) enterprises, and minority universities in all Agency contracts and subcontracts.

Code L The Office of Legislative Affairs coordinates all communications and relationships between NASA and the U.S. Congress, including congressional hearings and other meetings, briefings of congressional staffs, replies to congressional inquiries, and compliance with congressional reporting requirements.

Code M The Office of Space Flight provides payload transportation, operations and communications on Space Shuttle, International Space Station, and expendable launch vehicles (ELV's). It provides institutional management for Johnson Space Center (JSC), Kennedy Space Center (KSC), Marshall Space Flight Center (MSFC), and Stennis Space Center (SSC). OSF leads the Human Exploration and Development of Space (HEDS) Strategic Enterprise, in which OSS participates through robotic exploration missions and technology development.

Code P The Office of Public Affairs provides broad dissemination of research and mission results to news media and the general public. OSS interacts with Code P in developing press conferences, press releases, press kits, mission status reports, fact sheets. Code P assigns a senior news/information specialist to OSS to serve as Public Affairs Officer.

Code Q The Office of Safety and Mission Assurance ensures appropriate application of safety, reliability, maintainability, and quality assurance policies and standards throughout program/project life cycles. It establishes Agency standards and training, and provides oversight and independent assessment of risk and safety aspects of flight and ground operations.

Code R The Office of Aerospace Technology manages the Agency's aeronautics and space technology programs and policies, coordinating these efforts with other government agencies, industry, and academia, and providing an Agency-wide focus on establishing and expanding NASA partnerships with U.S. industry. OAT leads the Aerospace Technology Enterprise, and provides institutional management for the Ames Research Center (ARC), Dryden Flight Research Center (DFRC), Langley Research Center (LaRC), and Glenn Research Center (GRC).

Code S The Office of Space Science directs science research program management, mission and payload development to further the understanding of the universe, its origin, and the solar system, and conducts advanced technology and mission studies involving the development and testing of new concepts and tools to carry out space missions. OSS leads the Space Science Enterprise, and provides institutional management for Jet Propulsion Laboratory (JPL).

Code U The Office of Biological and Physical Research conducts basic and applied research (including clinical research) to support human exploration of space and to take advantage of the space environment as a laboratory for scientific, technological and commercial research. The Office leads the BPR Enterprise, and works closely with OSF in the HEDS Strategic Enterprise to enable and exploit human space flight and space exploration. OSS interacts with OBPR in areas of space exploration and cross-cutting technology development.

Code W The Office of the Inspector General serves as an independent and objective audit and investigative organization. The OIG prevents and detects fraud, waste and abuse, and assists NASA

management in promoting economy, efficiency, and effectiveness in its programs and operations.

Code X The Office of Security Management and Safeguards is the focal point for policy formulation, oversight, coordination, and management of the Agency security and counterintelligence functions.

Code Y The Office of Earth Science is dedicated to understanding the total Earth system, including the effects of the Sun on that system, and the effects of humans on the global environment. OES leads the Earth Science Enterprise, and provides institutional management for the Goddard Space Flight Center (GSFC). OSS interacts with OES in areas of solar interactions and crosscutting technology development.

APPENDIX B ACRONYMS AND ABBREVIATIONS

AA	Associate Administrator
ACE	Advanced Composition Explorer
AMS	Alpha Magnetic Spectrometer
AO	Announcement of Opportunity
APA	Allowance for Program Adjustment
APOC	Administrative Point of Contact
ARC	Ames Research Center
ARPA	Advanced Research Projects Agency (DOD)
ASCA	Advanced Satellite for Cosmology and Astrophysics
ASO	Astronomical Search for Origins & Planetary Systems
AST	Aerospace Technology Enterprise
ATP	Authority To Proceed
BAA	Broad Agency Announcement
BBXRT	Broad Band X-ray Telescope
BPR	Biological and Physical Research (Office and Enterprise)
C of F	Construction of Facilities
CA	Confirmation Assessment
CAAS	Contract Administration and Audit Services
CAN	Cooperative Agreement Notice
CBO	Congressional Budget Office
CCB	Configuration Control Board
CCSDS	Consultative Committee for Space Data Systems
CDR	Critical Design Review
CFO	Chief Financial Officer
CGRO	Compton Gamma Ray Observatory
CHIPS	Cosmic Hot Interstellar Plasma Spectrometer
CIC	Capital Investment Council
CNES	Centre National D'Etudes Spatiales (National Center for Space Studies, France)
COBE	Cosmic Background Explorer
CO-I	Co-investigator
CONTOUR	Comet Nucleus Tour
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off-the-Shelf
CR	Confirmation Review
CRR	Confirmation Readiness Review
CSOC	Consolidated Space Operations Contract
DAA	Deputy Associate Administrator
DDF	Director's Discretionary Fund (NASA Centers)
DFRC	Dryden Flight Research Center
DOD	Department of Defense
DOE	Department of Energy
DR	Decommissioning Review
DRDF	Director's Research and Development Fund

DSN	Deep Space Network
EA	Environmental Assessment
EAA	Enterprise Associate Administrator
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
EPMC	Enterprise Program Management Council
ESA	European Space Agency
ESE	Earth Science Enterprise
ESRIN	European Space Research Institute
ESS	Exploration of the Solar System
ESTEC	European Space Technology Center
EUVE	Extreme Ultraviolet Explorer
EVM	Earned Value Management
FACA	Federal Advisory Committee Act
FAD	Formulation Authorization Document
FAQ	Frequently Asked Questions
FAR	Federal Acquisition Regulation
FAST	Fast Auroral Snapshot Explorer
FAWG	Flight Assignment Working Group (Shuttle payloads)
FBO	Federal Business Opportunities (formerly Commerce Business Daily)
FFRDC	Federally Funded Research and Development Center
FOIA	Freedom of Information Act
FONSI	Finding of No Significant Impact
FRR	Flight Readiness Review
FTE	Full Time Equivalent (labor)
FUSE	Far Ultraviolet Spectroscopic Explorer
G&A	General and Administrative Costs
GALEX	Galaxy Evolution Explorer
GAO	General Accounting Office
GAS	Get Away Special (on Shuttle)
GEO	Geosynchronous Earth Orbit
GFE	Government Furnished Equipment
GOCO	Government-Owned Contractor-Operated
GPMC	Governing Program Management Council
GPRA	Government Performance and Results Act (1993)
GPS	Global Positioning System
GRC	Glenn Research Center (formerly Lewis Research Center)
GSA	General Services Administration
GSFC	Goddard Space Flight Center
HEDS	Human Exploration and Development of Space (Strategic Enterprise)
HEO	High Earth Orbit
HETE	High Energy Transient Explorer
HQSM	Headquarters Quality System Manual
HST	Hubble Space Telescope
HUT	Hopkins Ultraviolet Telescope
IA	Independent Assessment
IAA	Institutional Associate Administrator
IAR	Independent Annual Review

ICR	Initial Confirmation Review
IDEAS	Initiative to Develop Education Through Astronomy and Space Science
IFMS	Integrated Financial Management System
IG	Inspector General
IIR	Independent Implementation Review
IMAGE	Imager for Magnetopause-to-Aurora Global Exploration
IMP	Interplanetary Monitoring Platform
INSRP	Interagency Nuclear Safety Review Panel
INTEGRAL	International Gamma-Ray Astrophysics Laboratory
IPA	Inter-governmental Personnel Act
IPAO	Independent Program Assessment Office (LaRC)
IPO	Institutional Program Office
IRT	Independent Review Team
ISAS	Institute for Space and Astronautical Science (Japan)
ISO	Infrared Space Observatory
ISS	International Space Station
ISTP	International Solar-Terrestrial Physics
IT	Information Technology
ITAR	International Traffic in Arms Regulations
IUE	International Ultraviolet Explorer
JEA	Joint Endeavor Agreement
JOFOC	Justification for Other than Full and Open Competition
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
KAO	Kuiper Airborne Observatory
KSC	Kennedy Space Center
LaRC	Langley Research Center
LCC	Life Cycle Cost
LEO	Low Earth Orbit
LOA	Letter of Agreement
LWS	Living With a Star
MAP	Microwave Anisotropy Probe
MDR	Mission Definition Review
MIDEX	Medium-class Explorers
MIPR	Military Interdepartmental Purchase Request
MO&DA	Mission Operations and Data Analysis
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MOWG	Management Operations Working Group
MSFC	Marshall Space Flight Center
NAC	NASA Advisory Council
NAR	Non-Advocate Review
NAS	National Academy of Sciences
NASDA	National Space Development Agency of Japan
NEAR	Near Earth Asteroid Rendezvous
NEPA	National Environmental Policy Act
NFS	NASA Far Supplement
NGST	Next Generation Space Telescope

NHB	NASA Handbook (now NPG)
NLT	Not Later Than
NMI	NASA Management Instruction (now NPD's)
NMO	OSS JPL-NASA Management Office (at JPL)
NMP	New Millennium Program
NOA	New Obligation Authority
NODIS	NASA Online Directives Information System
NOI	Notice of Intent
NPD	NASA Policy Directive
NPG	NASA Procedures and Guidelines
NRA	NASA Research Announcement
NRC	National Research Council
NSF	National Science Foundation
NSSDC	National Space Science Data Center
OAT	Office of Aerospace Technology
OCT	Office of the Chief Technologist
OES	Office of Earth Science
OIC	Official In Charge
OMB	Office of Management and Budget
ORR	Operational Readiness Review
OSF	Office of Space Flight
OSS	Office of Space Science
OSSIM	OSS Information Management (file server)
OSTP	Office of Science and Technology Policy
OWI	Office Work Instruction
PAEB	Performance Award Evaluation Board
PAO	Public Affairs Office
PAPAC	Provide Aerospace Products and Capabilities
PCA	Program Commitment Agreement
PDMP	Project Data Management Plan
PDR	Preliminary Design Review
PE	Program Executive
PEB	Performance Evaluation Board
PFP	Program Financial Plan
PI	Principal Investigator
PMC	Program Management Council
PNAR	Preliminary Non-Advocate Review
POP	Program Operating Plan
PPAC	Planetary Protection Advisory Committee
PSR	Program (or Project) Status Report
QSR	Quarterly Status Report
R&A	Research & Analysis
RFP	Request for Proposal
RFQ	Request for Quotation
RHESSI	Reuven Ramaty High Energy Solar Spectroscopic Imager
ROD	Record of Decision
ROSAT	Roentgen Satellite
ROSS	Research Opportunities in Space Science (NRA)

RTG	Radioisotope Thermoelectric Generator
RTOP	Research and Technology Objectives and Plans
RXTE	Rossi X-ray Timing Explorer
SAMPEX	Solar Anomalous Magnetospheric Particle Explorer
SAR	Safety Analysis Report
SBIR	Small Business Innovation Research (Program)
SDR	System Definition Review
SDT	Science Definition Team
SEC	Sun/Earth Connection
SECAS	Sun-Earth Connections Advisory Subcommittee (of SScAC)
SEU	Structure & Evolution of the Universe
SEUAS	Structure and Evolution of the Universe Advisory Subcommittee (of SScAC)
SIM	Space Interferometry Mission
SIRTF	Space Infrared Telescope Facility
SMEX	Small Explorer
SMO	Systems Management Office (NASA Center)
SNOE	Student Nitric Oxide Explorer
SOFIA	Stratospheric Observatory for Infrared Astronomy
SOHO	Solar and Heliospheric Observatory
SOW	Statement of Work
SPARTAN	Shuttle-Pointed Autonomous Research Tool for Astronomy
SR&T	Supporting Research & Technology
SRR	Systems Requirements Review
SSB	Space Studies Board (NRC/NAS)
SSC	Stennis Space Center
SScAC	Space Science Advisory Committee (of the NAC)
SSE	Space Science Enterprise
SSES	Solar System Exploration Subcommittee (of SScAC)
SSSC	Space Science Steering Committee (of SScAC)
SSSO	Space Science Support Office at LaRC
STA	Science and Technology Agency (Japan)
STC	Senior Technology Council (in SSE)
STDT	Science and Technology Definition Team
STP	Solar-Terrestrial Probes
STS	Space Transportation System (Space Shuttle)
STScI	Space Telescope Science Institute
SWAS	Submillimeter Wave Astronomy Satellite
SWG	Science Working Group
TAM	Thrust Area Manager
TDRSS	Tracking and Data Relay Satellite System
TERRIERS	Tomographic Experiment using Radiative Recombinative Ionospheric EUV and Radio Sources
TIMED	Thermosphere - Ionosphere - Mesosphere Energetics and Dynamics
TMCO	Technical/Management/Cost/Other
TRACE	Transition Region and Coronal Explorer
TRL	Technology Readiness Level
TRR	Test Readiness Review
2MASS	Two Micron All Sky Survey

UPN	Unique Project Number
WBS	Work Breakdown Structure
WFF	Wallops Flight Facility
WFPC	Wide Field Planetary Camera
WIRE	Wide-Field Infrared Explorer
XMM	X-ray Multi-mirror Mission (ESA)

APPENDIX C DEFINITIONS

Allowance for Program Adjustment (APA) — Resources allocated for: the resolution of unforeseen major problems; expansions in mission requirements resulting from changes in project objectives or scope; project stretch-outs, etc.

Announcement of Opportunity (AO) — Competitive procurement vehicle used by the Office of Space Science to invite and procure research investigations to be carried out on spacecraft.

Approval subprocess — This second subprocess in program/project management establishes a program/project's readiness to proceed from formulation to implementation, resulting in authorization for the program or project to proceed to the implementation subprocess.

Award Fee — Discretionary funds a contractor can earn based upon subjective Government evaluation of its contractual performance.

Cancellation Review — A review by the Deputy Administrator or the PMC for the purpose of securing a recommendation as to whether to cancel or continue a major system program or project which is under the oversight of the PMC, which is in the Implementation Phase, and for which the estimated cost at completion is projected by the EAA or the CFO to exceed its Program Cost Commitment (PCC) or the development cost commitment component of the PCC by more than the amount specified in the Program Commitment Agreement.

Categorization — The process whereby proposed investigations are classified into four categories: synopsized here as Category I--recommended for immediate acceptance; Category II--recommended for acceptance but at a lower priority than Category I proposals; Category III--sound investigations requiring further development; Category IV--rejected.

Category I - — Well conceived and scientifically and technically sound investigations pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that data can be properly reduced, analyzed, interpreted, and published in a reasonable time. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.

Category II - — Well conceived and scientifically or technically sound investigations that are recommended for acceptance, but at a lower priority than Category I.

Category III - — Scientifically or technically sound investigations that require further development. Investigations may be funded for development and may be reconsidered at a later time for the same or other opportunities.

Category IV - — Proposed investigations which are recommended for rejection for the particular opportunity under consideration, whatever the reason.

Categorization Subcommittee — The sub-committee of the Space Science Steering Committee empowered to categorize proposals per NASA FAR Supplement (NFS) 1872.

Co-Investigator (Co-I)	Associate of a Principal Investigator, responsible to the Principal Investigator for discrete portions or tasks of the investigation.
Commitments	Administrative reservations of allotments and resources authority based on approved requisitions, procurement requests, authorizations to execute contracts, or other written evidence which authorizes the creation of obligations.
Community	The broad space science research community, including researchers at universities, NASA Centers, and in industry. In addition to informal consultation, formal communication with the community occurs through participation of community members on the SScAC, roadmapping teams, and entities of the National Research Council.
Configuration Control Board (CCB)	A committee established to review and approve change requests, deviation requests, waiver board requests, and change notices affecting products under configuration control.
Confirmation Review (CR)	A program review conducted by the Enterprise Associate Administrator for the purpose of approving the program for implementation.
Constant Year Dollars	A method of relating dollars in several years by removing the effects of inflation and showing all dollars at the value they would have in a selected base year.
Contracting Officer's Technical Representative (COTR)	Primary technical advisor to the Contracting Officer. Person responsible for technical direction of the contractor. COTR monitors compliance with all contract terms and conditions.
Cooperative Agreement Notice (CAN)	The procurement vehicle used to solicit proposals whenever the principal purpose is the transfer of anything of value to the recipient to accomplish a public purpose of support or stimulation authorized by Federal statute, and substantial involvement is anticipated between NASA and the recipient during performance of the contemplated activity. A Cooperative Agreement generally involves cost sharing between NASA and the grant recipient.
Critical Design Review (CDR)	A meeting chaired by the appropriate Project Manager or designated representative, to assure that the completed designs are in consonance with project specifications.
Designated Selecting Official (DSO)	The NASA official designated to determine the source for award of a contract or grant.
Environmental Assessment (EA)	Minimum NEPA compliance document describing a mission, which contains an estimate of whether or not the proposed mission will adversely affect the environment or be environmentally controversial.
Environmental Impact Statement (EIS)	Documents environmental impacts of missions that may have significant impact to the human environment or that may be controversial in the public mind.
Evaluation subprocess	This fourth and last subprocess in program/project management provides an independent assessment of the continuing ability of the program or project to meet its technical and programmatic commitments, and provides value-added assistance to the Program/Project Managers.

Federal Business Opportunities (FBO)	Publication in which the U. S. Government publicizes a potential acquisition (a 'synopsis') in order to notify interested vendors. (Formerly *Commerce Business Daily*)
Fee Determination Official (FDO)	The person responsible for determining the actual amount of award fee earned by the contractor and payable during each evaluation period.
Finding of No Significant Impact (FONSI)	Documents the decision of the Enterprise Associate Administrator for a course of action described in the EA.
"506" Authority	A NASA Form 506 Resource Authority Warrant approving the authorization of resources authority to commit, obligate and disburse funds available within the allotment authorization for the execution of approved projects and activities.
Formulation subprocess	This first subprocess in program/project management defines a program or project concept and plan for implementation to meet mission objectives or technology goals specified in either the NASA or Enterprise Strategic Plan, and results in a Program Commitment Agreement (PCA), Program Plan and Project Plan.
Governing Program Management Council (GPMC)	Forums composed of NASA Headquarters Managers and/or Center Senior Managers that assess program and project planning and implementation, and provide oversight and direction as appropriate.
Headquarters Contingency Plan	Describes a specific course of action in the event of a mission failure.
Implementation subprocess	This third subprocess in program/project management delivers the program and project products and capabilities specified in the approved program and project requirements and plans.
Independent Implementation Review (IIR)	An IIR is a regularly scheduled review by an Independent Review Team (IRT), intended to provide a validation of conformance to the Program Commitment Agreement and Program Plan. IIR findings are presented to the project and/or program at the Center, to the Center PMC, to the EPMC at NASA Headquarters, to the Chief Engineer's Office and last, if required, to the Agency PMC.
Institutional Program Office (IPO)	Designated Institutional Program Associate Administrators provide direction, leadership, and support to reporting NASA Centers in order to maintain the infrastructure, as well as the technical and management capabilities commensurate with their roles and missions within the Agency, and provide leadership and policy guidance to reporting NASA Centers regarding the assignment of projects from all Program Offices.
Justification for Other than Full and Open Competition (JOFOC)	A written document serving to justify award of a contract on a non-competitive basis.
Key process	A process which has a direct impact on the quality of a product or service being provided.
Launch Readiness Statement	Generally a letter from the Lead Center Director responsible for the mission certifying that the spacecraft is ready for launch.

Life Cycle Costs (LCC)	The total of the direct, indirect, recurring, non-recurring, and other related expenses incurred, or estimated to be incurred, in the design, development, verification, production, operation, maintenance, support, and retirement of a system over its planned life span.
Mission Success Criteria	Criteria based on the mission Level 1 requirements and the as-built configuration of the spacecraft to assess mission performance after end-of-mission.
NASA Management Office (NMO)	The local NASA contracting authority for matters pertaining to operation of the Jet Propulsion Laboratory.
NASA Procedures and Guidelines (NPG)	Handbooks created to provide implementation instructions for NASA Policy Directives. [Formerly called NASA Handbooks, NHBs.] NPG's provide specific, detailed instructions and guidelines for implementing NASA policy. NPG's describe the detailed "how to" instructions and procedures considered essential for accomplishing the deliverable requirements established by the NPD's. NPG's provide a basis for development of common approaches among NASA Centers, or between NASA Centers and NASA Headquarters, thereby reducing paperwork and streamlining interactions with customers.
NASA Program Management Council (PMC)	The NASA Program Management Council is responsible for reviewing new programs proposed by Enterprise Associate Administrators as part of the annual budget cycle and making recommendations to the Administrator. In addition, the Council reviews the performance of existing programs and projects in accordance with predetermined criteria. The Deputy Administrator chairs the NASA Program Management Council. Note Lead Centers also have Program Management Councils for programs under their jurisdiction. Every NASA program must go through a Program Management Council review on a periodic basis.
NASA Policy Directive (NPD)	NPD's document statements of NASA policy, descriptions of responsibilities and authorities, and principal policy relationships. NPD's describe "what" is required by NASA management for achieving NASA's vision and mission as depicted in the NASA Strategic Plan. NPD's are limited to no more than four pages plus an attachment for metrics or graphic displays for measuring the degree of compliance with the policy statement. NPD's previously were referred to as NASA Management Instructions (NMI's). The terms are still occasionally used interchangeably.
NASA Research Announcement (NRA)	The procurement vehicle used by the Office of Space Science to invite and procure research investigations for laboratory research, data analysis, theoretical research, and other ground-based investigations. The NRA differs from the AO in that the NRA is generally used for ground-based research, whereas the AO solicits investigations to be carried out on spacecraft.
National Environmental Policy Act (NEPA)	Public law that requires documentation of environmental effects/impacts of agency actions. In this case, the design, development, launch, and operation of a space science mission.

New Start	An item or effort appearing in the President's Budget for the first time; an item or effort that was previously funded in research or exploratory development and is transitioned to advanced or engineering development; or an item or effort transitioning into procurement; appearing in the President's Budget for the first time in the investment area.
Non-Advocate Review (NAR)	An analysis of a proposed program or project by a nonadvocate team comprised of management, technical, and budget personnel who will not participate in the implementation of the proposed program or project.
Non-conflicted Reviewer	Scientific peers who have no real or apparent financial interests, institutional affiliations, professional biases and associations, or familiar relationships with NRA proposers or their institutions.
Notice of Intent (NOI)	A notice or letter submitted by a potential investigator indicating the intent to submit a proposal in response to an AO or NRA.
Obligations	Amounts of orders placed, contracts awarded, services received, or other similar transactions which will require the disbursement of money.
Peer Review	The process of proposal review utilizing a group of peers, by mail and/or meeting in panel, in accordance with the stated evaluation criteria.
Performance Award Evaluation Board (PAEB)	The PAEB is responsible for evaluating contractor performance against the criteria elements established in the PEP and any special areas of emphasis for the period under review. The PAEB provides the FDO and PEB a detailed written evaluation of the Contractor's performance and a recommendation on the amount of award fee to be granted.
Performance Evaluation Board (PEB)	The PEB is responsible for receiving and evaluating recommendations of the PAEB and advising the FDO in determining final performance scores for each of the performance-evaluation factors contained in the PEP.
Performance Evaluation Plan (PEP)	The PEP is a NASA-internal management tool for evaluating and grading the adequacy of contractor performance under award-fee contracts. The PEP serves as a roadmap for the process of administering the award-fee provisions of the JPL operations contract. The PEP is not a contractual document, but rather is a NASA tool for evaluating the adequacy of prime-contractor management of the Jet Propulsion Laboratory. The PEP ensures timely evaluation, approval, and subsequent payment of award-fee amounts earned by the prime contractor under the contract. The PEP also details the mechanics of soliciting, collecting, and reporting summary findings of JPL performance in a given award-fee evaluation period.
Preliminary Design Review (PDR)	A meeting chaired by the appropriate Project Manager or designated representative, at which preliminary designs are reviewed with prime contractors to assure compliance with system and project requirements.

Principal Investigator (PI)	A person who conceives an investigation and is responsible for carrying it out and reporting its results.
Process	Set of inter-related resources and activities that transform inputs into outputs. Resources may include personnel, finance, facilities, equipment, techniques, and methods.
Product	The result of activities or processes.
Program	An activity within an Enterprise having defined goals, objectives, requirements and funding, and consisting of one or more projects reporting to the NASA PMC, unless delegated to a GPMC.
Program Commitment Agreement (PCA)	The contract between the NASA Administrator and the cognizant Enterprise Associate Administrator for the implementation of a program in terms of cost, schedule, and content.
Program-Level Requirements Appendix	The document that establishes the baseline for project implementation, including the Level 1 requirements, as well as the agreements among the cognizant Science Director, the lead Center Director, the (implementing) Center Director, and the Program Manager. This document is an appendix to the Program Plan under whose management authority it reports at the NASA Center.
Program Management Council (PMC)	The senior management group chaired by the Deputy Administrator responsible for integrated Agency-level program planning, recommending approval of proposed major system programs, and overseeing their implementation in accordance with Agency commitments, priorities, and policies.
Program Operating Plan (POP)	Yearly solicitation to NASA Centers by NASA Headquarters for planning information (including proposed budgets) for activities for the new budget year.
Program Plan	The document that establishes the baseline for program implementation, including the Level 1 requirements, as well as the agreements among the Enterprise Associate Administrator, the lead Center Director, the (implementing) Center Director, and the Program Manager.
Project	An activity designated by a program and characterized as having defined goals, objectives, requirements, life-cycle costs, a beginning and an end.
Real Year Dollars (Current Year Dollars)	Dollars that include the effects of inflation or escalation and reflect the price levels expected to prevail during the year at issue.
Reclama	An appeal by an Associate Administrator of the Administrator's budget decision(s) prior to finalization of the Agency's budget. May also refer to an Agency appeal of an OMB budget decision.
Record of Decision (ROD)	Documents the decision of the Enterprise Associate Administrator for a course of action described in the EIS.
Request for Proposal (RFP)	The release of a proposed procurement action to sources believed to possess the capacity, competence, and experience necessary to support the proposed requirement.

Research and Analysis (R&A)	Programs that fund supporting scientific research such as instrumentation, theory, and data analysis.
Research and Technology Objectives and Plans (RTOP)	Formal document that serves as a contract between a Program Manager and a NASA Headquarters program office for a specific science or technology discipline. An RTOP may span different NASA Centers and different directorates.
Research Program Plan	This plan includes a listing of all proposals from the current NRA recommended for selection or rejection, along with all continuing multi-year tasks and the required funding for each.
Roadmaps	Informal documents assembled by representatives of the research community that describe alternative future flight, research, and technology-development programs within their areas of competence.
Service	The results generated by activities at the interface between the supplier and the customer and by supplier-internal activities calculated to meet customer needs.
Space Science Advisory Committee (SScAC)	Primary committee of the NASA Advisory Council with cognizance of activities of the OSS.
Space Science Steering Committee (SSSC)	The panel appointed by the OSS AA in accordance with NASA FAR Supplement (NFS) 1872 that is empowered to review all documentation and processes leading to a recommendation for selection of proposals submitted in response to an AO.
Technical/Management/ Cost/Other (TMCO)	The series of evaluation factors against which proposals are graded in addition to their scientific merit.

APPENDIX D REFERENCES AND RELATED DOCUMENTS

Most of NASA's key documentation of plans, processes and programs are available both as paper products, usually from the generating offices, and on Internet locations for ready access and downloading. For NPD's, NPG's, NHB's and NMI's, NASA's Office of Management Systems maintains the NASA Online Directives Information System (NODIS) World Wide Web site at <*http://nodis3.gsfc.nasa.gov/library/main_lib.html* >, providing access to established policies, procedures and guidance concerning NASA's programs, services, and management activities.

NODIS DOCUMENTS

NPD 1000.1B	NASA Strategic Plan *[expires 9/27/2003]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_1000_001B_&page_name=main*
NPG 1000.2	NASA Strategic Management Handbook *[expires 1/19/2005]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_1000_0002_&page_name=main*
NPG 1000.3	The NASA Organization *[expires 3/1/2007]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_1000_0003_&page_name=main*
NPD 1080.1	NASA Generate Knowledge (GK) Process for Programs and Projects *[expires 8/26/2004]* http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_1080_0001_&page_name=main
HCP 1400-1	Document and Data Control *http://www.hq.nasa.gov/hqiso9000/library/iso9000_detail_HCP1400-1.html*
NPG 1441.1C	NASA Records Retention Schedules (NRRS) *[expires 9/18/2002]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_1441_001C_&page_name=main*
NP-2000-08-258-HQ	Space Science Enterprise Strategic Plan *http://spacescience.nasa.gov/admin/pubs/strategy/2000/index.html*
NPG 5100.4B	NASA Federal Acquisition Regulation (FAR) Supplement (esp see Part 1872) *[expires 8/31/2003]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_5100_004B_&page_name=main*
NPD 5101.32A	Procurement *[expires 5/1/2005]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_5101_032A_&page_name=main*
NPG 5800.1E	Grant and Cooperative Agreement Handbook *[expires 10/18/2005]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_5800_001E_&page_name=main*

NPD 7000.3	Allocation and Control of Agency Resources *[expires 12/31/2002]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_7000_003D_&page_name=main*
NPD 7100.10C	Control of Lunar Materials *[expires 3/19/2004]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_7100_010C_&page_name=main*
NPD 7120.4B	Program and Project Management – *[expires 12/6/2004]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_7120_004B_&page_name=main*
NPG 7120.5A	Program and Project Management Processes and Requirements *[expires 4/3/2003]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_7120_005A_&page_name=main*
NPD 7500.1	Program and Project Logistics Policy *[9/12/2002]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_7500_0001_&page_name=main*
NPD 8010.3	Notification of Intent to Terminate Operating Space Systems *[expires 6/30/2004]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8010_0003_&page_name=main*
NPD 8020.7E	Biological Contamination Control for Outbound and Inbound Planetary Spacecraft *[expires 2/19/2004]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8020_007E_&page_name=main*
NPD 8020.11C	Solar System Nomenclature *[expires 2/20/2003]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8020_011C_&page_name=main*
NPG 8020.12B	Planetary Protection Provisions For Robotic Extraterrestrial Missions *[expires 4/16/2005]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_8020_012B_&page_name=main*
NPD 8610.12D	Office of Space Flight (OSF) Space Shuttle Services for NASA and NASA-Sponsored Payloads *[expires 7/27/2004]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8610_012D_&page_name=main*
NPD 8610.24A	Expendable Launch Services (ELV) Launch Services Prelaunch Readiness Reviews *[expires 2/14/2005]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8610_024A_&page_name=main*
NPD 8621.1G	NASA Mishap Reporting and Investigating Policy *[expires 12/10/2002]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8621_001G_&page_name=main*

NPG 8621.1	NASA Procedures and Guidelines for Mishap Reporting, Investigating, and Recordkeeping *[expires 6/2/2007]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_8621_0001_&page_name=main*
NPD 8700.1	NASA Policy for Safety and Mission Success *[expires 10/31/2002]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8700_0001_&page_name=main*
NPD 8720.1	NASA Reliability and Maintainability (R&M) Program Policy *[expires 10/15/2002]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8720_0001_&page_name=main*
NPD 8730.3	NASA Quality Management System Policy (ISO 9000) *[expires 6/8/2003]* *http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PD_8730_0003_&page_name=main*
SP 6105	NASA Systems Engineering Handbook (1995)

OTHER REFERENCES

Government Performance and Results Act of 1993
http://govinfo.library.unt.edu/npr/library/misc/s20.html

Grants Information Homepage (GSFC and NASA Headquarters)
http://genesis.gsfc.nasa.gov/grants/grants.htm

Guidance for the Preparation and Submission of Unsolicited Proposals
http://ec.msfc.nasa.gov/hq/library/unSol-Prop.html

Office of Space Science Education Implementation Plan
http://spacescience.nasa.gov/admin/pubs/edu/imp_plan.htm

NASA Academy of Program and Project Leadership (formerly Program/Project Management) Home Page
http://appl.nasa.gov/

NASA Advisory Council
http://www.hq.nasa.gov/office/codez/new/poladvisor.html

NASA Headquarters Quality System Manual
http://www.hq.nasa.gov/hqiso9000/library/iso9000_level_1.html

NASA HQ ISO 9001 External Web
http://www.hq.nasa.gov/hqiso9000

NASA Lexicon
http://www.nasaappl.com/resources/lexicon.html

NASA FY 2003 Performance Plan
http://ifmp.nasa.gov/codeb/budget2003/28-Introduction.pdf

NASA Performance Report 2001
ftp://ftp.hq.nasa.gov/pub/pao/reports/2002/fy01_performancereport/overview.pdf

NASA Program Management Council Charter (in NPG 1000.3)
http://nodis3.gsfc.nasa.gov/library/displayDir.cfm?Internal_ID=N_PG_1000_0003_&page_name=6.6

NASA Technical Standards
http://standards.nasa.gov/

National Aeronautics and Space Act of 1958 (As Amended)
http://www.hq.nasa.gov/office/pao/History/amendact.html

National Space Policy (September 19, 1996)
http://spacescience.nasa.gov/admin/pubs/sciguide/index.htm

Office of Space Science Education and Outreach Homepage
http://spacescience.nasa.gov/education/index.htm

Office of Space Science Education and Public Outreach Annual Report
http://ossim.hq.nasa.gov/ossepo/

Office of Space Science (OSS) Guidebook for Proposers Responding to a NASA Research Announcement (NRA)
http://www.hq.nasa.gov/office/procurement/nraguidebook/gdbkcvr.html

Safety and Mission Assurance for the Space Science Enterprise
http://www.hq.nasa.gov/office/codeq/enterprise.htm

Space Science Advisory Committee (SScAC) Charter
http://www.hq.nasa.gov/office/codez/nac/ssac.htm

Space Science Education Resource Directory
http://teachspacescience.stsci.edu/cgi-bin/ssrtop.plex

Space Science Enterprise Strategic Themes

Structure and Evolution of the Universe
http://universe.gsfc.nasa.gov/

Exploration of the Solar System
http://sse.jpl.nasa.gov/

Search for Origins
http://origins.jpl.nasa.gov

The Sun-Earth Connection
http://sec.gsfc.nasa.gov/

Astrobiology
http://nai.arc.nasa.gov/

APPENDIX E TEMPLATES AND SAMPLE DOCUMENTS

The following are some templates and sample documents which may be helpful in executing various OSS AO, NRA and flight programs management processes.

APPENDIX E.1 NOMINAL CHECK LIST FOR OSS AO PROCESSES AND PRACTICES

Note: The Check List below is for overview purposes only. The ISO 9000 Office Work Instruction HOWI8310-S019, available through the NASA Web site http://www.hq.nasa.gov/hqiso9000/library/iso9000_level_3.html, is the only official set of instructions for this process and must be followed.

PRIOR TO RELEASE OF AO

___ Gain program approval from the Division Director and Associate Administrator for Space Science to issue AO of interest. Have the AA sign a memo, endorsed by the Division Director, formally designating a Program Scientist or Program Executive for the activity.

___ Assemble knowledge base needed to write AO, e.g.,
- Scientific (and possible technological) objectives of program
- Availability of needed technology
- Unique programmatic aspects (launch deadlines, cooperation with joint partners, etc.)
- Unique evaluation and/or selection criteria
- Program budget
- Overall schedule
- Unique international aspects

___ Distribute mature draft of AO that at a minimum follows the sample organization shown in NFS 1872.705 (see Appendix E.2 for example of table of contents) for review by key people, at a minimum including
- Chairman/Space Science Steering Committee (SSSC)
- Project Management Office
- OSS discipline Division Director(s) (as appropriate)
- Assigned Program Executive
- Representatives of Codes GK, HS, and IS (as appropriate for unusual issues)

___ Optional: Release draft of AO through OSS homepage for community comment, and be prepared to post FAQ as addendum to AO on Web. Allow two weeks for comments and then two weeks to incorporate comments into draft AO.

___ Develop plan for review and evaluation; coordinate at a minimum with the Designated Selecting Official, the SSSC Chair, the NASA Peer Review Services (NPRS) contractor, and the Program Management Office.

APPROVAL AND RELEASE OF AO

___ Submit final AO for Concurrence Cycle using currently approved routing slip (Note: the final Concurrence Cycle sheet is issued only by the OSS Executive Director for Science who is the standing designee as the SSSC Chairman; see Appendix E.3 for AO and NRA Concurrence Sheet template). Proceed only after final approval by the Program Executive, and OSS AA or a discipline Division Director as appropriate.

___ After completion of the Concurrence Cycle and final signature by the OSS AA, ensure publication through Federal Business Opportunities (FBO) Web site at least 15 days prior to AO release,

and issue an E-mail announcement to community through the OSS Electronic Notification System.

___ Ensure posting on the OSS World-Wide Web home page, and availability of printed copies (for internal NASA use only) on advertised day of release.

DURING PROPOSAL PERIOD

___ Finalize the proposal evaluation plan with the NPRS contractor for receipt and log-in of proposals.

___ Monitor NPRS contractor activities of processing Notices of Intent (NOI's) to propose.

___ Use NOI results to develop tentative non-conflicted review panel(s) and optional mail-in reviewers for both science and TMCO criteria; solicit approval of Chair/SSSC.

___ Ensure appropriate responses to any FAQ questions are posted on each Monday during proposal period of AO.

___ Identify appropriate dates for the meeting of the Categorization meeting and the Selection Meeting; reserve dates on the OSS AA's calendar for the latter event, as well as those of all other OSS personnel expected to attend as part of the selection process.

PROPOSAL RECEIPT AND DISTRIBUTION

___ Monitor NPRS contractor activities of receiving, sorting and logging submitted proposals.

___ Monitor NPRS contractor sending proposals to appropriate NASA Center to check on compliance with AO requirements, and for TMCO reviews as may be required and appropriate.

___ Based on Center review, return non-compliant proposals to submitters.

___ Forward a copy of all proposals having non-U.S. participants to Code IS and gain their concurrence of the acceptability of those nations as partners with NASA.

PROPOSAL REVIEW: SCIENTIFIC

___ Identify final membership of proposal review committees, based on actual proposer personnel, research objectives, and technologies of submitted proposals.

___ Monitor NPRS contractor distribution of compliant received proposals to all designated reviewers, for both "remote" and "on-site" reviews.

___ Monitor NPRS contractor receipt of postal or electronic evaluations submitted by "remote" reviewers.

___ Convene Peer Review Panel for "on-site" review of compliant proposals.

___ Distribute TMCO results and inputs from mail-in reviewers to appropriate Peer Review Panel committees for their consideration.

___ Personally monitor deliberations of Peer Review Panel to ensure fairness and completeness of all deliberations, and appropriate management of any conflicts of interest.

___ Receive from Peer Review Panel the final set of evaluations for the proposals.

CATEGORIZATION PROCESS - PREPARATION FOR AND CONDUCT OF

___ Identify membership of the Categorization Subcommittee of the SSSC, and obtain approval from the Chair/SSSC.

___ Convene Categorization Subcommittee to categorize the proposals based on the peer reviews. (See Appendix E.5 for a description of the Categorization Subcommittee process.)

___ Based on the Categorization Subcommittee determinations, develop a recommendation for selection of proposals in the competitive range (Categories I and II). For a selection of investigations for some specific research opportunity, like a specific mission, the recommendation chooses from among the Category I and II proposals those that best satisfy the stated science objectives as constrained by the available budget. For a program like Explorer or Discovery, this recommendation is *de facto* the unprioritized list of all Category I and II proposals.

SSSC - PREPARATION FOR AND CONDUCT OF

___ Request the Chair/SSSC to convene the Steering Committee. The Chairperson establishes a quorum from OSS Civil Servants

___ Present recommendations for proposal selection to the SSSC, for their review of the adequacy, completeness and fairness of the documentation and processes leading to the recommendation, and to ensure that all regulations and procedures were followed in issuing the AO, conducting the peer review, and formulating a recommendation for selection. (See Appendices E.6 and E.7 for description of the responsibilities of the SSSC, and a prototype SSSC meeting agenda.)

___ Close any actions directed by the deliberations of the SSSC and then gain approval for holding the Selection Meeting as scheduled.

___ Alert Code IS of all proposals having non-U.S. participation that are to be recommended for selection, and coordinate any particular issues with them.

SELECTION PROCESS - PREPARATION FOR AND CONDUCT OF

___ Prepare draft letters of selection and nonselection, the Selection Statement, and the Press Release; gain Code IS approval of all letters of selection that involve non-U.S. participation.

___ Forward the SSSC "findings" and supporting evaluation material to the Designated Selecting Official (DSO) by way of a presentation at the Selection Meeting.

___ The DSO selects the winning proposal(s) in executive session.

___ Prepare a detailed selection statement per provisions in NASA FAR Supplement (NFS) 1872.503, and letters of selection and non-selection, for signature by the DSO .

POST-SELECTION ACTIVITIES

___ Prepare and issue a press release identifying the selected proposal(s) (see Appendix E.9 for a sample timeline leading to the press release).

___ Send notification of selection and nonselection letters to all proposal submitters, which also should identify the selected proposals (Note: the press release may be used for this latter purpose).

___ Debrief all proposal submitters, following the procedures and policies found in NFS 1872.505 (see Appendix E.8 for further guidance on debriefing).

___ The AA notifies the designated NASA Center to proceed with the Program of the selected proposal(s) using a signed memo, to which is attached a copy of the Selection Statement, Letters of Selection, and originals of the selected proposals to the Center responsible for implementing the Program.

___ Attend the initial all-hands project meeting to transfer responsibility to the Project Office at the designated NASA Center.

APPENDIX E.2 SAMPLE AO TABLE OF CONTENTS

(Note: At a minimum, the AO must conform to the outline given in NFS 1872.705.)

AO:98-OSS-03
Explorer Program
Medium-class Explorers (MIDEX) and Missions of Opportunity (Released: March 25, 1998)

NASA Announcement of Opportunity (AO) Soliciting Proposals for Basic Research

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APPENDIX E.3 AO AND NRA CONCURRENCE CYCLE

(designate as appropriate)
ANNOUNCEMENT OF OPPORTUNITY
NASA RESEARCH ANNOUNCEMENT /OR/
COOPERATIVE AGREEMENT NOTICE)

ENTITLED

"Name of Announcement"

S/Executive Director for Science – *name* Date

Sx/Program Scientist or Executive – *name as assigned* Date

As appropriate, provide for OSS science Division concurrence(s):
Sx/Director, *name of appropriate science Division* Date

If solicitation is for a Mars program, include the following in addition to SE/Director:
SM/Director, Mars Program Division – *name* Date

If solicitation is for a Living With a Star (LWS) program, include the following in addition to SS/Director:
SS/Living With Star Program Scientist – *name* Date

S/Executive Director for Programs – *name* Date

S/Director, Strategic & International Planning – *name* Date

S/Director, Education & Outreach – *name* Date

IS/Director, Space Science & Aeronautics Division Date

Office of External Relations – *name* Date

H/Office of Procurement – no *name; Code H assigns as appropriate* Date

GK/Office of General Counsel – *name* Date

SP/Program Support Specialist – *name* Date

SB/Management Support Specialist – *name* Date

S/Executive Director for Science – *name* Date

Special Instructions

- Only S/Executive Director for Science has the authority to issue or alter this sheet; he/she will issue a customized version of it based on the type of solicitation involved and its sponsoring OSS science Division.
- After the first two signatures are obtained, parallel concurrence may be solicited from all designated offices up to Code G. If such parallel action is initiated the Program Scientist is responsible for the distribution, collection, and collation of all individually signed sheets and comments for provision to Code G; only a fully amended/corrected copy of the solicitation is to be forwarded to Code G.
- Regardless of whether parallel concurrence is sought or not, a preliminary version may be given to SP/Program Support Specialist at the beginning of the cycle to expedite proof reading for Government Printing Office standards.
- Substantive changes at any one step may require reconcurrence by prior concurees, as appropriate.
- All specified changes and final editing must be made before final submission to SP/Program Support Specialist.
- All changes specified by the SP/Program Support Specialist must be made, and all embedded Web links (i.e., URL addresses) must be checked for accuracy and accessibility before submission in final hardcopy and as an electronic Word file to SB/Management Support Specialist.
- After final inspection for completeness and editing by S/Executive Director for Science, the SB/Management Support Specialist will secure the authorizing signature by the designated selection official, initiate the FBO announcement process, and transmit the final electronic file to the NASA Proposal Review Service (NPRS) contractor.
- The earliest date for the release of a document is 23 days after the final authorizing signature by the Selection Official (eight for processing and 15 for posting in the Federal Business Opportunities (FBO) website as required by law); 10 days of this period is required by NPRS for conversion into Web formats.
- The Program Scientist is responsible for inspection and approval of the final document on the Web page for OSS Open Research Solicitations.

OFFICE OF SPACE SCIENCE
NPG 7120.5 CERTIFICATION FOR RELEASE OF SOLICITATION

This Certification verifies that the NASA research solicitation, entitled,
Announcement of Opportunity / NASA Research Announcement / Cooperative Agreement Notice:

_____

sponsored by the Office of Space Science, NASA Headquarters, is hereby approved for pre-release announcement in the *Federal Business Opportunities* (FBO). In accordance with Procurement Information Circular (PIC) 99-6, dated Mar. 26, 1999, this solicitation (initial as appropriate):

_____(1) is not in support of a program or project that is subject to the requirements of NPG 7120.5;

-or-

_____(2) is in support of a program or project that is subject to the requirements of NPG 7120.5, and –

_____all NPG 7120.5 required documentation is current and approved;

-or-

_____authority to release the solicitation without the required documentation has been granted by the chair of the Governing Program Management Council (GPMC) or designee.

CONCURRENCE:

_____ _____
Name Date
S/Executive Director for Flight Programs

APPROVAL:

_____ _____
Name Date
Associate Administrator for Space Science

Special Instructions

- Only S/Executive Director for Science has the authority to issue or alter this sheet, which is required by the SB/Management Support Specialist in order to submit the FBO notice to the Procurement Office at GSFC for transmittal to the FBO office.

APPENDIX E.4 SAMPLE NON-DISCLOSURE STATEMENT

SAMPLE NON-DISCLOSURE STATEMENT

[SUBJECT SCIENCE SUBDISCIPLINE]

RESEARCH AND ANALYSIS PROGRAM

In the course of my participation in the NASA Peer Review of [subject science subdiscipline] Research and Analysis Program Proposals, I will have access to proprietary information contained in the proposals and to confidential information relating to the evaluation of the proposals. I understand that unauthorized disclosure of this information could adversely affect NASA's solicitation process.

Accordingly, unless specifically authorized by a cognizant NASA official, I agree not to disclose any of the following information outside of the Peer Review Panel:

a) Proprietary information contained in the proposals;

b) Confidential information relating to the evaluation, selection, or rejection of any proposals.

In the event that I have a conflict of interest with a proposal that is to be evaluated as part of the review process, I will made this conflict known to the NASA representative or to the Chairman of the Panel so that appropriate steps may be taken to protect the integrity of the peer review process.

_____ _____

Signature Date

_____

Name (Please Print)

APPENDIX E.5 PROTOTYPE CATEGORIZATION SUBCOMMITTEE PROCESS

Introduction & Charge to Subcommittee (Chairperson)

- Identification / certification of Subcommittee members and visitors
- Identification / certification of recording Executive Secretary
- Statement of confidentiality of proceedings
- Purpose of activity and definitions of Category per NFS 1872
- Statement of *modus operandi* of Subcommittee

Program Overview (Program Scientist and/or Program Manager)

- Review of program history
- Description of Announcement of Opportunity (esp. special features)
- Overview of proposals received (types, numbers, etc.)
- Detailed description of the processes for proposal science and technical reviews
- Definition / determination of unique and/or summary evaluation factors
- Prognosis for selection(s) within likely budgets (*as appropriate*)

Categorization of Proposals (Program Scientist)

- Presentation for each proposal:
  - Overview of proposed investigation
  - Exposition of strengths and weaknesses as determined by reviews
  - Review of Summary Evaluation
  - Statement of recommended Categorization
  - Discussion (moderated by Chairperson & recorded* by Executive Secretary)
  - Vote** by Subcommittee (recorded by Executive Secretary)
- Review / closure of any action items

Conclusions of Proceedings (Chairperson)

- Review / revote of all proposals to ensure self-consistent 'calibration' point
- Restatement of confidentiality of proceedings
- Establishment of due date for minutes

---

* Only if questions are raised about the adequacy or completeness of the science/technical reviews, or in cases where significant issues are raised.

** Note: Program Scientist abstains from voting except in case of a tie vote of the subcommittee.

APPENDIX E.6 CHARGE OF RESPONSIBILITIES TO THE SPACE SCIENCE STEERING COMMITTEE (SSSC)

Charter (*defined by NASA Federal Acquisition Regulations (FAR) Supplement (NFS) Part 1872.406, "ACQUISITION OF INVESTIGATIONS"*)

- "... to provide a substantive review of a potential payload or program of investigations and to recommend a selection to the Program Associate Administrator."

- "... applies the collective experience of representatives from the program and discipline communities and offers a forum for discussing the selection from those points of view."

- "... is responsible for assuring adherence to required procedures" (and finally provides) "... the forum where discipline objectives are weighed against program objectives and constraints."

SSSC Responsibilities (*NFS Part 1872.406(b)*)

"To ...

- "Review compliance with procedures governing the application of the AO process" (*i.e., all the rest of NFS 1872.0*).

- "Ensure that adequate documentation exists has been made of the steps in the evaluation process"
(namely,
. the Announcement of Opportunity;
. the peer scientific, technical & programmatic evaluations;
. the Categorizations; and
. the formulation of the recommendation for selection.)

- "Review the results of the evaluation by the (*Categorization*) subcommittee, Project, and Program Offices and prepare an assessment or endorsement of a recommended payload or program of investigations to the Program AA."

What SSSC Does *It reviews the:*

"(1) Degree to which results of evaluations and recommendations follow logically from the criteria in the AO.

"(2) Consistency with objectives and policies generally beyond the scope of Project/Program Offices.

"(3) Sufficiency of reasons stated for tentative recommendations of those investigations requiring further instrument research and development
(*Category III proposals only).*

"(4) Sufficiency of reasons stated for determining responsibilities for instrument development (*Category III proposals only).*

"(5) Sufficiency of consideration of reusable space flight hardware and support equipment for the recommended investigations.

"(6) Sufficiency of reasons for classifying proposed investigations in their respective categories.

"(7) Fair treatment of all proposals."

What SSSC Does Not Do.

Re-review proposals
(*although the Committee may request that such activity be undertaken by the Program Scientist if it is judged that inadequate and/or inconsistent reviews are presented*).

Re-categorize proposals
(*although the Committee may request that such activity be undertaken, or even recommend an alternative Categorization itself, if inadequate and/or inconsistent documentation is presented*).

Reject a recommendation for selection by the Program Scientist
(*although the Committee may recommend that the Program Scientist revise their recommendation, or in an extreme case, the Committee may provide an alternative recommendation to be forwarded to the S/AA*).

Final Product of SSSC:

"... makes recommendations to the selection official on the payload or program of investigations and notes caveats or provisions important for consideration of the selection official."

In practice, this "recommendation" takes the form of a finding *or* determination *prepared by the SSSC Chairman that introduces the Selection Statement forwarded by the Program Scientist to the Program AA.*

- In the best case, the Committee goes on formal record as determining that all elements of the solicitation, review, categorization, and recommendation processes are in order and are properly documented, and that the SSSC endorses without qualification the Selection Statement as proffered.

- In the worst (and exceptional!) case, the SSSC may tender an alternative recommendation for selection to the Program AA.

APPENDIX E.7 PROTOTYPE AGENDA OF THE SSSC

Introduction & Charge to Committee (Chairperson)

Identification / certification of Committee members and visitors
Identification / certification of recording Executive Secretary
Statement of confidentiality of proceedings
Purpose of activity per FAR Section 18-70.103, Appendix I
Discussion of *modus operandi* of Committee

Mission Overview and Program History (Program Scientist &/or Manager)

History of mission or program
Science & technical overview of mission (or program)
Description of Announcement of Opportunity (esp. special features)
Overview of proposals received (types, numbers, etc.)

Proposal Review and Categorization Processes (Program Scientist)

Description of Technical/Management and Science Peer Review processes:
- Logistics
- Layout and features of Review Forms
- Participants by name, organization, & qualifications

Description of Categorization process: logistics & participants
Presentation of evaluations and categorization for each proposal:
- Brief overview of proposal
- Brief overview of strengths and weaknesses
- Summary evaluation and Categorization votes

Summary of Categorizations
- Overview of results for all proposals
- Identification of proposals in competitive range for selection

Recommendations for Selection (Program Scientist)

If AO is for multiple investigations to be accommodated by a single mission:
- Competitive range proposals vs. mission science objectives
- Prioritization of any directly competing proposals
- Resolution of any cost or technical issues of candidate proposals
- Rationale for recommending partial or joint selections
- Recommendation for selection of proposals, including budget implications

/ OR /

If AO is for proposals that constitute entire missions:
- Prioritization of candidate proposals having nearly identical objectives
- Resolution of any cost or technical issues of candidate proposals
- Rationale for recommending partial or joint selections
- Summary of competitive range (i.e., Category I & II) proposals with final evaluation scores
- *If science themes were specified in AO as a selection criteria*, prioritization of competitive range proposals compared to those themes.

Summary of Recommendations and Future Activities (Program Scientist &/or Manager)

Overview of budget issues/constraints (as appropriate)
Summary of special circumstances (if any) of recommendation for selection
Draft letters for selection and non-selection
Draft plan to arrange selections involving non-U.S. institutions (if any)
Plan for debriefing non-selected proposers
Draft press release announcing results (to be sent to selected proposers)
Draft plan for implementation of selected proposals (i.e., next step)

Summary/Conclusions (SSSC Chairperson)

Summary of any action items for Program Office
Statement of schedule for submitting recommendation to AA/OSS

APPENDIX E.8 POLICY AND PROTOCOL FOR DEBRIEFING PROPOSERS FOLLOWING AN AO SELECTION ACTIVITY

PREFACE

Following the selection of proposals, debriefing of proposers is a required part of the overall Announcement of Opportunity (AO) process, as specified in NASA Federal Acquisition Regulations (FAR) Supplement (NFS) Part 1872, entitled "Acquisitions Of Investigations," (URL <www.hq.nasa.gov/office/procurement/regs/1872.htm>. In particular, Section 1872.505, "Debriefing," is given as follows:

> "It is the policy to debrief, if requested, unsuccessful proposers of investigations in accordance with FAR 15.1004. The following shall be considered in arranging and conducting debriefings:
>
> "(a) Debriefing shall be done by an official designated by the responsible Program AA. Any other personnel receiving requests for information concerning the rejection of a proposal shall refer to the designated official.
>
> "(b) Debriefing of unsuccessful offerors shall be made at the earliest possible time; debriefing will generally be scheduled subsequent to selection but prior to award of contracts to the successful proposers.
>
> "(c) Material discussed in debriefing shall be factual and consonant with the documented findings of several stages of the evaluation process and the selection statement.
>
> "(d) The debriefing official shall advise of weak or deficient areas in the proposal, indicate whether those weaknesses were factors in the selection, and advise of the major considerations in selecting the competing successful proposer where appropriate.
>
> "(e) The debriefing official shall not discuss other unsuccessful proposals, ranking, votes of members, or attempt to make a point-by-point comparison with successful proposals.
>
> "(f) A memorandum of record of the debriefing shall be provided the Chairperson of the Steering Committee.

The following additional "how to" comments have been derived from experience over many years in carrying out such debriefings in accordance with the policy as given above. It should be noted that the debriefing can and usually does take at least 30 minutes, and not infrequently an hour or more for complex proposals.

A request for a debriefing may come only from the Principal Investigator (PI) of a submitted proposal but may be by phone, in writing or, commonly today, by E-mail. Generally speaking a Program Scientist is advised never to attempt to debrief in real time or "on demand" in response to a phone call, but rather to make an appointment for the event to allow adequate review of the relevant peer review materials as well as to ensure being free of other commitments for at least one hour. Traditionally the Office of Space Science policy has been that the initial debriefings for AO's have been by telephone. Starting with the recent Discovery and Explorer AO's for complete missions involving very complex proposals, however, it has

become common for the initial debriefing to be in person at NASA Headquarters. In such cases, one key member from each of the consortium members of a proposal team may also attend in addition to the PI. However, a firm ground rule for such in-person debriefings is that NASA funds may not be used to defray travel costs.

Whether by phone or in person, at the beginning of a debriefing, the following protocol and policies should be explained:

NASA provides only one debriefing per proposal, and thereafter it is the PI's responsibility to convey the results to their team members. In the case of a debriefing by telephone, the PI may request that some of the science team members be allowed to listen either on a speaker phone or through a distributed conference call, but in such cases the PI is responsible for setting up such arrangements.

Notes may be taken by those being debriefed, but recording devices of any kind are not allowed. (*Point of order: If a PI records the debriefing, then so must NASA in order to adequately defend itself in case a challenge were to be made, and we are not staffed or equipped to record and transcribe such activities*.)

If a proposer is not satisfied with the initial debriefing, he/she may request a face-to-face debriefing with the Research Program Management Division Director. In such a case, the PI may be accompanied by a key individual associated with the original proposal but not legal counsel. As in the initial debriefing, however, the Program Scientist speaks for NASA, with the RPM Director acting in the role of a moderator/witness of the proceeding.

NASA policy has always been that all peer review materials used in making the selection are considered "pre-decisional" and, therefore, not releasable even under the Freedom of Information Act (FOIA). [As a point of information: the only item technically releasable, if requested by name, is the Selection Statement signed by the Source Selecting Official, i.e., the OSS AA or the delegated OSS Science Program Director; Section 503 of NFS 1872 explicitly states what is to be included in the Selection Statement.] (*Point of order: Although deficiencies in scientific or technical merit are the primary reasons why a proposal is not a candidate for selection, there may be Management, Cost, Outreach, or Programmatic reasons that are just as important and that may not be included in the Peer Panel materials alone; therefore releasing just the peer reviews may give a very incomplete picture of why a proposal was not selected.)*]

During the debriefing competing proposals are never discussed under any circumstances except to say that all proposals were subjected to identical review procedures before the same panels, and that the selected proposal(s) is(are) of sufficient merit to be selected.

Selected proposals are never released by the Agency even under FOIA in order to protect proprietary material (technical, managerial, and/or financial). *(Point of order: Selected PI's may voluntarily release their proposals, but NASA does not request them to do so. If so requested the Agency may release the abstract that the PI of the selected proposal has approved. Otherwise mission descriptions are given only in press releases, talks at meetings, published articles, and/or brochures.)*

The role of the debriefing Program Scientist is that of a neutral conveyor of the peer review comments and not that of an originator or defender thereof. (*Point of order: Although the Program Scientist is the coordinator, expediter, and interpreter of the review process, he/she is not empowered to overturn or even revise review materials. Should an apparently valid error in reviews be demonstrated by the proposer, they may request in writing that further reviews be conducted.*)

The debriefer should note that the NASA Announcement of Opportunity (AO) process derives directly from the statutory guidance as provided by NFS 1872 that is not subject to modification by the Program Office. All steps therein from the format of the AO through to final selection are specified, the adherence to which has been scrutinized and verified by the Space Science Steering Committee. (*Point of Order:* ***Experience has shown that at this point it is very helpful to show the proposer a simplified flow chart of the review and evaluation procedures through which all proposals to the AO were subjected; such demonstration of process helps allay many questions/suspicions on the part of the proposer. If the debriefing is by telephone, this item may be faxed in advance****. The message to be conveyed: While the AO process may appear Byzantine, it is not capricious, and contains many checks and balances to ensure completeness and fairness*.)

During the debriefing, especially if it is anticipated that the evaluation or selection may be contentious for any reason, another NASA civil servant may be present with the debriefer to take notes and witness the proceedings.

Following these introductory points, the debriefer should then proceed to read/paraphrase the content of the peer technical and scientific review materials to the PI (*Point of order: While the review materials themselves should not be shown directly to the proposer, it is permissible, and even desirable, to let the proposer see that such a compendium of written reviews does exist*s.)

Care should be taken to accurately convey only the written information, omitting gratuitous comments or even tonal inflections that detract from or color the written facts. Paraphrase the material from the peer reviews and repeat as many times as requested in order to allow the PI to take accurate notes.

Both positive and negative aspects of the proposal, as determined by the peer review process, should be clearly and accurately related to allow the PI to understand the proposal's strengths and weaknesses. Strive to differentiate between "Major" and "Minor" discriminators but note that, owing to the intense competition common in most AO's, a single major shortcoming of a proposal can easily prevent a proposal from being a candidate for selection. (*Point of order: Strive to convey the contents of the reviews but resist the urge to give a tutorial on how to write an effective proposal. Such advice may be misconstrued as giving the proposer the idea that they might enjoy a competitive edge in the next competition.*

Do not compare competing proposals under any circumstances. (*Point of order: By inference, any winning proposal that directly competed in objectives with that of someone not selected won because it was judged to be superior in one respect or another*.)

As may be the case, describe programmatic factors that might explain why a proposal was not selected rather than just dwelling on relatively minor negative science/technical discriminators, e.g., that the selection was restricted owing to budget limitations, weight, science scope, overlap of science objectives, etc. A well-written AO will have anticipated such boundary conditions, to which the attention of the person being debriefed should be directed. (*Point of order: Sometimes a PI responds to an AO they think, or wish, had been written, not the one that was in fact written. Point out that once an AO is issued, for better or for worse NASA is required to carry out the reviews against the mission and selection criteria as described therein*.)

It is permissible, and usually even desirable to tell the PI of their proposal's Categorization (I, II, III, or IV). The AO should contain the definitions. (*Point of order: If the Categorization is revealed, make sure the proposer understands that this process takes into account the totality of all evaluation factors and is a very non-linear rating scale.)*

One of the toughest aspects of debriefing is explaining to a PI of a Category I proposal why it wasn't selected. In these such, the reasons are almost always one or more of the following:

- A competing Category I proposal was judged to have even better scientific or technical merits (e.g., less demand on resources, better science focus, better plan for data reduction, etc.), and/or was judged a better programmatic fit to the opportunity in terms of Agency and/or OSS strategies; or
- The non-selected proposal was not as critically focused on the core science objectives for a multi-experiment payload, or not of the highest contemporary importance to a science discipline for a "total mission" opportunity like Discovery or Explorer.

These reasons may be difficult to relate in a compelling manner, since the rationale may lie in strategic plans with which the proposer may not be particularly familiar and/or even accepted by him even if they are. In any case, all non-selected proposers should understand that the final selection is made by the Associate Administrator (or the designated OSS Science Program Director for some AO's) in executive session, and the basis for that decision is not necessarily reflected in the peer review materials themselves. (*Point of order: In order to achieve a selection NASA may have to invoke third, fourth, or even fifth order discriminators to decide between closely competing proposals*.)

Finally, be pleasant and courteous at all times even if the proposer is not. (*Point of order: By failing to win, the proposer's professional life almost always has been significantly affected, whereas yours has not*.)

As specified in NFS 1872.505(f), after all debriefings are completed a Memo for the record, addressed to the Chair of the Steering Committee and maintained in the Program files at NASA Headquarters, should be submitted indicating who was debriefed and when, and noting any special issues that may have been raised as well as the disposition of any action items that may have resulted.

APPENDIX E.9 SAMPLE COUNTDOWN FOR AO SELECTION PRESS RELEASE

Countdown For
<<date>> Press Release
<<AO Name>> Selection

Date	Time	Milestone	Action
NLT SMD – 1		Notify Code L and Code P of selection meeting date; confirm notification schedule	Code S (Program Scientist)
NLT SMD - 1		Prepare draft press release	Code S/Code P (Program Scientist / Beasley)
Selection Meeting Date (SMD)	Selection Meeting Time	Selection Meeting	Code S (Program Scientist)
		EAA obtains Administrator's concurrence for larger missions	Code S (AA)
SMD	By COB	Draft press release to Code L	Code P (Beasley)
SMD + 1	9:00 am	Notification to Sen. Mikulski's Office (Only if MD involvement?)	Code L (Cherry/Hollebeke)
SMD + 1	9:00 am	Selection statement and letters ready for Dr. Weiler's signature	Code S (Program Scientist) and/or NASA PRS
SMD + 1	By COB	Dr. Weiler approves and signs selection statement and letters	Code S
SMD + 1	By COB	Press release to press room; press room provides final copy of press release to Codes L and LD (Rothman, Kliensorge, Hollebeke)	Code P (Beasley)
SMD + 2	By 1:30 pm	Calls to ESA and CSA (as applicable) plus Successful / Unsuccessful Offerors*	Code S (Program Scientist)
SMD + 2	2:00 p.m.	Notification to Members issued via FAX Sr.	Code LD (Rothman/Kleinsorge)
SMD + 2	4:00 p.m.	Press Release	Code P (Jacobs/Keegan)
SMD + 2	By COB	NASA PRS received signed letters, copies letters, returns Program Scientist and Weiler copies, and prepares for distribution of remainder.	NASA PRS
SMD + 4	2:00 p.m.	NASA PRS mails letters to PI's and all cc's.	NASA PRS

***** Before calls are made verify that Code L has made necessary contacts for any press releases made by members. Contact Code LD (Kliensorge) once all calls are complete.

APPENDIX E.10 GENERIC GUIDELINE FOR PROGRAM LEVEL REQUIREMENTS

EXPLORER PROGRAMS

(*Suggested wording is shown in normal text; wording can be changed as necessary, but be sure to retain the essential content. Guidance is shown in italics. Items requiring replacement are contained inside << >> markers.)*

1. SCOPE

This appendix to the Explorer Program Plan identifies the mission, science and programmatic (funding and schedule) requirements imposed on the **<<name of the organization(s) having prime responsibility >>** for the development and operation of the **<<project name >>** Project of the Explorer Program. Requirements begin in Section 4. Sections 1,2 & 3 are intended to set the context for the requirements that follow.

This document serves as the basis for mission assessments conducted by NASA Headquarters during the development period and provides the baseline for the determination of the science mission success following the completion of the operational phase.

Program authority is delegated from the Associate Administrator for the Office of Space Science (AA/OSS) through the GSFC Center Director to the Explorer Program Manager within the Flight Projects Directorate at GSFC.

The **<<organization name>>**, under contract to **<<contracting organization>>,** is responsible for the scientific success of the **<<project name >>** Project, using the set of approved co-investigators reflected in the proposal including any approved changes prior to the release of this appendix.

The **<<organization name>>**, under contract to **<<contracting organization>>,** is responsible for design, development, test, mission operations, and data verification tasks and shall coordinate the work of all contractors and co-investigators.

Changes to information and requirements contained in this document require approval by the Office of Space Science, NASA Headquarters.

2. SCIENCE DEFINITION

2.1 Baseline Science Objectives

This section shall provide a brief, high level description of the mission science objectives, in terms of the fundamental questions, the Enterprise goals, and the science goals, as defined in the NASA Space Science Enterprise Strategic Plan. The accepted proposal should be a primary source for this section.

2.2 Science Instrument Summary Description

This section will provide a very brief, high level description of what science instruments will be used to satisfy the mission objectives. (2-3 sentences typical)

3. PROJECT DEFINITION

3.1 Project Organization & Management

This section describes the organizational relationships proposed for the development and operation of the mission.

3.2 Project Acquisition Strategy

This section briefly describes the proposed acquisition approach for the Project's components. The description should include the spacecraft, scientific instruments, launch vehicle, and operations. If applicable, the acquisition of mission critical components should also be briefly described.

4. PROGRAMMATIC REQUIREMENTS

NOTE: The following sections identify normally required content. The organization scheme is not intended to be restrictive. Paragraphs can be renumbered and reorganized, provided that required content is retained.

4.1 Science Requirements

4.1.1 Baseline Science Requirements

This section shall describe the scientific requirements that must be achieved in order to fully satisfy the baseline science objectives defined above. Requirement statements should be concise and clearly stated in a form suitable for objective verification. The document must state which of these baseline requirements must be met to satisfy the full mission success criteria.

4.1.2 Minimum Science Requirements

This section shall describe the minimum scientific requirements (the "science floor") that are required to scientifically justify performing the mission. Requirement statements should be concise, succinct, and suitable for objective verification. The document must state which of these minimum requirements must be met to satisfy the minimum mission success criteria.

4.1.3 Science Instrument Requirements

This section shall specify what is crucial about the instrument that must be present to accomplish the mission objectives. This may include the scientific measurements required to be accomplished with each instrument, and/or the critical science instrument design and required operating capabilities for accomplishing these measurements. State only requirements for which failing to meet the requirement would jeopardize meeting the mission objectives.

4.2 Mission and Spacecraft Performance

This paragraph shall specify particular mission or spacecraft performance requirements that are critical in successfully meeting the scientific objectives of the mission. Mission lifetime should be specified here, as well as particular performance features which are mission critical.

4.3 Launch Requirements

This section shall define launch requirements such as the launch time frame, launch window, the spacecraft orbit, and/or the method for achieving launch and orbit insertion.

4.4 Ground System Requirements

This section shall specify particular ground system design or performance requirements that are critical in meeting the science objectives of the mission.

4.5 Mission Data Requirements

4.5.1 Science Data Management

The **<<project acronym>>** Principal Investigator shall be responsible for initial analysis of the data, its subsequent delivery to an appropriate data repository, the publication of scientific findings, and communication of results to the public. Additionally, the **<<project acronym>>** Principal Investigator shall be responsible for collecting engineering, and ancillary information necessary to validate and calibrate the scientific data prior to depositing it in a NASA approved data repository. The time required to complete this process shall be the minimum necessary to provide accurate and complete scientific data to the science community and the general public. The **<<project acronym>**> science data base shall be made available to the science community without restrictions or proprietary data rights of any kind.

4.5.2 Analysis Software

Science analysis software development, utilization, and ownership shall be covered in the Data Management Plan. (see section 4.5.3)

4.5.3 Data Management Plan

The **<<project acronym>>** Project shall develop a data management plan to address the total activity associated with the flow of science data, from acquisition, through processing, data product generation and validation, to archiving and preservation. The data management plan shall be formally approved as a Level 2 requirement no later than the **<<project acronym>>** Critical Design Review.

5. NASA MISSION COST REQUIREMENT

5.1 Cost Cap

<<project name >> funding is capped at a cost of **<< TBD >>** dollars for the design, development, and operation of the mission. *Include wording on whether or not the launch vehicle costs are included in the cost cap.*

5.2 Cost Management and Scope Reduction

Provided that Program Level Requirements are preserved, and that due consideration has been given to the use of budgeted contingency and planned schedule contingency, the **<<project name >>** shall pursue scope reduction and risk management as a means to control cost. The **<<project name >>** project plan shall include potential scope reductions and the time frame in which they could be implemented. If other methods of cost containment are not practical, the reductions identified in the Project Plan may be exercised; ***however, any reduction in scientific capability, including those reductions specifically identified***

in the Project Plan, shall be implemented only after consultation with and approval by the Program Scientist. Any potential scope reductions affecting these Program Requirements shall be agreed to by the signers of this document.

6. MULTI-MISSION NASA FACILITIES

This section shall define the Program's intended use of multi-mission NASA facilities, and include a definition of how the use of these facilities will be funded. Negotiated agreements or draft agreements with defensible cost estimates shall be supplied at the Phase C/D Confirmation Review.

7. EXTERNAL AGREEMENTS

This section will define the external organizations that the project is dependent upon for mission success. Program requirements supported by these agreements shall be clearly identified.

8. PUBLIC OUTREACH AND EDUCATION

The **<<project name >>** project shall develop and execute an Education and Public Outreach Plan consistent with information provided as a part of the NASA Headquarters, Office of Space Science (OSS) Confirmation Review.

9. SPECIAL INDEPENDENT EVALUATION

Specification of independent evaluation is a Program requirement which should be defined at the Project level only if there are unique factors which would call for a correspondingly unique independent evaluation. An example would be situations in which the science is compelling enough to warrant embracing exceptional technical risk, to the extent that HQ would require a special independent evaluation. Ordinary independent reviews, such as Confirmation Reviews are required by existing directives and need not be specifically called out in this appendix to the Program Plan.

10. TAILORING

This section must document, either explicitly or by reference, any NPG 7120.5 requirements or processes which the project is either eliminating or substantially modifying at the Project level. The approval of such tailoring changes shall be cited. Program level tailoring of NPG 7120.5 requirements should not be repeated in this document.

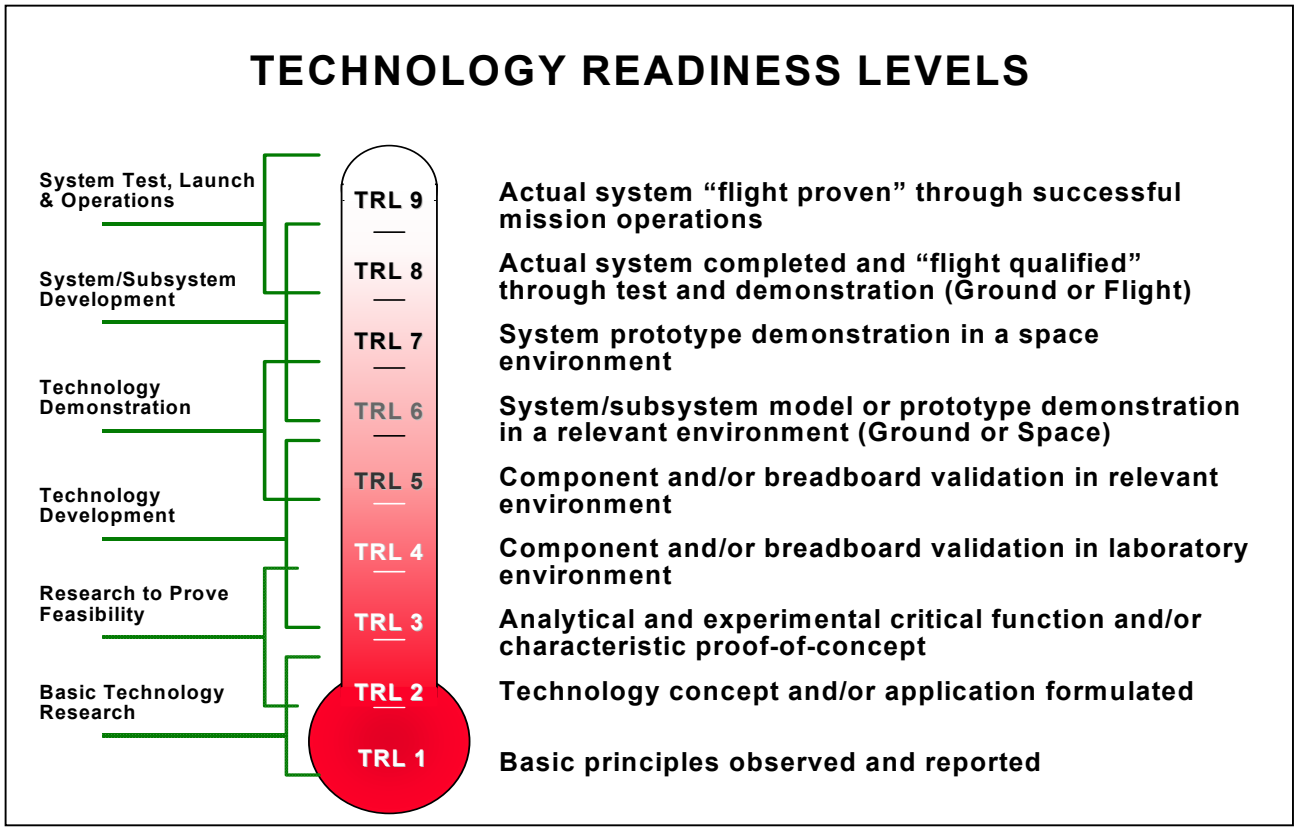
11. REQUIRED APPROVALS

Principal Investigator or Project Scientist
Project Scientist
Project Manager
Program Manager
Program Executive
HQ Program Scientist
HQ Science Division Director
HQ Executive Director for Programs
Enterprise Associate Administrator

APPENDIX E.11 TECHNOLOGY READINESS LEVELS

Introduction

Technology Readiness Levels (TRL's) are a systematic metric/measurement system that supports assessments of the maturity of a particular technology and the consistent comparison of maturity between different types of technology. The TRL approach has been used on-and-off in NASA space technology planning for many years and has been incorporated into relevant documentation addressing integrated technology planning at NASA. The figure below provides a summary view of the technology maturation process model for NASA space activities for which the TRL's were originally conceived; other process models may be used. However, to be most useful the general model must include: (a) 'basic' research in new technologies and concepts (targeting identified goals, but not necessary specific systems), (b) focused technology development addressing specific technologies for one or more potential identified applications, (c) technology development and demonstration for each specific application before the beginning of full system development of that application, (d) system development (through first unit fabrication), and (e) system 'launch' and operations.



Technology Readiness Levels Summary

TRL 1 Basic principles observed and reported

TRL 2 Technology concept and/or application formulated

TRL 3 Analytical and experimental critical function and/or characteristic proof-of-concept

TRL 4 Component and/or breadboard validation in laboratory environment

TRL 5 Component and/or breadboard validation in relevant environment

TRL 6 System/subsystem model or prototype demonstration in a relevant environment (ground or space)

TRL 7 System prototype demonstration in a space environment

TRL 8 Actual system completed and "flight qualified" through test and demonstration (ground or space)

TRL 9 Actual system "flight proven" through successful mission operations

Discussion of Each Level

The following paragraphs provide a descriptive discussion of each technology readiness level, including an example of the type of activities that would characterize each TRL.

TRL 1
Basic principles observed and reported

This is the lowest "level" of technology maturation. At this level, scientific research begins to be translated into applied research and development. Examples might include studies of basic properties of materials (e.g., tensile strength as a function of temperature for a new fiber).

Cost to Achieve: Very Low 'Unique' Cost
(investment cost is borne by scientific research programs)

TRL 2
Technology concept and/or application formulated

Once basic physical principles are observed, then at the next level of maturation practical applications of those characteristics can be 'invented' or identified. For example, following the observation of high critical temperature (Htc) superconductivity, potential applications of the new material for thin-film devices (e.g., SIS mixers) and in instrument systems (e.g., telescope sensors) can be defined. At this level, the application is still speculative: there is not experimental proof or detailed analysis to support the conjecture.

Cost to Achieve: Very Low 'Unique' Cost
(investment cost is borne by scientific research programs)

TRL 3
Analytical and experimental critical function and/or characteristic proof-of-concept

At this step in the maturation process, active research and development (R&D) is initiated. This must include both analytical studies to set the technology into an appropriate context and laboratory-based studies to physically validate that the analytical predictions are correct. These studies and experiments should constitute "proof-of-concept" validation of the applications/concepts formulated at TRL 2. For example, a concept for High Energy Density Matter (HEDM) propulsion might depend on slush or supercooled hydrogen as a propellant: TRL 3 might be attained when the concept-enabling phase/temperature/pressure for the fluid was achieved in a laboratory.

Cost to Achieve: Low 'Unique' Cost
(technology-specific)

TRL 4
Component and/or breadboard validation in laboratory environment

Following successful "proof-of-concept" work, basic technological elements must be integrated to establish that the "pieces" will work together to achieve concept-enabling levels of performance for a component and/or breadboard. This validation must be devised to support the concept that was formulated earlier and should also be consistent with the requirements of potential system applications. The validation is relatively "low-fidelity" compared to the eventual system: it could be composed of ad hoc discrete components in a laboratory. For example, a TRL 4 demonstration of a new 'fuzzy logic' approach to avionics might consist of testing the algorithms in a partially computer-based, partially bench-top component (e.g., fiber optic gyros) demonstration in a controls lab using simulated vehicle inputs.

Cost to Achieve: Low-to-moderate 'Unique' Cost
(investment will be technology-specific, but probably
several factors greater than investment required for TRL 3)

TRL 5
Component and/or breadboard validation in relevant environment

At this, the fidelity of the component and/or breadboard being tested has to increase significantly. The basic technological elements must be integrated with reasonably realistic supporting elements so that the total applications (component-level, sub-system level, or system-level) can be tested in a 'simulated' or somewhat realistic environment. From one-to-several new technologies might be involved in the demonstration. For example, a new type of solar photovoltaic material promising higher efficiencies would at this level be used in an actual fabricated solar array 'blanket' that would be integrated with power supplies, supporting structure, etc., and tested in a thermal-vacuum chamber with solar-simulation capability.

Cost to Achieve: Moderate 'Unique' Cost
(investment cost will be technology-dependent, but likely to be several factors
greater that cost to achieve TRL 4)

TRL 6
System/subsystem model or prototype demonstration in a relevant environment (ground or space)

A major step in the level of fidelity of the technology demonstration follows the completion of TRL 5. At TRL 6, a representative model or prototype system or system — which would go well beyond ad hoc, 'patch-cord' or discrete component level breadboarding — would be tested in a relevant environment. At this level, if the only 'relevant environment' is the environment of space, then the model/prototype must be demonstrated in space. Of course, the demonstration should be successful to represent a true TRL 6. Not all technologies will undergo a TRL 6 demonstration: at this point, the maturation step is driven more by assuring management confidence than by R&D requirements. The demonstration might represent an actual system application, or it might only be similar to the planned application, but using the same technologies. At this level, several-to-many new technologies might be integrated into the demonstration. For example, a innovative approach to high temperature/low mass radiators, involving liquid droplets and composite materials, would be demonstrated to TRL 6 by actually flying a working, subscale (but scaleable) model of the system on a Space Shuttle or International Space Station 'pallet'. In this example, the reason space is the 'relevant' environment is that microgravity plus vacuum plus ther-

mal environment effects will dictate the success/failure of the system — and the only way to validate the technology is in space.

Cost to Achieve: Technology- and demonstration-specific; a fraction of TRL 7 if on ground; nearly the same if space is required

TRL 7
System prototype demonstration in a space environment

TRL 7 is a significant step beyond TRL 6, requiring an actual system prototype demonstration in a space environment. It has not always been implemented in the past. In this case, the prototype should be near or at the scale of the planned operational system and the demonstration must take place in space. The driving purposes for achieving this level of maturity are to assure system engineering and development management confidence (more than for purposes of technology R&D). Therefore, the demonstration must be of a prototype of that application. Not all technologies in all systems will go to this level. TRL 7 would normally only be performed in cases where the technology and/or subsystem application is mission-critical and relatively high-risk. Example: the Mars Pathfinder Rover is a TRL 7 technology demonstration for future Mars micro-rovers based on that system design. Example: X-vehicles are TRL 7, as are the demonstration projects planned in the New Millennium spacecraft program.

Cost to Achieve: Technology- and demonstration-specific, but a significant fraction of the cost of TRL 8 (investment = "Phase C/D to TFU" for demonstration system)

TRL 8
Actual system completed and "flight qualified" through test and demonstration (ground or space)

By definition, all technologies being applied in actual systems go through TRL 8. In almost all cases, this level is the end of true 'system development' for most technology elements. Example: this would include DDT&E through Theoretical First Unit (TFU) for a new reusable launch vehicle. This might include integration of new technology into an existing system. Example: loading and testing successfully a new control algorithm into the onboard computer on Hubble Space Telescope while in orbit.

Cost to Achieve: Mission-specific; typically highest unique cost for a new technology (investment = "Phase C/D to TFU" for actual system)

TRL 9
Actual system "flight proven" through successful mission operations

By definition, all technologies being applied in actual systems go through TRL 9. In almost all cases, the end of last 'bug fixing' aspects of true 'system development'. For example, small fixes/changes to address problems found following launch (through '30 days' or some related date). This might include integration of new technology into an existing system (such operating a new artificial intelligence tool into operational mission control at JSC). This TRL does not include planned product improvement of ongoing or reusable systems. For example, a new engine for an existing RLV would not start at TRL 9: such 'technology' upgrades would start over at the appropriate level in the TRL system.

Cost to Achieve: Mission-specific; less than cost of TRL 8 (e.g., cost of launch plus 30 days of mission operations)

(White Paper by John C. Mankins, Office of Space Access and Technology, April 6, 1995)

APPENDIX E.12 SAMPLE FORMULATION AUTHORIZATION DOCUMENT (FAD)

Formulation Authorization
For The
Next Generation Space Telescope (NGST) Program

PURPOSE:

NGST is a key element of the Origins Initiative which is part of The Space Science Enterprise Strategic Plan (November 1997). One of the science goals in this plan is to "understand how structure in our universe (e.g., cluster of galaxies) emerged from the Big Bang." In order to fill in the missing link in the history of our universe between the first condensations of matter after the Big Bang and the galaxies we see today, we need to make direct observations of the first generation of stars and galaxies. This must be carried out at near-infrared wavelengths and requires a telescope with a large aperture (to provide sensitivity to faint objects) and superb angular resolution (to observe structure in distant objects). This is the prime motivation for NGST.

TERMS OF REFERENCE:

The formulation phase effort will include: 1) definition of the key science requirements which will become the Level 1 science requirements, 2) demonstration of the feasibility of concepts for an observatory system that satisfies the Level 1 requirements, 3) identification and development of technology options that support the concepts, 4) establishment of internal management control functions that will be used throughout the life of the program, 5) identification of both reserves associated with program risk management and other estimated program reserves.

The formulation phase is planned to be complete in late fiscal year (FY) 2002 with a Preliminary Design Review and Non-Advocate Review.

The minimum capability of NGST has been established as the science floor requirements. In addition, both science and engineering goals for NSGT have been established. These are summarized in the table below.

Parameter	Science Floor	Goals
Wavelength Range	1-5 microns	0.5-30 microns
Angular Resolution	Diffraction-limited at 2 microns	Diffraction-limited at 0.5 microns
Aperture Diameter	4 meters	8 meters
Sensitivity	Zodiacal background Limited at 1 AU	Cosmic infrared background-limited
Lifetime	5 years	10 years

Instruments	Wide Field Camera/ Spectrometer	Add visible, MIR Camera/ Spectrometer and chronograph

The cost target for the C/D development phase for NGST is less than $500 M (in 1996 dollars). The total cost target including the C/D development phase, launch vehicle and mission operations phase (but not including data analysis) is less than $900 M (in 1996 dollars).

FUNDING:

The following funding guidelines for the NGST formulation phase are consistent with the FY 2000 Program Financial Plan, Office of Space Science budget. Values are in real year $K. Funding for FY 1999 includes 5 months of pre-formulation activities.

FY 1999	FY2000	FY 2001	FY 2002
32,190	46,560	61,540	55,440

INTERNAL PARTICIPANTS:

Goddard Space Flight Center will be given Managing Center responsibility for the development of the NGST program. Other Centers involved in the program formulation include Ames Research Center, Marshall Space Flight Center, Langley Research Center, Jet Propulsion Laboratory, and Space Telescope Science Institute.

EXTERNAL PARTICIPANTS:

The Air Force Research Laboratory and the National Reconnaissance Office are involved in a joint mirror technology development activity with NASA. This 2-year effort started in FY 1999.

The European Space Agency (ESA) and NASA plan to develop a partnership in the NGST. ESA plans to provide for European studies and technology development during program formulation. ESA plans to provide some combination of instrument and spacecraft hardware, portions of the ground system, and/or scientific operations during the implementation phase of NGST.

The Canadian Space Agency also plans to develop a partnership with NASA in the NGST for both the formulation and implementation phases of the program.

APPENDIX E.13 SAMPLE PROGRAM DELEGATION LETTER

SD

TO: Jet Propulsion Laboratory
Attn: 180-904/Director

FROM: S/Associate Administrator for Space Science

SUBJECT: Assignment of Managing Center Responsibility for the Navigator Program

Consistent with the Agency's policy to transfer program responsibility to the Field Centers, JPL is assigned the Managing Center responsibility for the Navigator program (In Search of New Worlds). The Navigator program is a collection of related existing projects and activities already located at JPL. This program is being created to obtain synergy among the project elements. The Navigator program will consist only of the projects identified in the enclosed Navigator Program Formulation Authorization Document (FAD). The Navigator program is not a continuing series of missions and will end with the Terrestrial Planet Finder project.

You are requested to develop a program plan for executing this responsibility and submit it to the Office of Space Science (OSS) for formal approval by April 30, 2001. In implementing this Managing Center responsibility, JPL will be responsible for accomplishing the project goals identified in the enclosed FAD. JPL will also be responsible for tracking program metrics and reporting program status to NASA Headquarters.

In accordance with the NASA Strategic Handbook, NASA Headquarters will retain responsibility for defining program policy, establishing the science and technology requirements, soliciting and selecting the science investigations, allocating the program budget, establishing key milestones, establishing program and project top-level requirements and metrics, and assessing the program and financial status. NASA Headquarters will also retain the responsibility for establishing the formal agreements with other U.S. Government organizations and with foreign space organizations and institutions.

Edward J. Weiler

Enclosure

Approval:

_____ _____
Daniel S. Goldin Date
Administrator

cc:
S/Dr. E. Huckins
S/Dr. A. Kinney
SD/Mr. R. Howard
SD/Ms. L. LaPiana
SD/Mr. K. Ledbetter
SD/Mr. E. Moore
SD/J. Lee
SP/Mr. R. Maizel
SP/Mr. C. Tupper
SR/Dr. P. Crane
SR/Dr. G. Riegler
JPL/100-22CIT/Dr. C. Beichman
JPL/180-704/Dr. C. Elachi
JPL/233-200/Mr. M. Devirian
JPL/126-304/Mr. L. Simmons
SD:LlaPiana:fb:x1544:11/29/00:doc:PFP Managing Center Delegation
AE: Mmoore:revised:fb:12/18/00
Revised: LlaPiana:fb:12/8/00:
AI: Signature change:fb:1/18/01
Revised: Code A:LlaPiana:fb:1/30/01:Code G:2/15/01
Revised: Ehuckins:Llapiana:fb:3/1/01

APPENDIX E.14 SAMPLE PROJECT AUTHORIZATION LETTER

S

December 12, 2001

TO: Goddard Space Flight Center
100/Director
460/Living with a Star Program Manager

FROM: S/Associate Administrator for Space Science

SUBJECT: Authorization to Initiate Solar Dynamics Observatory (SDO) Project

Based on the successful concept studies performed by the Living With a Star Program Office and the Solar Dynamics Observatory pre-project, and the successful selection of the SDO science investigations, you are hereby authorized to initiate Phase A of Formulation for the SDO Project. The approved Formulation Authorization Document (FAD) is attached.

The guidelines and constraints for the SDO project are as follows. The project includes both Formulation and Implementation, (Phases A through E) as well as funding for the launch vehicle, data analysis, project operations, education, and outreach. Prime mission operations should end five years and thirty days after launch. The SDO project should include six years of data analysis in its budget where each of the last four years' funding is half the value of each of the first two years' funding. Funding should not exceed $410 million for all elements of the prime SDO project. The Living With a Star Program should set aside contingency funding for a five-year extended mission even though the SDO spacecraft is designed for a five-year lifetime. Launch should be planned for August 2007.

An independent assessment will precede the Initial Confirmation Review that OSS will hold to determine whether the project is ready for Phase B. This review will include a life cycle cost estimate for the project as directed by Congress. A Non-Advocate Review (NAR) will be conducted near the end of Phase B. The NAR results will be presented to the Agency Program Management Council (PMC) to seek approval for the formal transition of the SDO project from Formulation to Implementation, because the SDO project is the first project in the LWS Program. After the SDO mission successfully transitions from Phase B to Phase C, the governing PMC for the LWS Program will move to the Space Science Enterprise PMC at NASA Headquarters.

I look forward to a successful SDO mission.

Edward J. Weiler

APPENDIX F AO AND NRA PROCESSES

The two most important tools by which OSS solicits and selects research investigations are Announcements of Opportunity (AO) and NASA Research Announcements (NRA). Detailed procedures for AO and NRA solicitations are documented in HOWI8310-S019 and HOWI8310-S018, respectively, and are reproduced herein. Additional guidance in carrying out various elements of these processes can be found in Appendix E of this Handbook.

APPENDIX F.1 THE ANNOUNCEMENT OF OPPORTUNITY (AO) PROCESS

The flow of activities involved in the process by which the OSS generates and issues AO's and reviews and selects submitted proposals is given in Figures F.1-1 through F.1-12 below (from HOWI8310-S019) and the following procedure (numbered steps refer to the figures). (To ensure use of the most current OWI, check http://www.hq.nasa.gov/ hqiso9000/library.htm.)

1. The Program Scientist determines the feasibility of a proposed AO by iterating the following activities:
   - Review NASA FAR Supplement Part 1872 & OSS information about the AO process
   - Define NASA research objectives
   - Define the scope of a possible program
   - Solicit comments from the science community
   - Determine the availability of needed technologies
   - Verify budgetary authority for the program
   - Initiate NPG 7120.5 compliance activities

   [NOTE: These activities occur in parallel in an iterative manner.]
2. In accordance with NASA FAR Supplement Part 1872.102 [paragraph (a)(1)] and NASA FAR Supplement Part 1872.2, if the Associate Administrator for Space Science signs the authorization to proceed with development of the AO (which is created by the Program Scientist) and designates the cognizant Program Scientist, proceed to Step #3. If authority to proceed is denied, end the process.
3. In accordance with NASA FAR Supplement Part 1872.3 and the technical program description submitted by the implementing NASA Center, the Program Scientist prepares the draft AO and the draft notice summarizing the purpose and content of the AO for publication via the *Federal Business Opportunities* (FBO*)*.
4. In accordance with the content of the draft AO, the Program Scientist solicits comments and recommendations from cognizant personnel within Code S (at a minimum, the OSS Executive Director for Science), Code IS, Code HS, and Code GK, and revises the draft AO to incorporate the results of this review.
5. In accordance with NASA FAR Supplement Part 1872.303 [paragraphs (b) and (c)] and an OSS-approved fundamental-dependency link with HOWI7100-I003, the Executive Director for Science selects NASA Headquarters personnel to review the draft AO in accordance with the subject matter of the AO (i.e., cognizant OSS personnel plus, at a minimum, Code IS, Code HS, and Code GK). The Executive Director for Science creates an AO Concurrence Sheet (*see sample Concurrence Sheet in Appendix E.3*) to document the results of this review, and provides the draft AO to each reviewer identified on the AO Concurrence Sheet.
6. If all reviewers of the draft AO have concurred upon it and have signed the AO Concurrence Sheet, proceed to Step #8. If any reviewer has non-concurred upon the draft AO, proceed to Step #7.
7. The Program Scientist revises the draft AO to address the issues identified via any non-concurrences received, and repeat the review cycle at Step #6.
8. If the Associate Administrator for Space Science approves and signs the AO and the NPG 7120.5 Certification document (in accordance with NASA FAR Supplement Part 1835.016 [paragraph (a)(iii)(A)], proceed to Step #10. If not, proceed to Step #9.
9. The Program Scientist revises the draft AO in accordance with the comments provided by the Associate Administrator for Space Science, and repeat the review cycle at Step #8.
10. In accordance with NASA FAR Supplement Part 1872.302 [paragraphs (b)(1) and (c)] and NASA FAR Supplement Part 1872.702 [paragraph (a)], the Code SP Program Support Specialist sends the *Federal Business Opportunities* (FBO) Notice and the NPG 7120.5

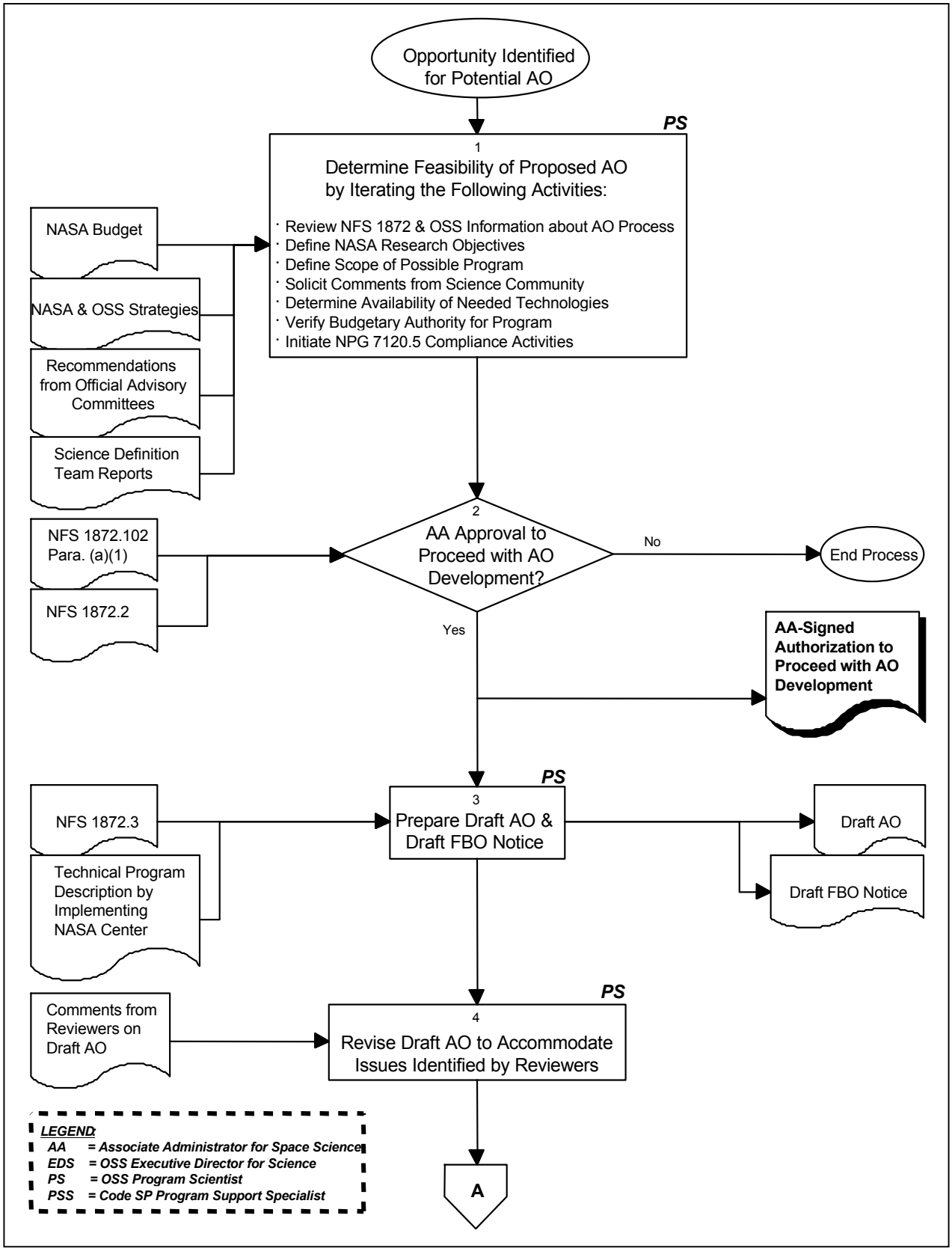


Figure F.1-1 Prepare AO Solicitation

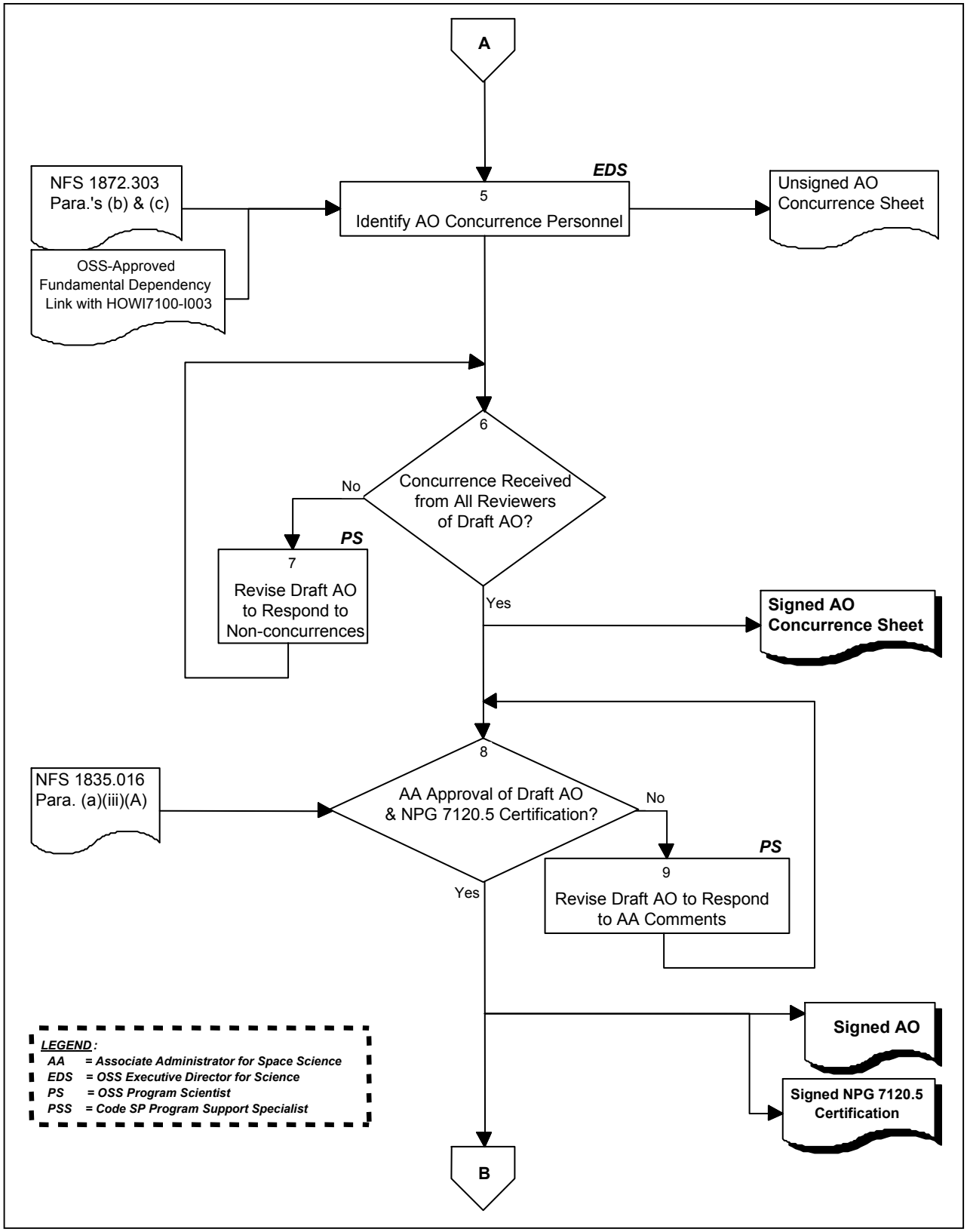


Figure F.1-2 Approve AO

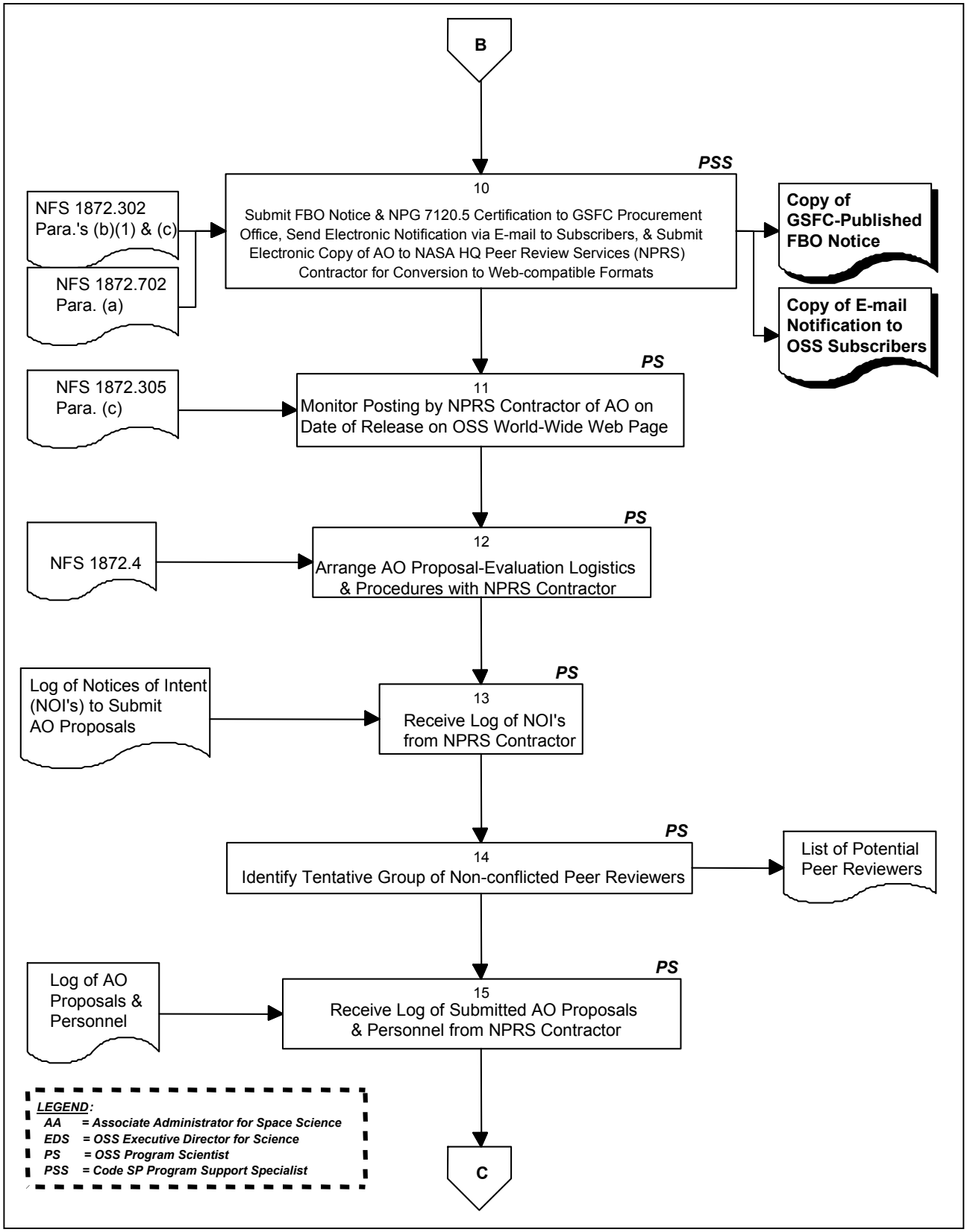


Figure F.1-3 Release AO

Certification document to the Goddard Space Flight Center (GSFC) Procurement Office, which then publicly announces the forthcoming AO via the FBO at least fifteen calendar days prior to formal release of the AO. The Program Support Specialist sends the notice through the OSS Electronic Notification System to all subscribers, and submits an electronic copy of the AO to the NASA Headquarters Peer Review Services (NPRS) Contractor for conversion into Web-compatible formats.

11. The NPRS Contractor posts the AO on its advertised date of release on the OSS World-Wide Web home page. The Program Scientist verifies compliance with this requirement and notifies the NPRS Contractor to correct any instances of noncompliance. This activity satisfies the requirements of NASA FAR Supplement Part 1872.305 [paragraph (c)].
12. The Program Scientist arranges with the NPRS Contractor the AO proposal-evaluation logistics and procedures (at a minimum, the timeline for activities, format of the peer-review forms, use of mail-in reviews, and details of logistics for the peer-review panels) in accordance with NASA FAR Supplement Part 1872.4.
13. The Program Scientist receives from the NPRS Contractor a log of Notices of Intent (NOI's) to submit AO proposals. OSS requests all interested proposers to submit NOI's. Although these NOI's are not mandatory, they facilitate OSS selection of non-conflicted peer reviewers of submitted proposals.
14. The Program Scientist prepares a list of a tentative group of non-conflicted Peer Reviewers of proposals that are expected to be submitted in response to the AO, based upon NOI's and upon research areas expected in proposals.
15. The Program Scientist receives from the NPRS Contractor a log of all submitted AO proposals and associated personnel.
16. If any of the AO proposals involve foreign participation, proceed to Step #16.1. If not, proceed to Step #17.

Code IS-Interface "Letter of Endorsement" Subprocess

16.1 In accordance with an OSS-approved fundamental-dependency link with HOWI7100-I003, the Program Scientist provides a list of all AO proposals with foreign participation and copies of the associated Letters of Endorsement (see NASA FAR Supplement Part 1872.705-2 [paragraph "Management Plan" (a)(3)(iii)]) to Code IS after the closing date of the AO (as specified in the AO's Summary of Solicitation).

16.2 If Code IS notifies the OSS Program Scientist that the Letters of Endorsement are acceptable, proceed to Step #16.4. If Code IS notifies the OSS Program Scientist that one or more of the Letters of Endorsement are unacceptable (in accordance with an OSS-approved fundamental-dependency link with HOWI7100-I003), proceed to Step #16.3.

16.3 The Program Scientist contacts the foreign-sponsor author of each Letter of Endorsement that is unacceptable to Code IS, negotiates receipt by OSS of a revised Letter of Endorsement that eliminates the deficiency(ies) identified by Code IS, and resubmits the revised Letter of Endorsement for review by Code IS at Step #16.1.

Code IS-Interface "No-Exchange-of-Funds" Subprocess

16.4 The Program Scientist reviews the AO proposals with foreign participation with respect to the NASA policy of "no exchange of funds" as stated in NPD 1360.2 [paragraph (1)(d)], NASA FAR Supplement Part 1835.016-70 [paragraphs (a)(1) and (b)], and NASA FAR Supplement Part 1872.705-2 [paragraph "Management Plan" (a)(3)(ii) and (b)(4)].

16.5 If an AO proposal with foreign participation meets the NASA policy of "no exchange of funds", proceed to Step #17. If not, proceed to Step #16.6.

16.6 In accordance with NASA FAR Supplement Part 1835.016-70 [paragraph

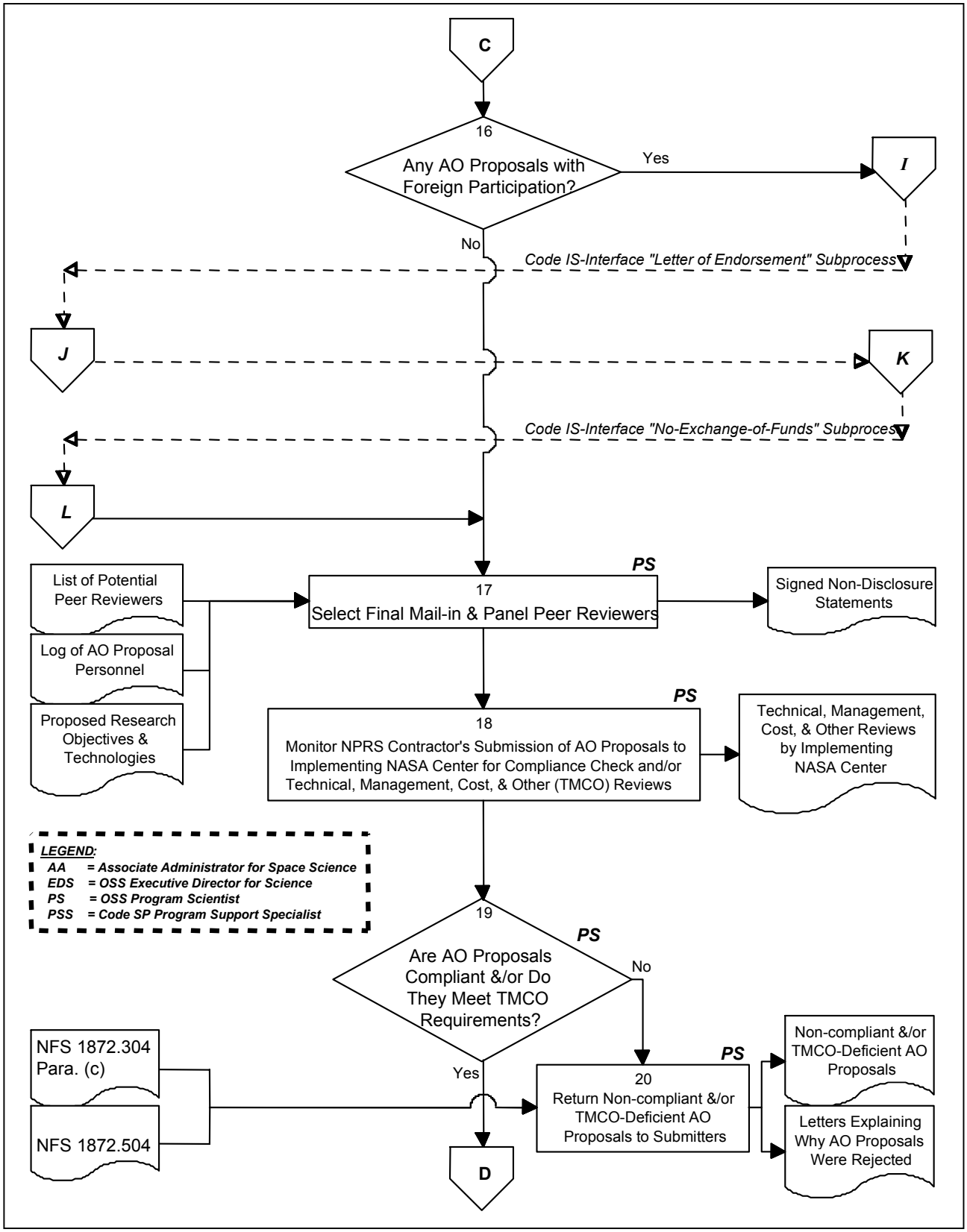


Figure F.1-4 Receive and Process AO Proposals

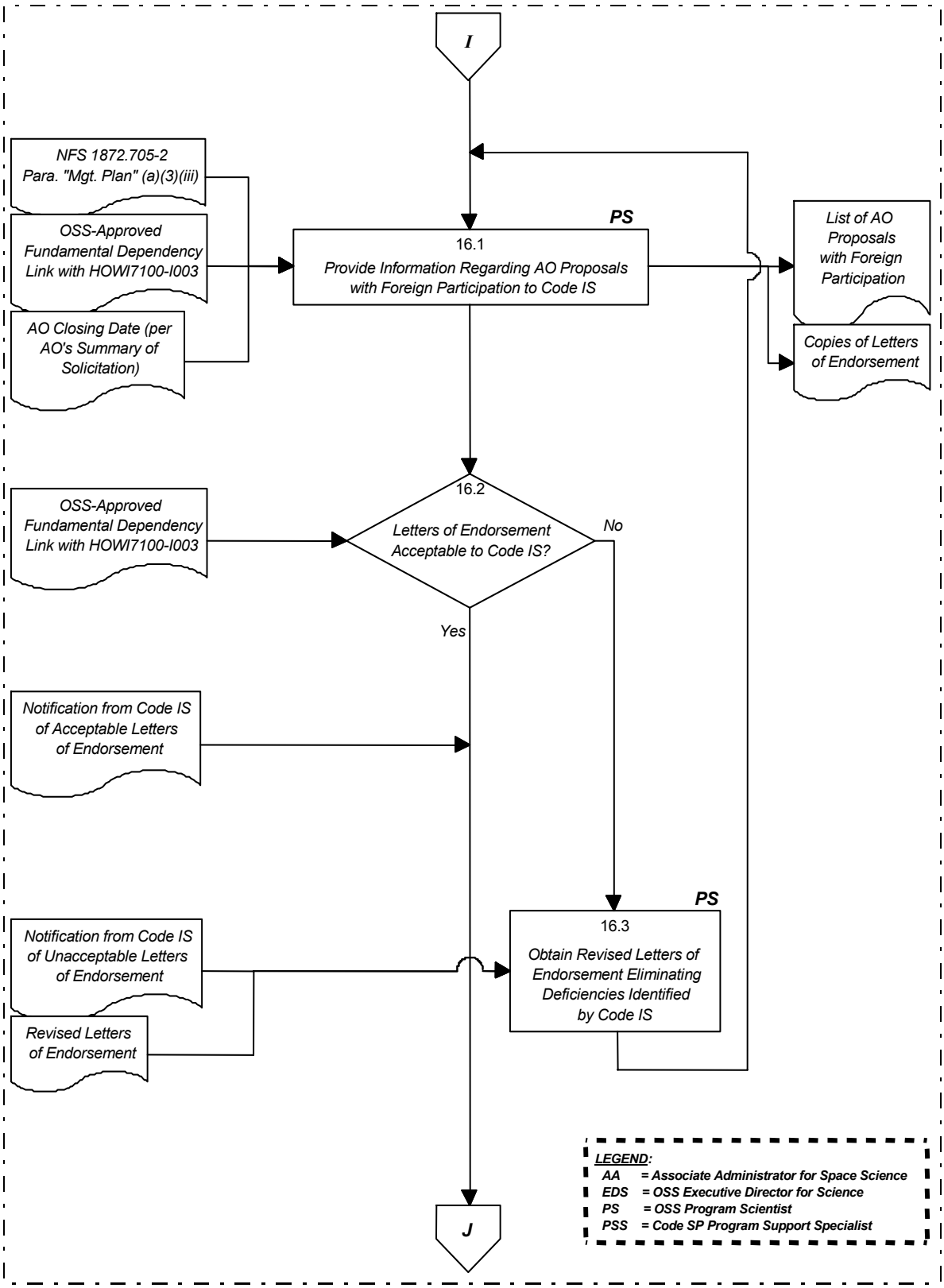


Figure F.1-5 Code IS-Interface "Letter of Endorsement" Subprocess

(b)(2)(i)], the Program Scientist evaluates whether AO proposals with foreign participation that do not meet the NASA policy of "no exchange of funds" merit further consideration.

16.7 If a non-compliant AO proposal with foreign participation merits further consideration, proceed to Step #16.8; if not, proceed to Step #16.10.

16.8 In accordance with NASA FAR Supplement Part 1835.016-70 [paragraphs (b)(2)(ii) and (b)(3)], the Program Scientist sends to Code IS (via Code HS) for review: (a) AO proposals with foreign participation that do not currently meet the NASA policy of "no exchange of funds" but nevertheless merit further consideration, and (b) background information (as specified by NASA FAR Supplement Part 1872.504 [paragraph (c)]) concerning the selected AO proposals with foreign participation.

16.9 If an AO proposal is approved by Code IS as being worthy of further consideration in spite of its not currently meeting the NASA policy of "no exchange of funds", proceed to Step #17. If not, proceed to Step #16.10.

16.10 In accordance with NASA FAR Supplement Part 1872.304 [paragraph (c)] and NASA FAR Supplement Part 1872.504, the Program Scientist returns rejected AO proposals with foreign participation to their submitters, with letters explaining why the proposals are unacceptable, and sends copies of the rejection letters to the cognizant foreign sponsors.

17. The Program Scientist selects the final mail-in reviewers and Peer Review panel members, based upon the list of potential Peer Reviewers created at Step #14, the log of AO proposal personnel, and the proposed research objectives and technologies, and obtains a signed Non-Disclosure Statement from each selected non-government reviewer (*see Appendix E.4 for a template*).

18. In accordance with the content of the received AO proposals, the Program Scientist monitors the NPRS Contractor's activity of sending the proposals to the implementing NASA Center to check on their compliance with requirements stated in the AO and/or to conduct Technical, Management, Cost and Other (TMCO) reviews of the proposals.

19. Based upon the results of the activity in Step #18, if the Program Scientist determines that an AO proposal is not compliant with the requirements stated in the AO or that it does not meet Technical, Management, Cost and Other (TMCO) requirements, proceed to Step #20. *("Other" includes education, outreach, small disadvantaged business and minority institution subcontracts, and technology infusion.)* For compliant and non-deficient AO proposals, proceed to Step #21.

20. In accordance with NASA FAR Supplement Part 1872.304 [paragraph (c)] and NASA FAR Supplement Part 1872.504, the Program Scientist returns non-compliant and/or TMCO-deficient AO proposals to their submitters, with letters explaining why the proposals are unacceptable. If a non-compliant or deficient AO proposal involves foreign participation, the Program Scientist sends a copy of the rejection letter to the cognizant foreign sponsor.

21. The Program Scientist monitors the NPRS Contractor's activity of sending copies of AO proposals to selected Peer Reviewers. Some of these reviewers may conduct a "remote" review and submit their evaluations via postal or electronic mail. Other reviewers will participate in an "on-site" Peer Review Panel.

22. The Program Scientist submits a proposed membership of the Categorization Subcommittee of the Space Science Steering Committee (SSSC) to the Chairman of the SSSC.

23. If the Chairman of the SSSC approves the proposed membership of the Categorization Subcommittee, proceed to Step #25. If not, proceed to Step #24.

24. The Program Scientist revises the proposed membership of the Categorization Subcommittee to address the issues identified by the Chairman of the SSSC, and repeats the

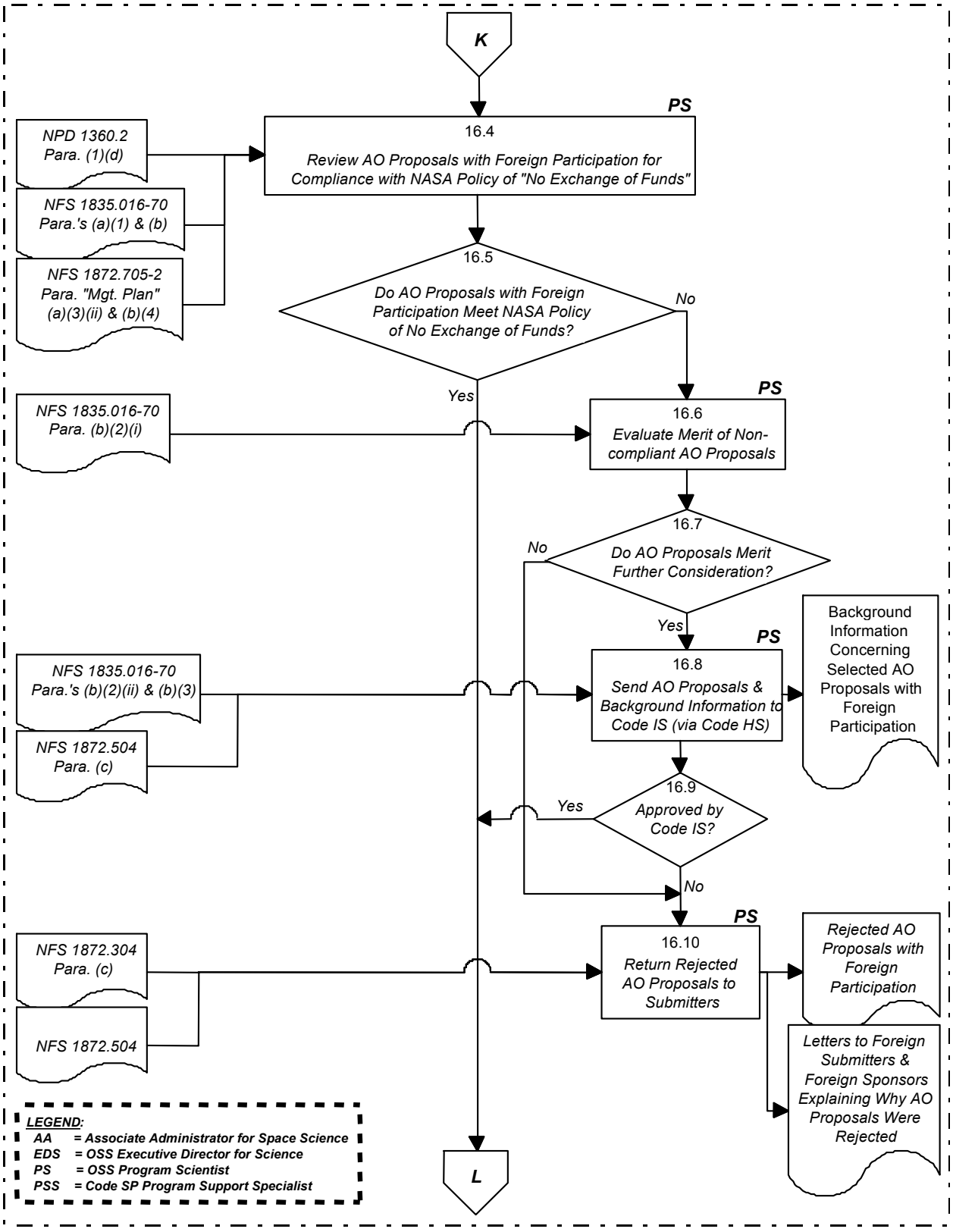


Figure F.1-6 Code IS-Interface "No-Exchange-of-Funds" Subprocess

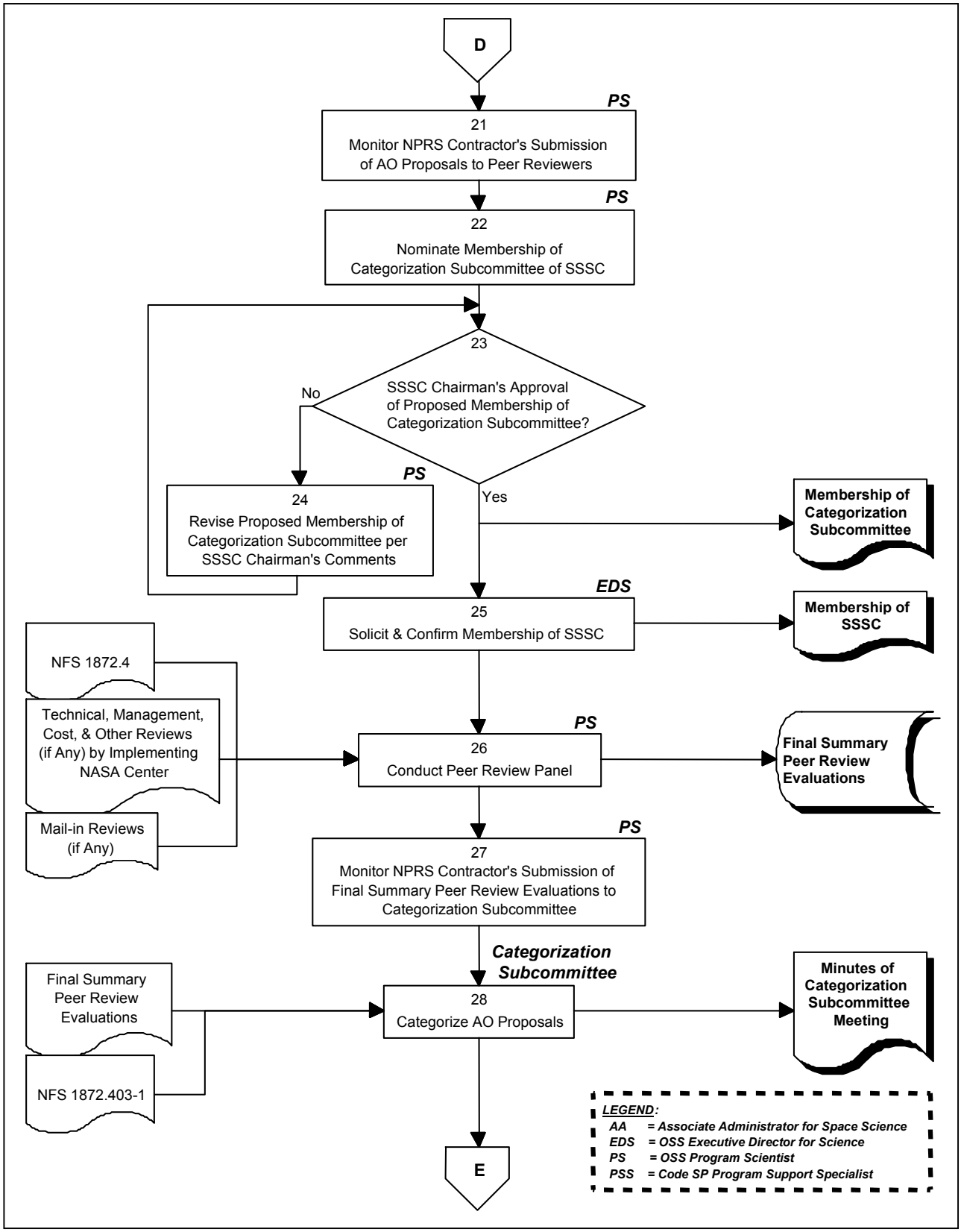


Figure F.1-7 Review and Categorize AO Proposals

review cycle at Step #23 listed in Section 7 of this Office Work Instruction (OWI).

25. The Executive Director for Science solicits and confirms the membership of the SSSC.

26. In accordance with NASA FAR Supplement Part 1872.4 and the AO proposal-evaluation logistics and procedures generated at Step #12, the Program Scientist conducts the Peer Review Panel to review and evaluate each AO proposal. Any TMCO review inputs (generated in Step #18) from the implementing NASA Center are examined by the Peer Review Panel. The Panel incorporates the inputs submitted from any mail-in reviewers into a set of final summary peer-review evaluations for the proposals. These evaluations are entered into the NASA Headquarters SYSEYFUS electronic database by the NPRS Contractor.

27. Not later than five calendar days prior to the Categorization Subcommittee meeting, the Program Scientist ensures that the NPRS Contractor provides the final summary peer review evaluations to the subcommittee members.

28. In accordance with NASA FAR Supplement Part 1872.403-1, the Categorization Subcommittee meets to categorize the AO proposals, based upon the final summary peer-review evaluations generated at Step #26. (*See Appendix E.5 for an example of the Categorization Subcommittee meeting structure.*) The quorum for a Categorization Subcommittee meeting is established by OSS to be five members, including the Chairperson.

29. In accordance with NASA FAR Supplement Part 1872.405 [paragraph (a)(1)], if the AO has been issued regarding an "optimum payload (for a single mission)", proceed to Step #30. If the AO has been issued regarding a "program of investigations", proceed to Step #31.

30. In accordance with NASA FAR Supplement Part 1872.405, the Program Scientist develops a recommendation for selection of AO proposal(s) regarding an "optimum payload (for a single mission)" in the competitive range (Categories I and II) based upon categorization, program objectives, budget, and schedule. For a selection of investigations for some specific research opportunity (e.g., a specific mission), the recommendation chooses from among the Category I and II proposals those that best satisfy the stated science objectives, as constrained by the available budget. For a program like Explorer or Discovery, this recommendation is the list of <u>all</u> Category I and II proposals.

31. In accordance with NASA FAR Supplement Part 1872.405, the Program Scientist prepares a list of all Category I and Category II AO proposals regarding a "program of investigations". This list serves as the Recommendation for Selection.

32. The Program Scientist monitors the NPRS Contractor's providing of a binder containing the following information to each member of the SSSC:

    - Final summary peer review evaluations
    - Minutes of the Categorization Subcommittee meeting
    - Recommendation for Selection
    - Draft notification letters of selected and non-selected AO proposals
    - Draft AO-selection press release
    - Draft AO proposal Selection Statement
    - Debriefing Plan

33. In accordance with NASA FAR Supplement Part 1872.406, the Program Scientist provides binders of AO information (including the final summary peer-review evaluations (generated at Step #26) and the Recommendation for Selection of AO proposal(s) (generated at Step #30 or Step #31)) to the SSSC.

    The SSSC serves as a review board to ensure the adequacy, completeness, and fairness of the review and that all regulations and procedures are followed in issuing the AO, conducting the peer review, and formulating a Recommendation for Selection. The SSSC ensures that the selection is based upon the merits of the submitted proposals and that the selection can withstand legal scrutiny. (*Further guidelines on SSSC responsibilities are*

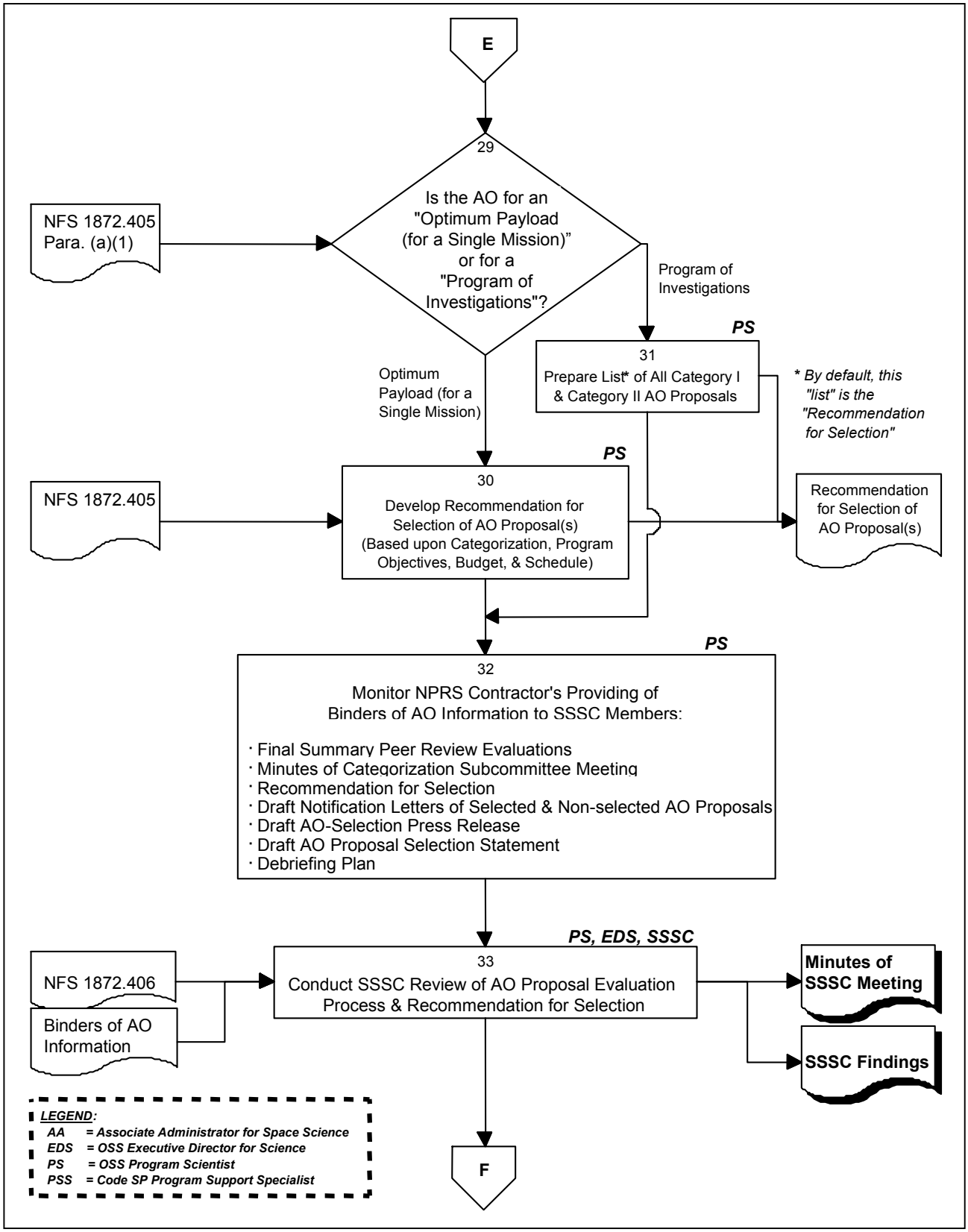


Figure F.1-8 Develop and Review AO Selection Recommendation

given in Appendix E.6, and a prototype meeting agenda in Appendix E.7.)

The OSS Executive Director for Science (unless otherwise delegated by the Associate Administrator for Space Science) is the Chairperson of the SSSC. A candidate membership list of OSS science personnel for the SSSC is developed by the SSSC Chairperson, from which the Chairperson seeks a quorum (set at five, including the Chairperson).

The Chairman of the SSSC produces a set of "findings" (which may include a Recommendation for Selection from the SSSC) that are then forwarded (with all supporting evaluation materials) to the Associate Administrator for Space Science.

34. If any of the AO proposals involve foreign participation, proceed to Step #35. If not, proceed to Step #38.

35. The Program Scientist provides the Recommendation for Selection and the findings of the SSSC review of the AO proposals to Code IS.

36. If Code IS concurs upon the Recommendation for Selection and the findings of the SSSC review, proceed to Step #38. If not, proceed to Step #37.

37. The Program Scientist resolves the issues identified by Code IS, and repeats the review cycle at Step #35.

38. The Program Scientist provides the binders of AO information (used by the SSSC members and augmented with the findings of the SSSC review of AO proposals) to the Associate Administrator for Space Science and any designated selection advisors.

39. Based upon the final summary peer-review evaluations, the minutes of the Categorization Subcommittee meeting, the SSSC findings, and inputs from other OSS personnel selected by the Associate Administrator for Space Science as desired, the Associate Administrator for Space Science selects the winning AO proposal(s) and creates an AO Proposal Selection Statement in accordance with NASA FAR Supplement Part 1872.503. (The AO Proposal Selection Statement is the only artifact of this process that must be available to the public. All other artifacts are "predecisional" and therefore do not need to be released to the public.)

40. The Associate Administrator for Space Science informs the NASA Administrator of the planned AO proposal selection prior to public announcement of the selection.

41. If any of the selected AO proposals involve foreign participation, proceed to Step #41.1. If not, proceed to Step #42.

Code IS-Interface "Draft Notification Letter" Subprocess

41.1 In accordance with NASA FAR Supplement Part 1835.016-70 [paragraphs (b)(2)(iii) and (b)(3)], NASA FAR Supplement Part 1872.304 [paragraph (c)], NASA FAR Supplement Part 1872.504, and an OSS-approved fundamental-dependency link with HOWI7100-I003, the Program Scientist provides draft OSS notification letters of selected and non-selected AO proposals with foreign participation to Code IS (via Code HS) for review prior to sending the letters to the cognizant proposers and their foreign sponsors.

41.2 If Code IS concurs with the content of draft OSS notification letters of selected and non-selected AO proposals with foreign participation, proceed to Step #42. If not, proceed to Step #41.3.

41.3 The Program Scientist revises the draft OSS notification letters of selected and non-selected AO proposals with foreign participation in accordance with issues raised by Code IS via its non-concurrence, and repeat the review cycle at Step #41.1.

42. In accordance with NASA FAR Supplement Part 1872.304 [paragraph (c)], NASA FAR Supplement Part 1872.504, and NASA FAR Supplement Part 1872.505, the Program Scientist prepares and the Associate Administrator for Space Science signs the final notification letters of selected and non-selected AO proposals. These letters either include an

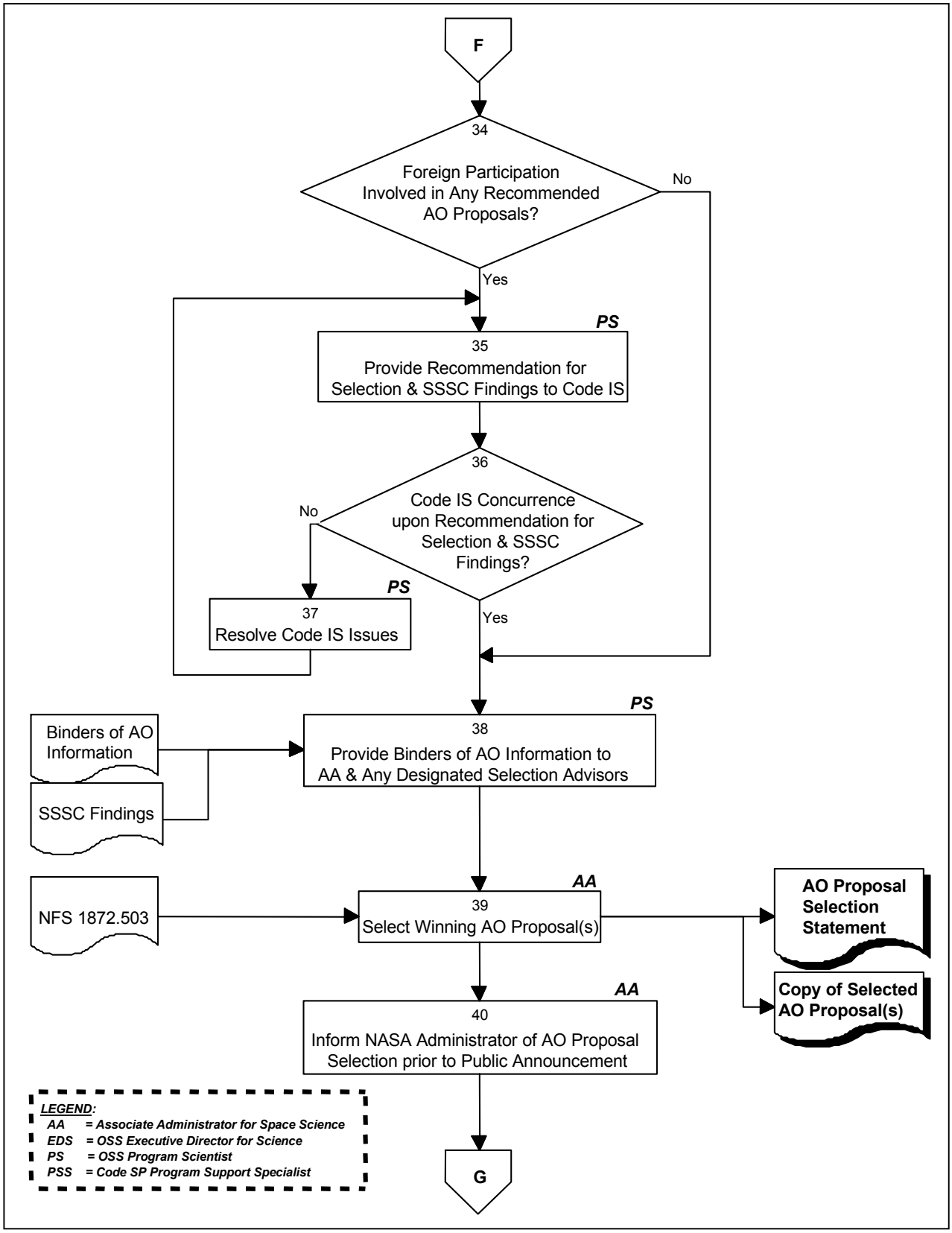


Figure F.1-9 Selection of Winning AO Proposals

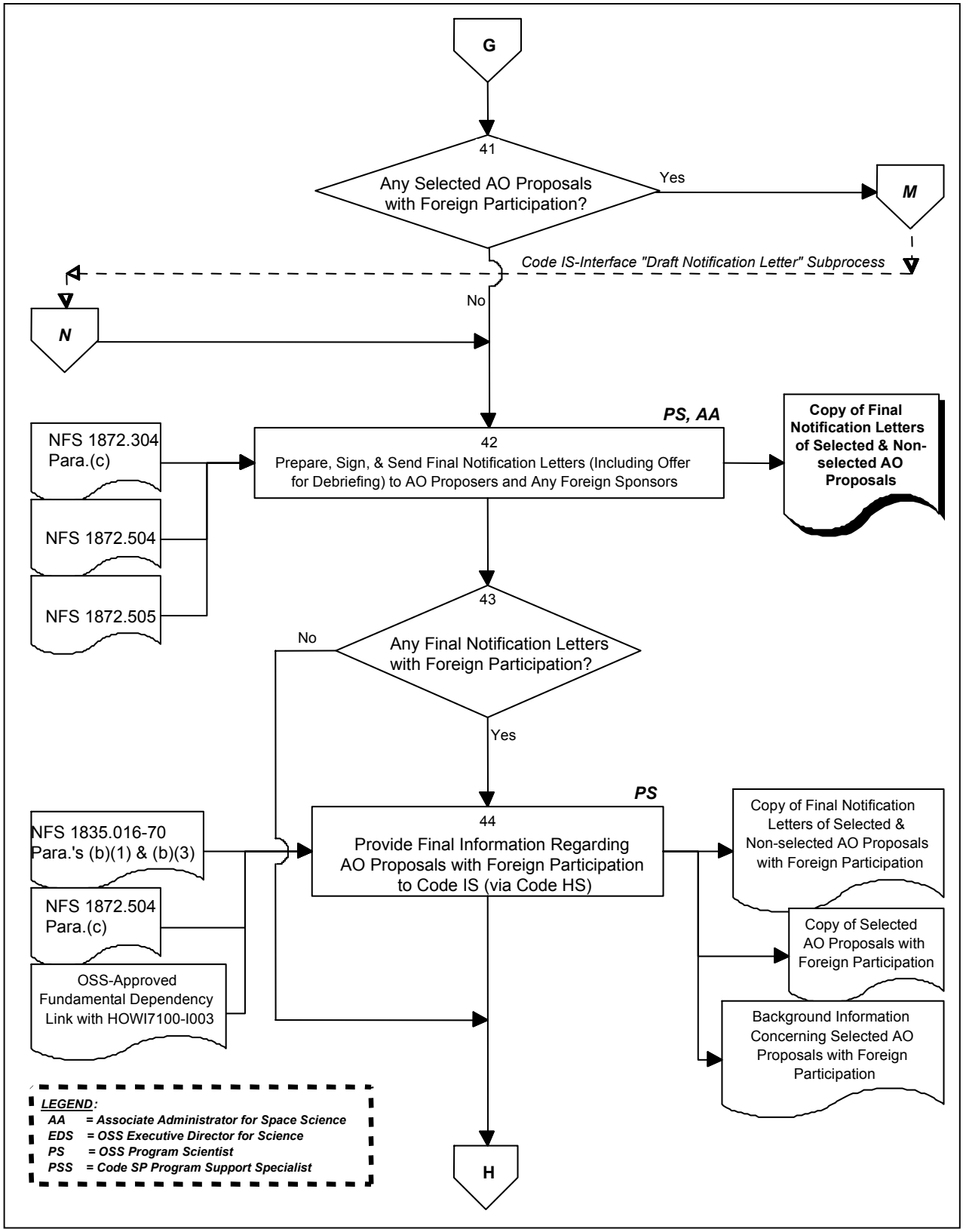


Figure F.1-10 Prepare AO Proposal Selection Notification

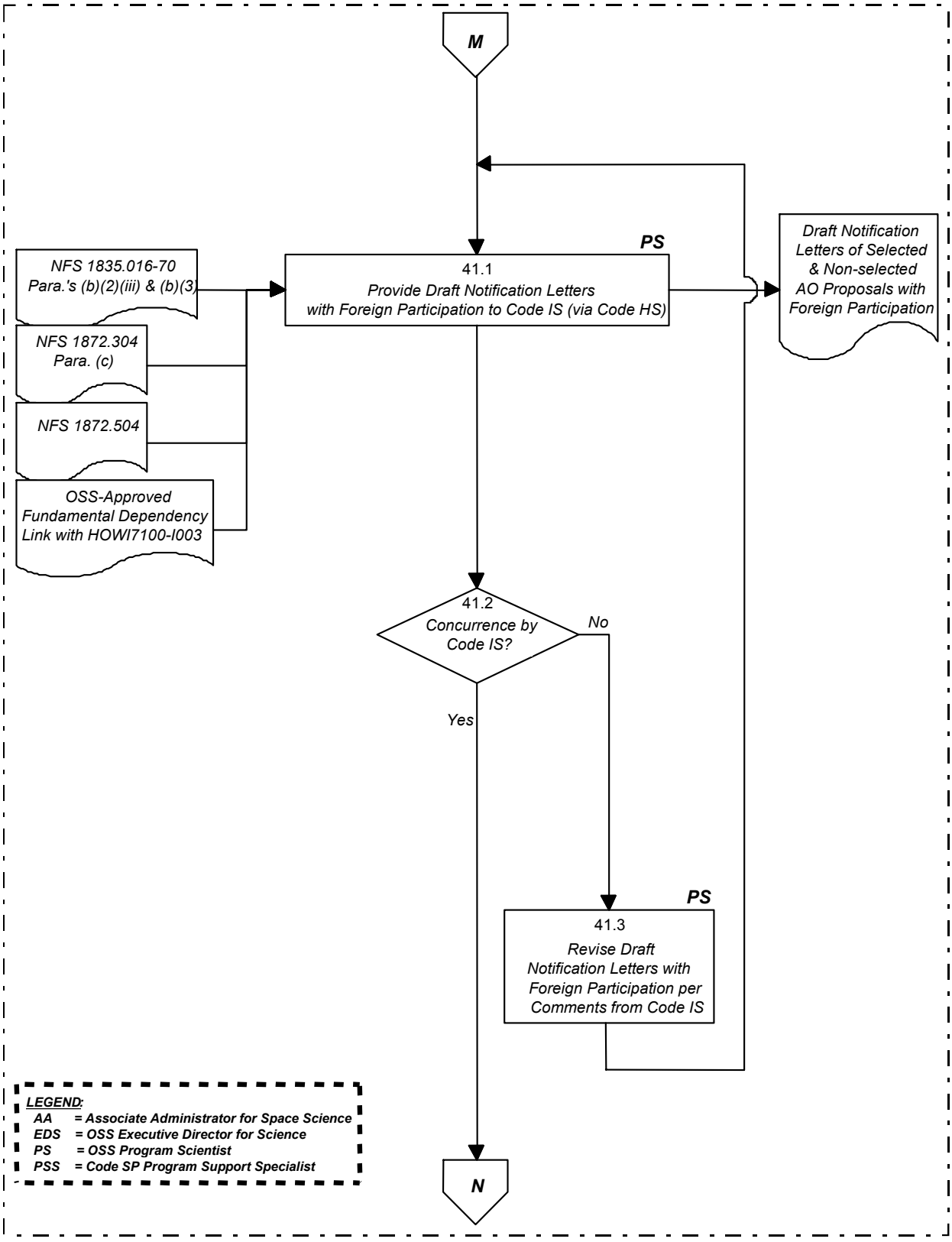


Figure F.1-11 Code IS-Interface "Draft Notification Letter" Subprocess

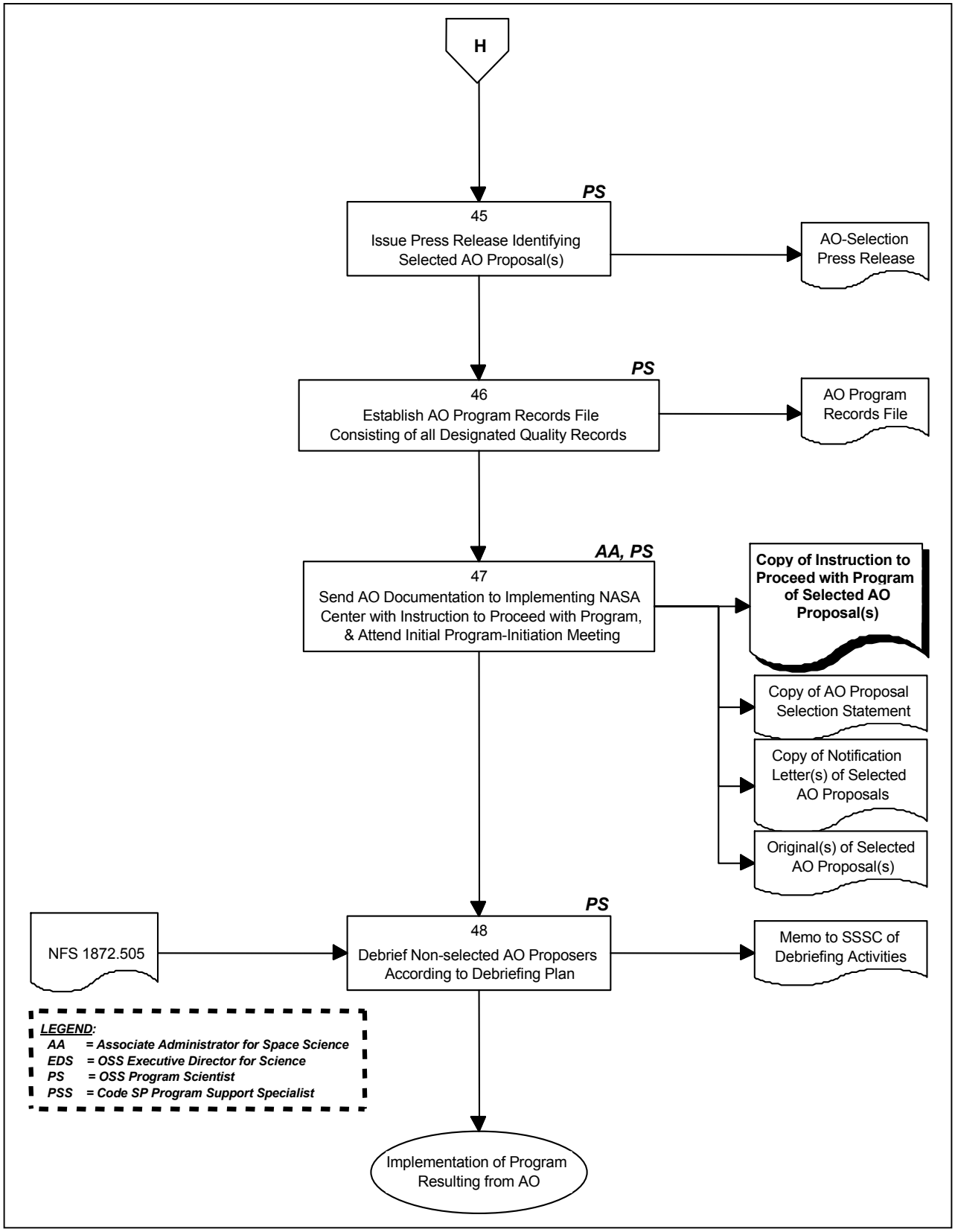


Figure F.1-12 Complete AO Process and Initiate Selected Program

offer to provide a debriefing of the reasons why a given proposal was selected or not selected, or incorporate a copy of the final summary peer-review evaluation for the proposal. The Program Scientist sends one of these letters to each AO proposal submitter (and to the foreign sponsor of any AO proposal with foreign participation).

43. If any OSS final notification letters of selected and non-selected AO proposals involve proposals with foreign participation, proceed to Step #44. If not, proceed to Step #45.

44. In accordance with NASA FAR Supplement Part 1835.016-70 [paragraphs (b)(1) and (b)(3)], NASA FAR Supplement Part 1872.504 [paragraph (c)], and an OSS-approved fundamental-dependency link with HOWI7100-I003, the Program Scientist provides to Code IS (via Code HS) a copy of OSS final notification letters of selected and non-selected AO proposals with foreign participation, a copy of selected AO proposals with foreign participation, and background information concerning the selected AO proposals with foreign participation.

45. The Program Scientist issues a Press Release identifying the selected AO proposal(s). (*See Appendix E.9 for a sample sequence of events in accomplishing this sensitive activity.)*

46. The Program Scientist establishes an AO Program Records File consisting of all AO-related quality records listed in Section 7 of this Office Work Instruction (OWI).

47. The Associate Administrator for Space Science sends an instruction to proceed with the program of the selected AO proposal(s), and the Program Scientist sends a copy of the AO Proposal Selection Statement, a copy of the Notification Letter(s) of Selected AO Proposal(s), and the original(s) of the selected AO proposal(s) to the NASA Center responsible for implementing the program.

    The Program Scientist attends the initial all-hands program-initiation meeting to transfer responsibility to the Program Office for implementing the AO.

48. In response to requests received from non-selected AO proposers, the Program Scientist provides a debriefing to each of them of the reasons for their not being selected, in accordance with NASA FAR Supplement Part 1872.505 and the Debriefing Plan.

    This process is concluded by the implementation of a new program resulting from an AO.

APPENDIX F.2 THE NASA RESEARCH ANNOUNCEMENT (NRA) PROCESS

The process by which the OSS generates and issues NRA's, reviews and selects submitted proposals, and monitors and manages the resulting financial awards through to the end of their periods of performance is illustrated by Figures F.2-1 through F.2-11 below (from HOWI8310-S018) and the following procedure (numbered steps refer to the figures). (To ensure use of the most current OWI, always check http://www.hq.nasa.gov/hqiso9000/library.htm.)

1. The Program Scientist or Program Executive determines the feasibility of a proposed NRA by iterating the following activities:
   - Review NASA FAR Supplement Part 1835 & OSS information about the NRA process
   - Define NASA research objectives
   - Define the scope of a possible program
   - Solicit comments from the science community
   - Determine the availability of needed technologies
   - Verify budgetary authority for the program
   - Initiate NPG 7120.5 compliance activities
   - Identify the Designated Selecting Official (per consultation with the Associate Administrator for Space Science, in accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (b)(1)])

   [NOTE: These activities occur in parallel in an iterative manner.]

2. In accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (b)(4)], if the Designated Selecting Official (who may be the cognizant Director of Code SE, Code SS, or Code SZ) signs the authorization to proceed with development of the NRA (which is created by the Program Scientist or the Program Executive) and designates the cognizant Program Scientist (for science-related research) or Program Executive (for technology-related research), proceed to Step #3. If authority to proceed is denied, end the process.

3. In accordance with NASA FAR Supplement Part 1835.016-71 [paragraphs (a), (b)(2), and (c)] and the "NASA Guidebook for Proposers Responding to a NASA Research Announcement (NRA)", the Program Scientist or Program Executive prepares the draft NRA and the draft notice summarizing the purpose and content of the NRA for publication via the *Federal Business Opportunities* (FBO).

4. In accordance with the content of the draft NRA, the Program Scientist or Program Executive solicits comments and recommendations from cognizant personnel within Code S (at a minimum, the OSS Executive Director for Science), Code IS, Code HS, and Code GK, and revises the draft NRA to incorporate the results of this review.

5. In accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (b)(1)] and an OSS-approved fundamental-dependency link with HOWI7100-I003, the Executive Director for Science selects NASA Headquarters personnel to review the draft NRA in accordance with the subject matter of the NRA (i.e., cognizant OSS personnel plus, at a minimum, Code IS, Code HS, and Code GK). The Executive Director for Science creates an NRA Concurrence Sheet (*see sample Concurrence Sheet in Appendix E.3*) to document the results of this review, and provides the draft NRA to each reviewer identified on the NRA Concurrence Sheet.

6. If all reviewers of the draft NRA have concurred upon it and have signed the NRA Concurrence Sheet, proceed to Step #8. If any reviewer has non-concurred upon the draft NRA, proceed to Step #7.

7. The Program Scientist or Program Executive revises the draft NRA to address the issues identified via any non-concurrences received, and repeats the review cycle at Step #6.

8. In accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (b)(1)] and

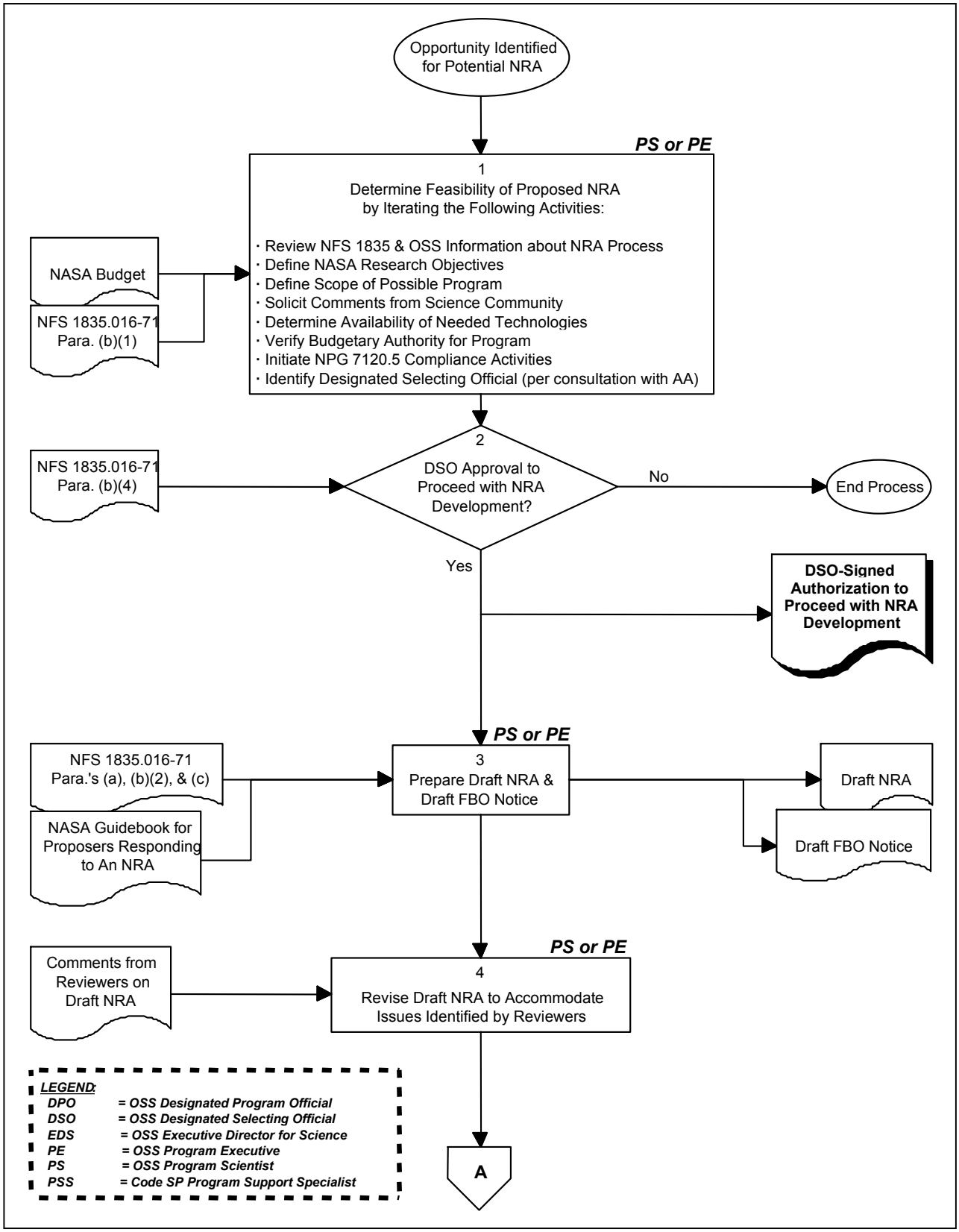


Figure F.2-1 Prepare NRA Solicitation

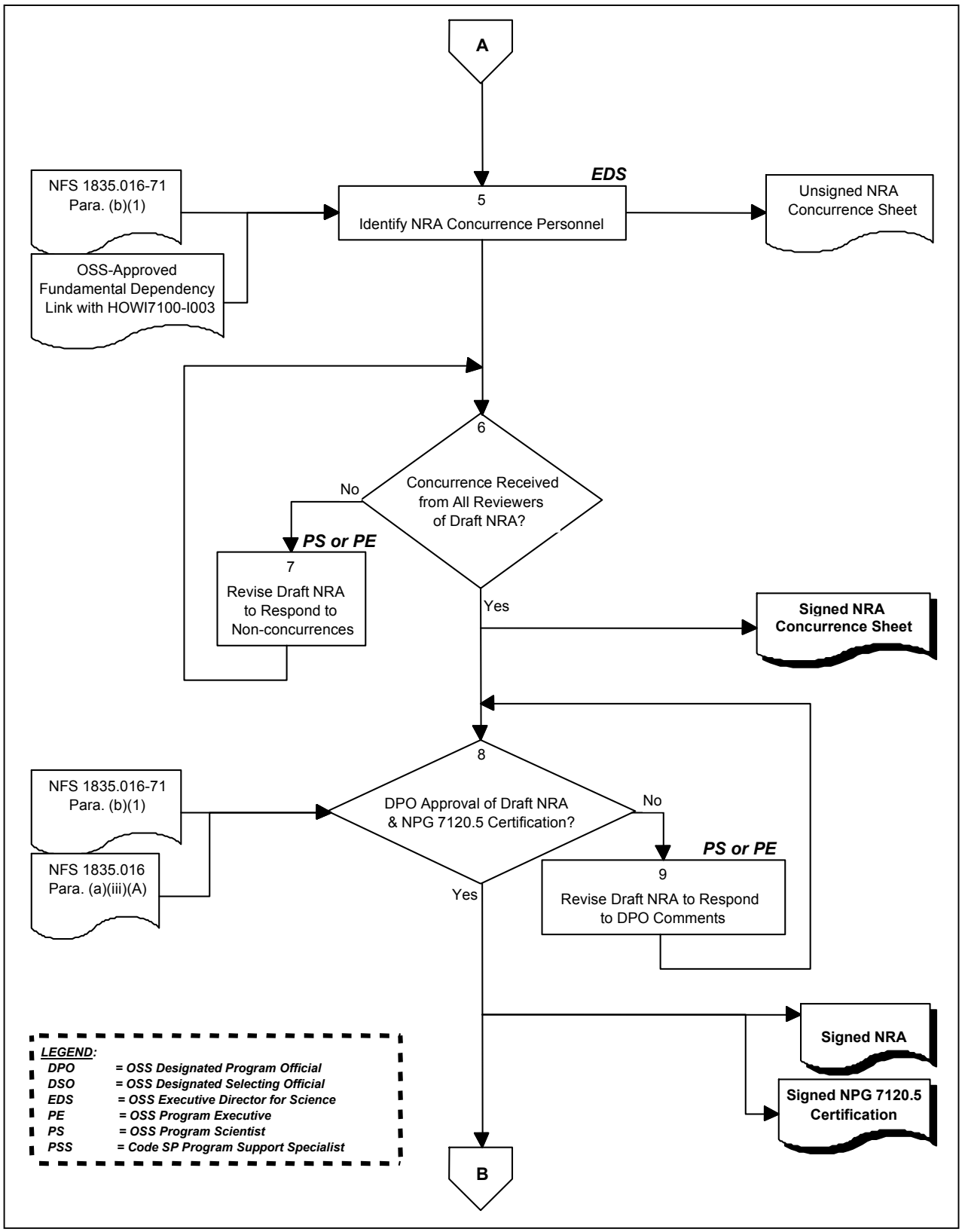


Figure F.2-2 Approve NRA

NASA FAR Supplement Part 1835.016 [paragraph (a)(iii)(A)], if the Designated Program Official (e.g., the Associate Administrator for Space Science or the designated cognizant Director of Code SE, Code SS, or Code SZ) approves and signs the NRA and the NPG 7120.5 Certification document, proceed to Step #10. If not, proceed to Step #9.

9. The Program Scientist or Program Executive revises the draft NRA in accordance with the comments provided by the Designated Program Official, and repeats the review cycle at Step #8.

10. The Code SP Program Support Specialist sends the *Federal Business Opportunities* (FBO) Notice and the NPG 7120.5 Certification document to the Goddard Space Flight Center (GSFC) Procurement Office, which then publicly announces the forthcoming NRA via the FBO at least fifteen calendar days prior to formal release of the NRA. The Program Support Specialist sends the notice through the OSS Electronic Notification System to all subscribers, and submits an electronic copy of the NRA to the NASA Headquarters Peer Review Services (NPRS) Contractor for conversion into Web-compatible formats.

11. The NPRS Contractor posts the NRA on its advertised date of release on the OSS World-Wide Web home page. The Program Scientist or Program Executive verifies compliance with this requirement and notifies the NPRS Contractor to correct any instances of non-compliance.

12. The Program Scientist or Program Executive arranges with the NPRS Contractor the NRA proposal-evaluation logistics and procedures (at a minimum, the timeline for activities, format of the peer-review forms, use of mail-in reviews, and details of logistics for the peer-review panels) in accordance with NASA FAR Supplement Part 1852.235-72 [paragraph (j)] and with Appendix C of the "NASA Guidebook for Proposers Responding to a NASA Research Announcement (NRA)".

13. The Program Scientist or Program Executive receives from the NPRS Contractor a log of Notices of Intent (NOI's) to submit NRA proposals. OSS requests all interested proposers to submit NOI's. Although these NOI's are not mandatory, they facilitate OSS selection of non-conflicted peer reviewers of submitted proposals.

14. The Program Scientist or Program Executive prepares a list of a tentative group of non-conflicted Peer Reviewers of proposals that are expected to be submitted in response to the NRA, based upon NOI's and upon research areas expected in proposals.

15. The Program Scientist or Program Executive receives from the NPRS Contractor a log of all submitted NRA proposals and associated personnel.

16. If any of the NRA proposals involve foreign participation, proceed to Step #16.1. If not, proceed to Step #17.

Code IS-Interface "Letter of Endorsement" Subprocess

16.1 In accordance with an OSS-approved fundamental-dependency link with HOWI7100-I003, the Program Scientist or Program Executive provides a list of all NRA proposals with foreign participation and copies of the associated Letters of Endorsement to Code IS after the closing date of the NRA (as specified in the NRA's Summary of Solicitation).

16.2 If Code IS notifies the OSS Program Scientist or Program Executive that the Letters of Endorsement are acceptable, proceed to Step #16.4. If Code IS notifies the OSS Program Scientist or Program Executive that one or more of the Letters of Endorsement are unacceptable (in accordance with an OSS-approved fundamental-dependency link with HOWI7100-I003), proceed to Step #16.3.

16.3 The Program Scientist or Program Executive contacts the foreign-sponsor author of each Letter of Endorsement that is unacceptable to Code IS, negotiates receipt by OSS of a revised Letter of Endorsement that eliminates the deficiency(ies) identified by Code IS, and

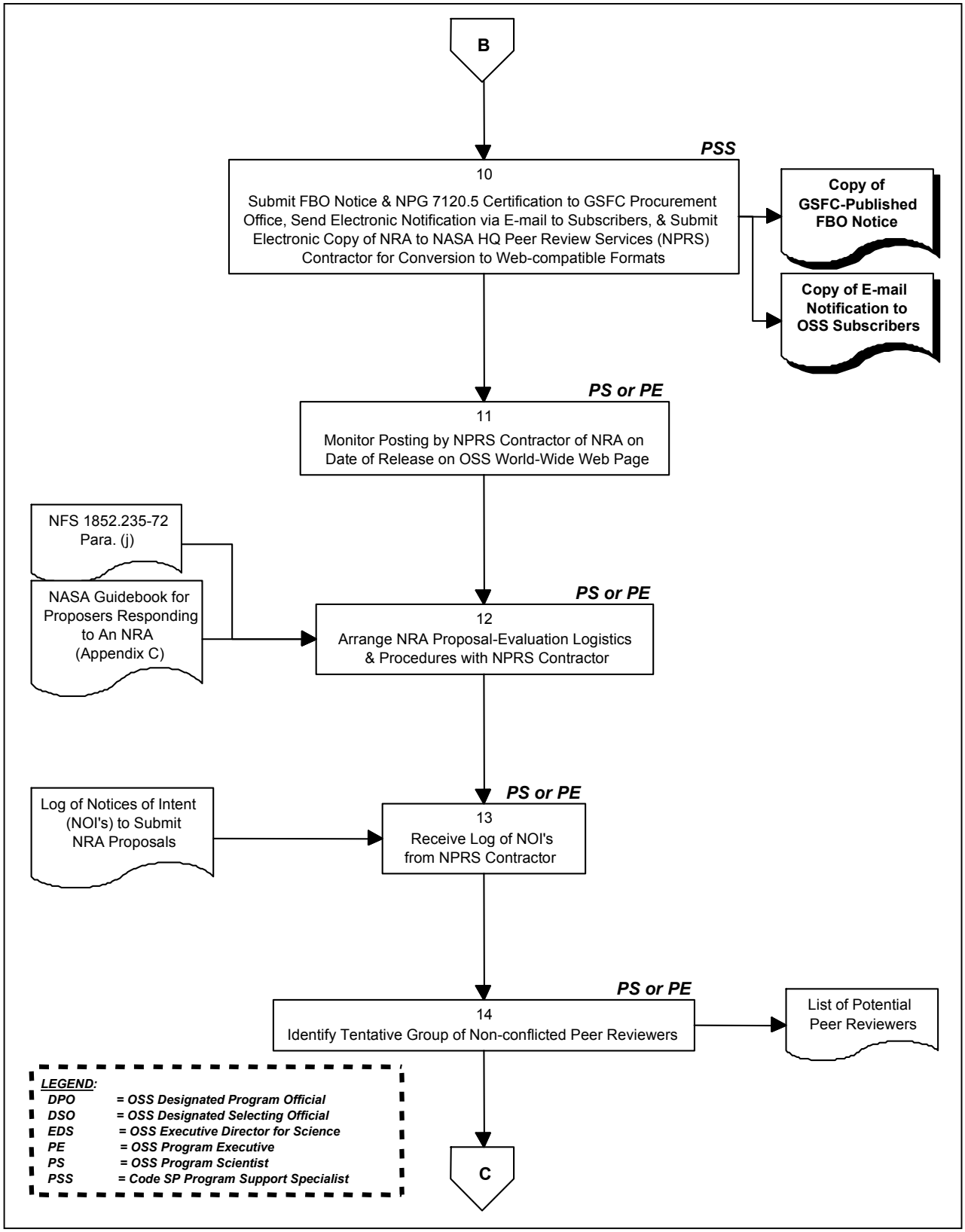


Figure F.2-3 Release NRA

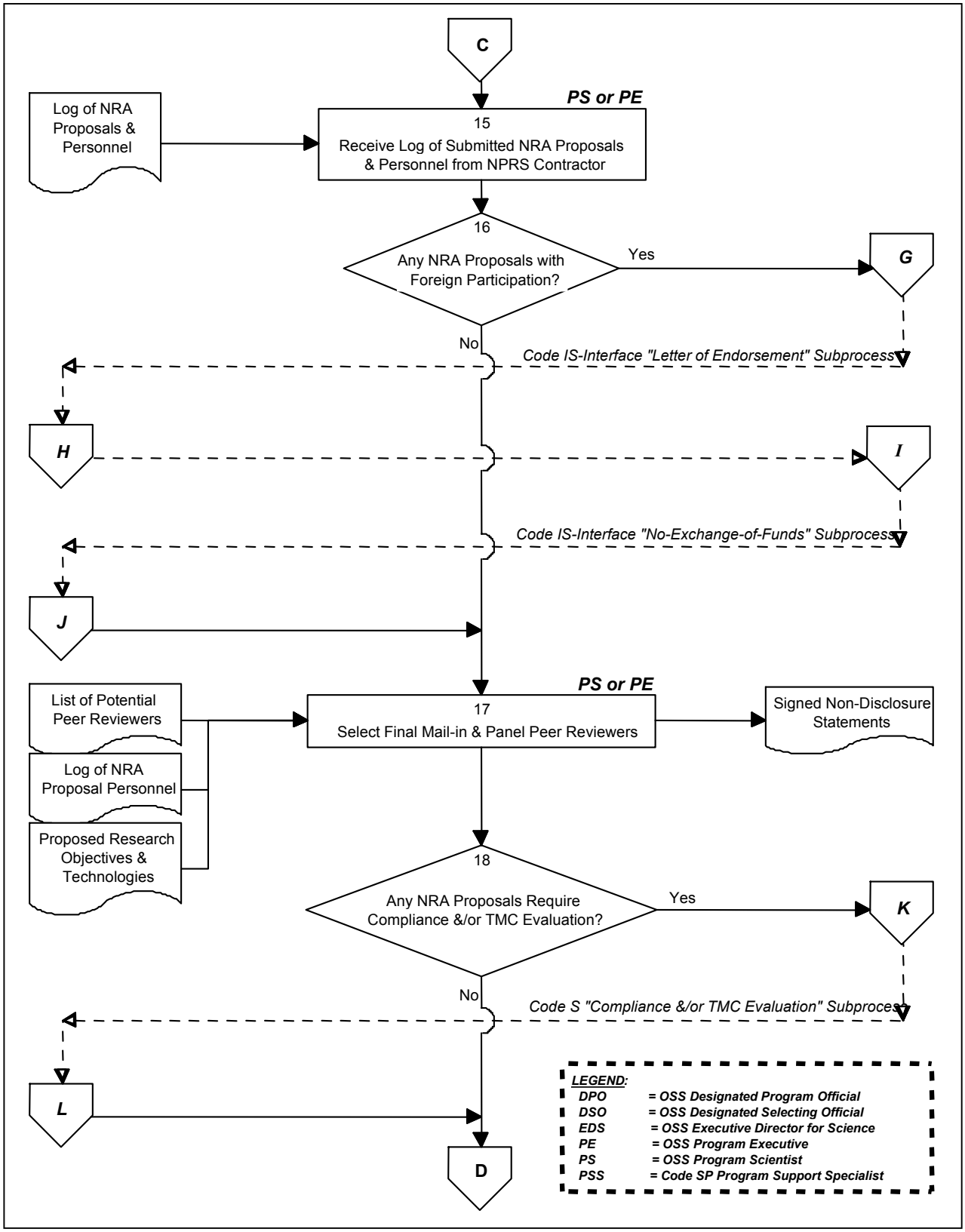


Figure F.2-4 Receive and Process NRA Proposals

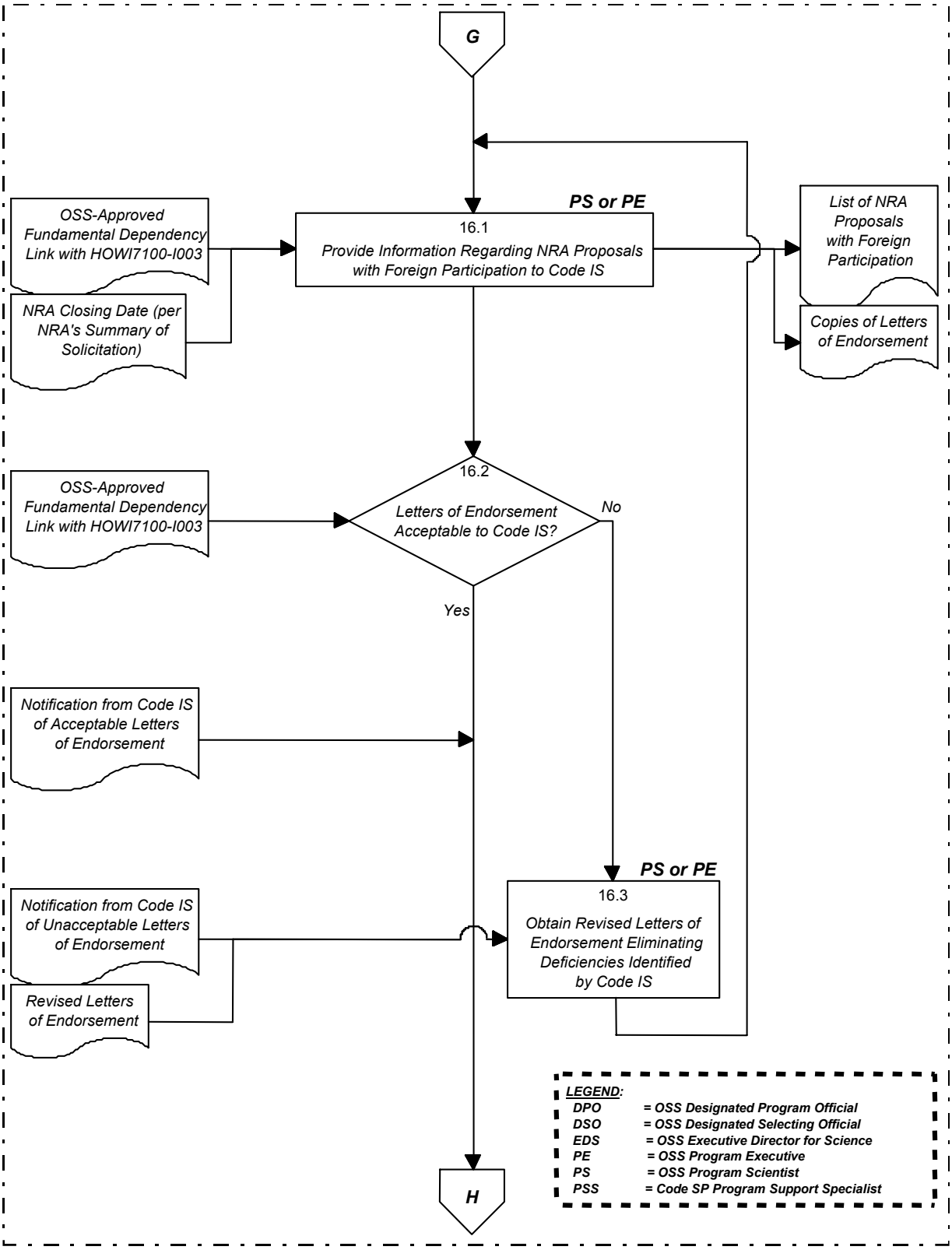


Figure F.2-5 Code IS-Interface "Letter of Endorsement" Subprocess

resubmits the revised Letter of Endorsement for review by Code IS at Step #16.1.

Code IS-Interface "No-Exchange-of-Funds" Subprocess

16.4 The Program Scientist or Program Executive reviews the NRA proposals with foreign participation for compliance with the NASA policy of "no exchange of funds" as stated in NPD 1360.2 [paragraph (1)(d)], NASA FAR Supplement Part 1835.016-70 [paragraphs (a)(1) and (b)], NASA FAR Supplement Part 1852.235-72 [paragraphs (c)(8)(iv) and (l)(1)], and NASA Procurement Notice 97-34.

16.5 If an NRA proposal with foreign participation meets the NASA policy of "no exchange of funds", proceed to Step #17. If not, proceed to Step #16.6.

16.6 In accordance with NASA FAR Supplement Part 1835.016-70 [paragraph (b)(2)(I)], the Program Scientist or Program Executive evaluates whether NRA proposals with foreign participation that do not meet the NASA policy of "no exchange of funds" merit further consideration.

16.7 If a non-compliant NRA proposal with foreign participation merits further consideration, proceed to Step #16.8; if not, proceed to Step #16.10.

16.8 In accordance with NASA FAR Supplement Part 1835.016-70 [paragraphs (b)(2)(ii) and (b)(3)], the Program Scientist or Program Executive sends to Code IS (via Code HS) for review: (a) NRA proposals with foreign participation that do not currently meet the NASA policy of "no exchange of funds" but nevertheless merit further consideration, and (b) background information concerning the selected NRA proposals with foreign participation.

16.9 If an NRA proposal is approved by Code IS as being worthy of further consideration in spite of its not currently meeting the NASA policy of "no exchange of funds", proceed to Step #17. If not, proceed to Step #16.10.

16.10 In accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (d)(7)] and NASA FAR Supplement Part 1852.235-72 [paragraphs (k)(1) and (l)(3)], the Program Scientist or Program Executive returns rejected NRA proposals with foreign participation to their submitters, with letters explaining why the proposals are unacceptable, and sends copies of the rejection letters to the cognizant foreign sponsors.

17. The Program Scientist or Program Executive selects the final mail-in reviewers and Peer Review panel members, based upon the list of potential Peer Reviewers created at Step #14, the log of NRA proposal personnel, and the proposed research objectives and technologies. The Program Scientist or Program Executive obtains a signed Non-Disclosure Statement from each selected reviewer (*see Appendix E.4 for template*).

18. If any NRA proposals require compliance and/or Technical, Management, Cost and Other (TMCO) evaluation, proceed to Step #18.1. If not, proceed to Step #19.

Code S "Compliance &/or TMCO Evaluation" Subprocess

18.1 In accordance with the content of the received NRA proposals, the Program Scientist or Program Executive monitors the NPRS Contractor's activity of sending the proposals to a NASA Center to check on their compliance with requirements stated in the NRA and/or to conduct TMCO reviews of the proposals.

18.2 Based upon the results of the activity in Step #18.1, if the Program Scientist or Program Executive determines that an NRA proposal is not compliant with the requirements stated in the NRA or that it does not meet TMCO requirements, proceed to Step #18.3. For compliant and non-deficient NRA proposals, proceed to Step #19.

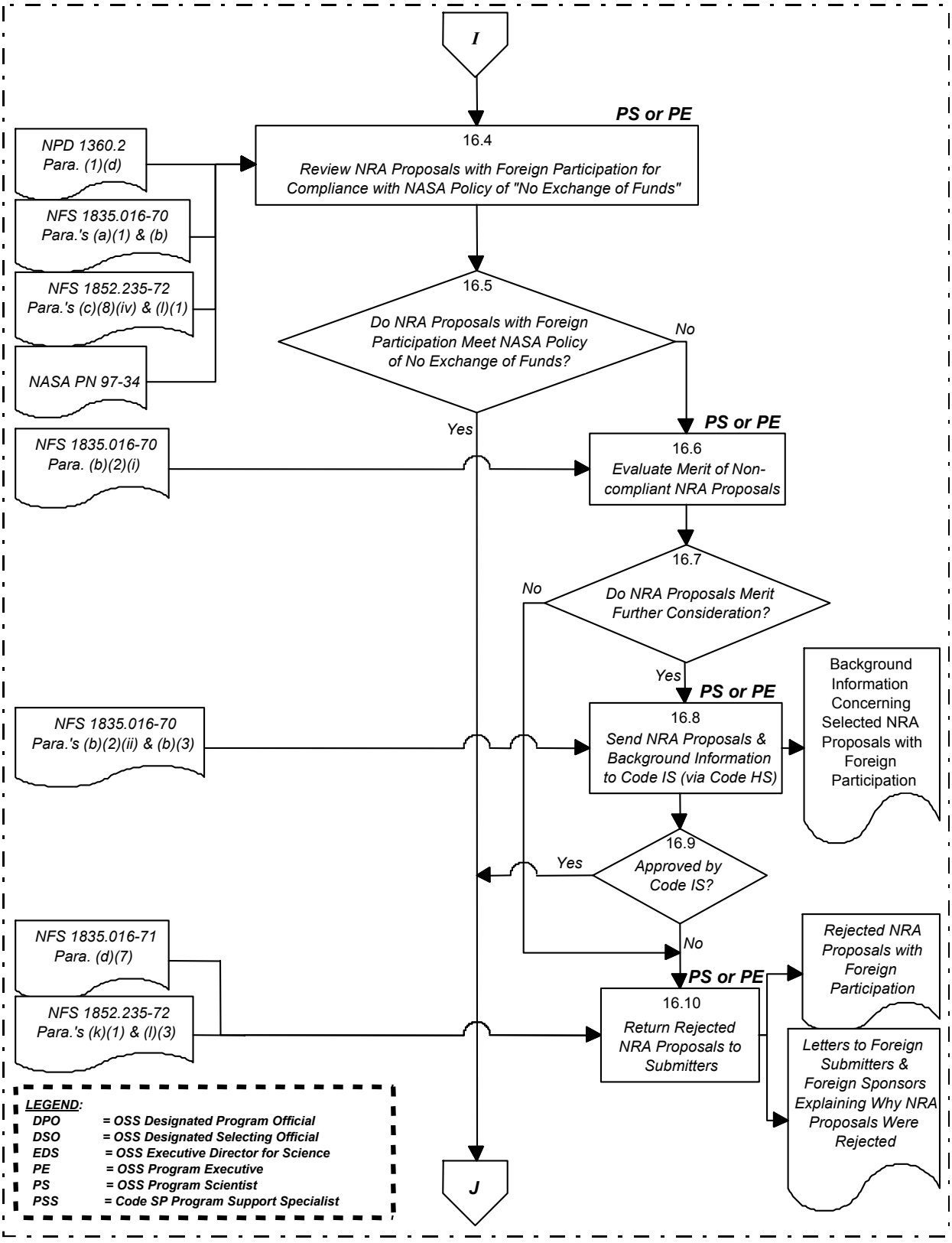


Figure F.2-6 Code IS-Interface "No-Exchange-of-Funds" Subprocess

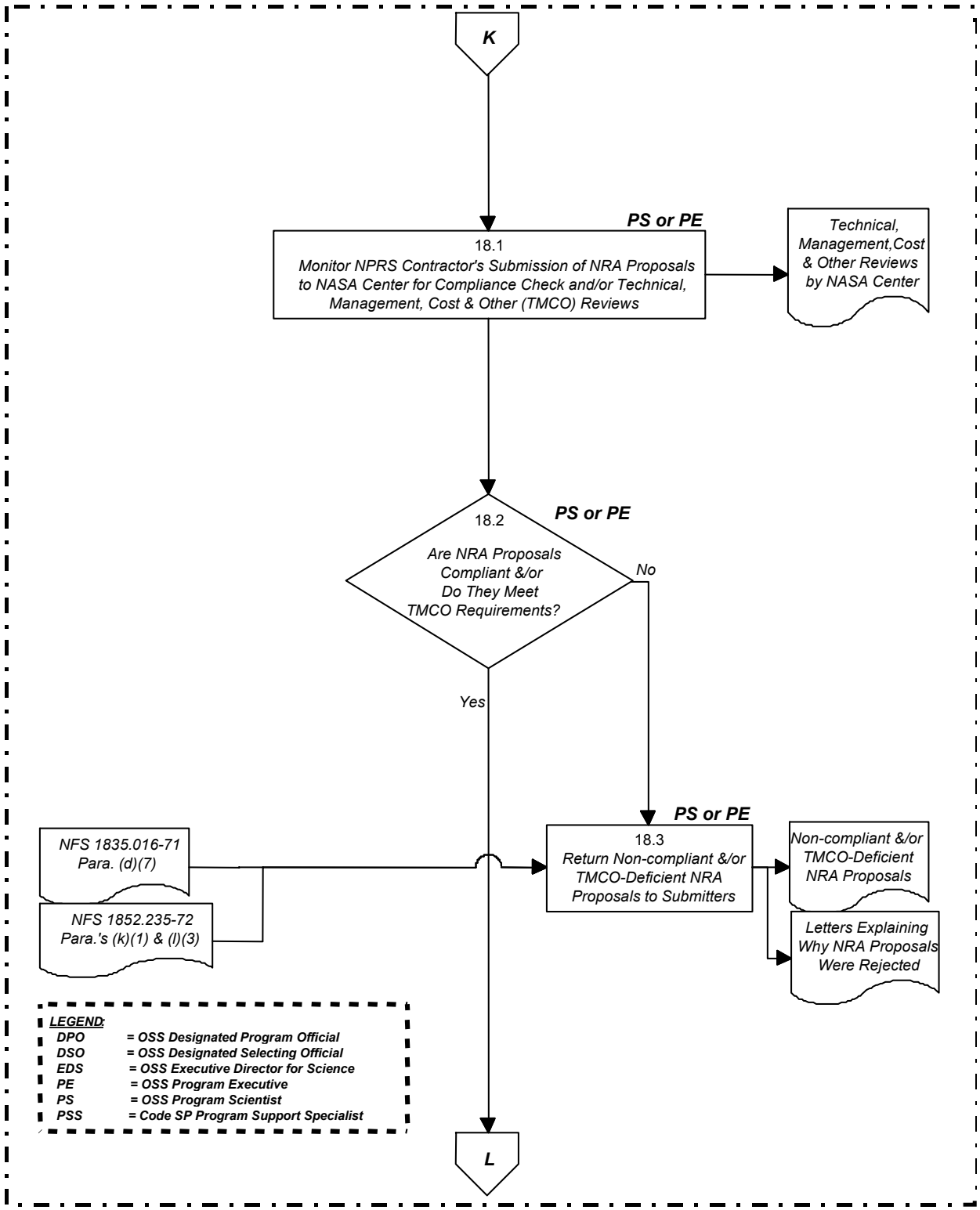


Figure F.2-7 Code S "Compliance &/or TMCO Evaluation" Subprocess

18.3 In accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (d)(7)] and NASA FAR Supplement Part 1852.235-72 [paragraphs (k)(1) and (l)(3)], the Program Scientist or Program Executive returns non-compliant and/or TMCO-deficient NRA proposals to their submitters, with letters explaining why the proposals are unacceptable. If a non-compliant or deficient NRA proposal involves foreign participation, the Program Scientist or Program Executive sends a copy of the rejection letter to the cognizant foreign sponsor.

19. The Program Scientist or Program Executive monitors the NPRS Contractor's activity of sending copies of NRA proposals to selected Peer Reviewers. Some of these reviewers may conduct a "remote" review and submit their evaluations via postal or electronic mail. Other reviewers will participate in an "on-site" Peer Review Panel.

20. In accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (d)(3)], NASA FAR Supplement Part 1852.235-72 [paragraphs (i) and (j)], and the NRA proposal-evaluation logistics and procedures generated at Step #12, the Program Scientist or Program Executive conducts the Peer Review Panel to review and evaluate each NRA proposal. Any TMCO review inputs (generated in Step #18.1) from a NASA Center are examined by the Peer Review Panel. The Panel incorporates the inputs submitted from any mail-in reviewers into a set of final summary peer-review evaluations for the proposals. These evaluations are entered into the NASA Headquarters SYS-EYFUS electronic database by the NPRS Contractor.

21. In accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (d)(6)] and the results of the final summary peer review evaluations, the Program Scientist or Program Executive prepares the Research Program Plan (i.e., "selection statement"), and presents it to the OSS Designated Selecting Official.

22. In accordance with NASA FAR Supplement Part 1852.235-72 [paragraph (j)], if the OSS Designated Selecting Official approves the Research Program Plan (via signature within the document), proceed to Step #24. If not, proceed to Step #23.

23. The Program Scientist or Program Executive revises the Research Program Plan to address the issues identified by the OSS Designated Selecting Official, and repeats the review cycle at Step #22.

24. The Program Scientist or Program Executive establishes an NRA Program Records File consisting of all NRA-related quality records listed in Section 7 of this Office Work Instruction (OWI).

25. If any of the selected NRA proposals involve foreign participation, proceed to Step #25.1. If not, proceed to Step #26.

Code IS-Interface "Draft Notification Letter" Subprocess

25.1 In accordance with NASA FAR Supplement Part 1835.016-70 [paragraphs (b)(2)(iii) and (b)(3)], NASA FAR Supplement Part 1835.016-71 [paragraph (d)(7)], NASA FAR Supplement Part 1852.235-72 [paragraph (k)(1)], and an OSS-approved fundamental-dependency link with HOWI7100-I003, the Program Scientist or Program Executive provides draft OSS notification letters of selected and non-selected NRA proposals with foreign participation to Code IS (via Code HS) for review prior to sending the letters to the cognizant proposers and their foreign sponsors

25.2 If Code IS concurs with the content of draft OSS notification letters of selected and non-selected NRA proposals with foreign participation, proceed to Step #26. If not, proceed to Step #25.3.

25.3 The Program Scientist or Program Executive revises the draft OSS notification letters of selected and non-selected NRA proposals with foreign participation in accordance with issues raised by Code IS via its non-concurrence, and repeats the review cycle at Step #25.1.

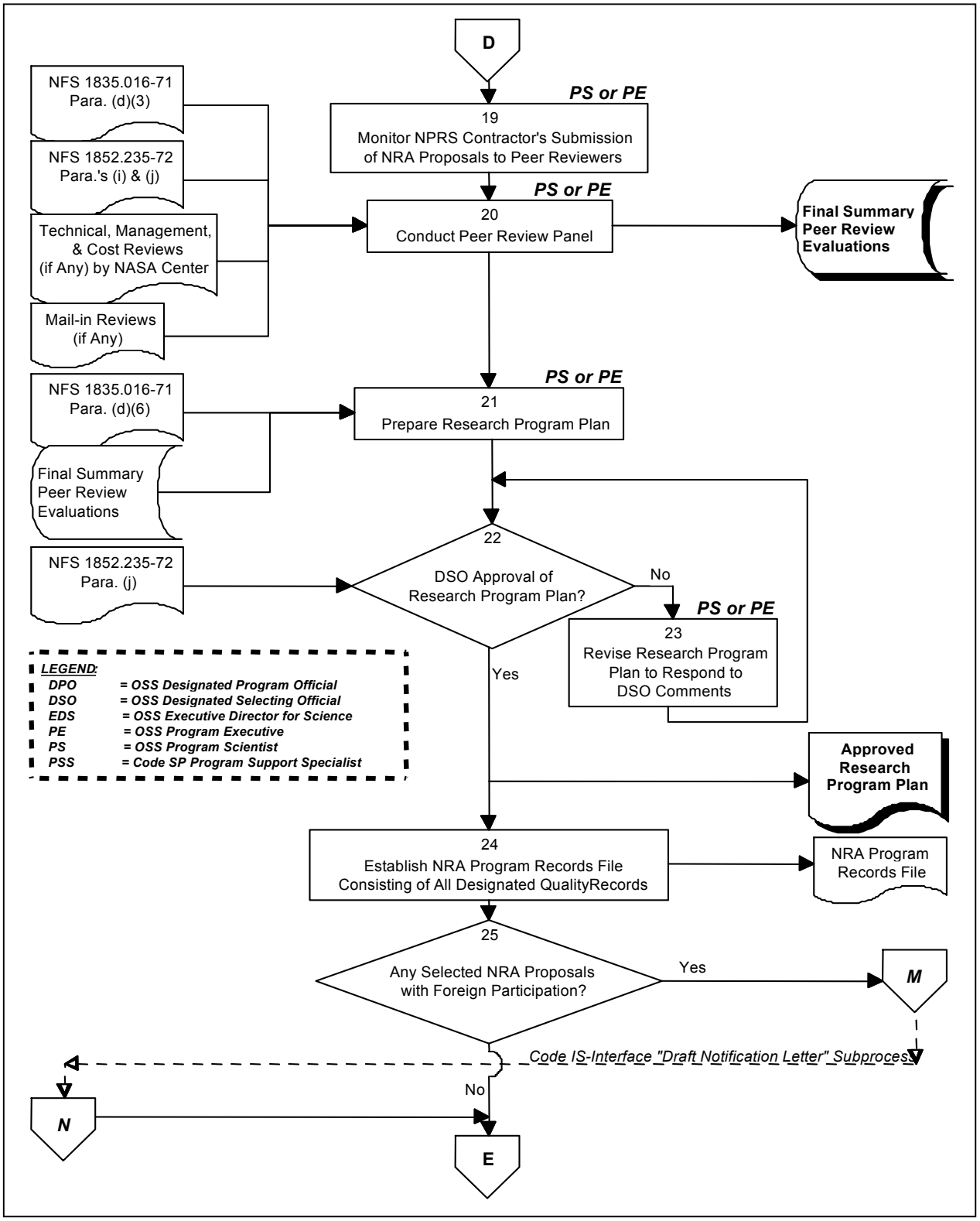


Figure F.2-8 Review Proposals

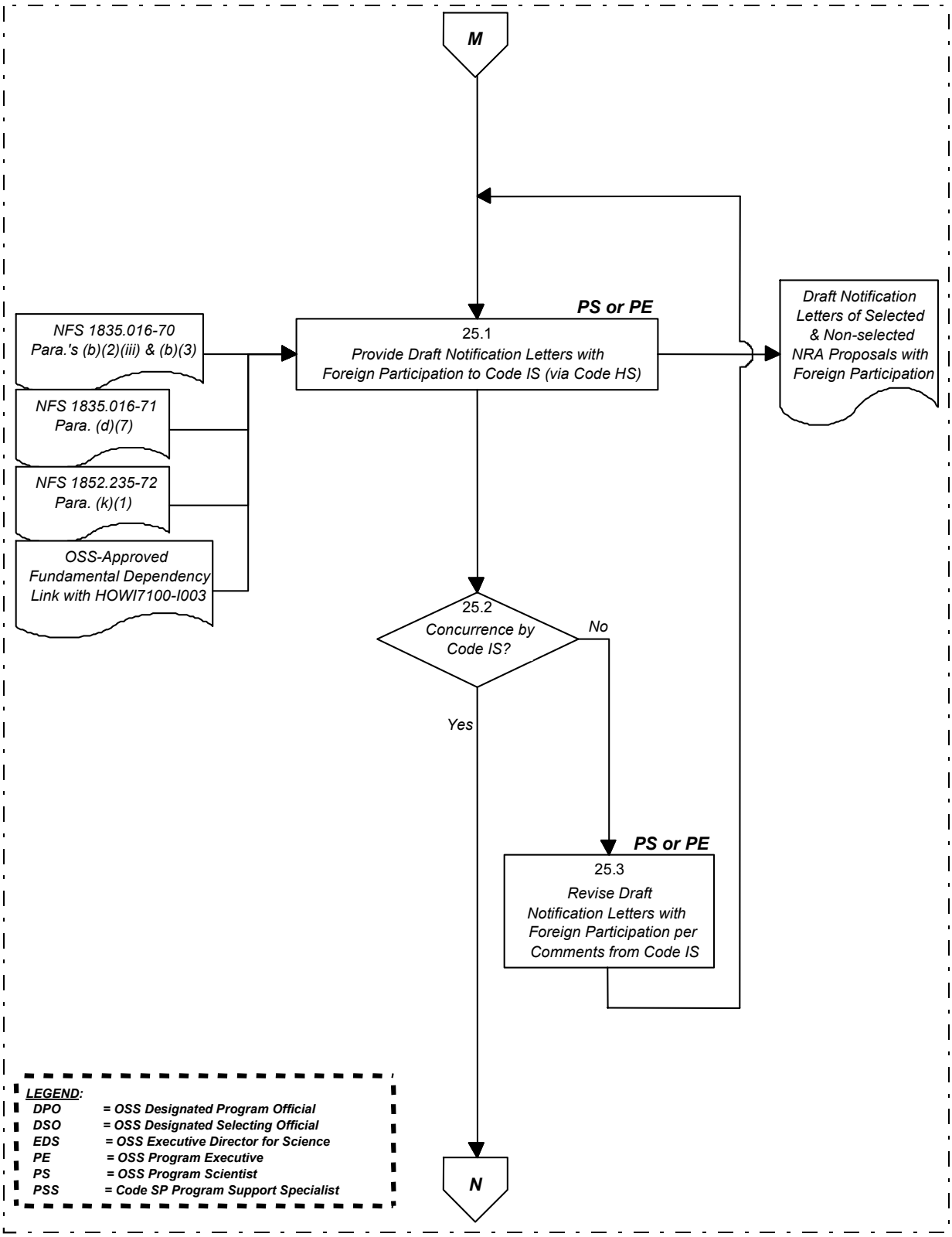


Figure F.2-9 Code IS-Interface "Draft Notification Letter" Subprocess

26. In accordance with NFS 1835.016-71 [paragraph (d)(7)] and NASA FAR Supplement Part 1852.235-72 [paragraphs (k)(1) and (l)(3)], the Program Scientist or Program Executive prepares and the OSS Designated Selecting Official signs the final notification letters of selected and non-selected NRA proposals. These letters either include an offer to provide a debriefing of the reasons why a given proposal was selected or not selected, or incorporate a copy of the final summary peer-review evaluation for the proposal. The Program Scientist or Program Executive sends one of these letters to each NRA proposal submitter (and to the foreign sponsor of any NRA proposal with foreign participation).

27. If any OSS final notification letters of selected and non-selected NRA proposals involve proposals with foreign participation, proceed to Step #28. If not, proceed to Step #29.

28. In accordance with NASA FAR Supplement Part 1835.016-70 [paragraphs (b)(1) and (b)(3)] and an OSS-approved fundamental-dependency link with HOWI7100-I003, the Program Scientist or Program Executive provides to Code IS (via Code HS) a copy of OSS final notification letters of selected and non-selected NRA proposals with foreign participation, a copy of selected NRA proposals with foreign participation, and background information concerning the selected NRA proposals with foreign participation.

29. In accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (d)(8)], the Program Scientist or Program Executive prepares the Procurement Request package (incorporating the original selected NRA proposals), and sends the Procurement Request package to the Procurement Office at the Goddard Space Flight Center (GSFC), which issues the signed Award Notice (in accordance with NASA FAR Supplement Part 1835.016-71 [paragraph (e)]) and returns a copy of it to OSS.

30. The Program Scientist or Program Executive files a copy of each selected NRA proposal, its peer-review evaluation, a copy of its final notification letter of selection, and a copy of its Award Notice in a Proposal Jacket. (The original selected NRA proposal and its Award Notice are retained by the GSFC Procurement Office.)

31. In accordance with NPG 5800.1, at a minimum of 60 calendar days prior to the anniversary date of the award of a program resulting from an NRA, the Program Scientist or Program Executive receives a Yearly Progress Report from the Principal Investigator via the NASA Headquarters SYS-EYFUS electronic database.

32. The Program Scientist or Program Executive monitors and evaluates the progress of the awarded program by reviewing the Yearly Progress Report.

33. If the Yearly Progress Report is acceptable to the Program Scientist or Program Executive, proceed to Step #35. If not, proceed to Step #34.

34. The Program Scientist or Program Executive requests that the Principal Investigator provide additional information or clarification regarding the submitted Yearly Progress Report, and repeats the review cycle at Step #32.

35. If the program has reached the end of its period of performance, the Program Scientist or Program Executive ends the process by accepting the Final Progress Report. If not, proceed to Step #36.

36. The Program Scientist or Program Executive prepares a recommendation for award to the Principal Investigator of a yearly funding supplement, and sends this recommendation to the GSFC Procurement Office.

37. The Program Scientist or Program Executive receives notification from the GSFC Procurement Office of its issuance of the yearly funding supplement to the Principal Investigator. Repeat Step #31 through Step #37 throughout the period of performance of the awarded program.

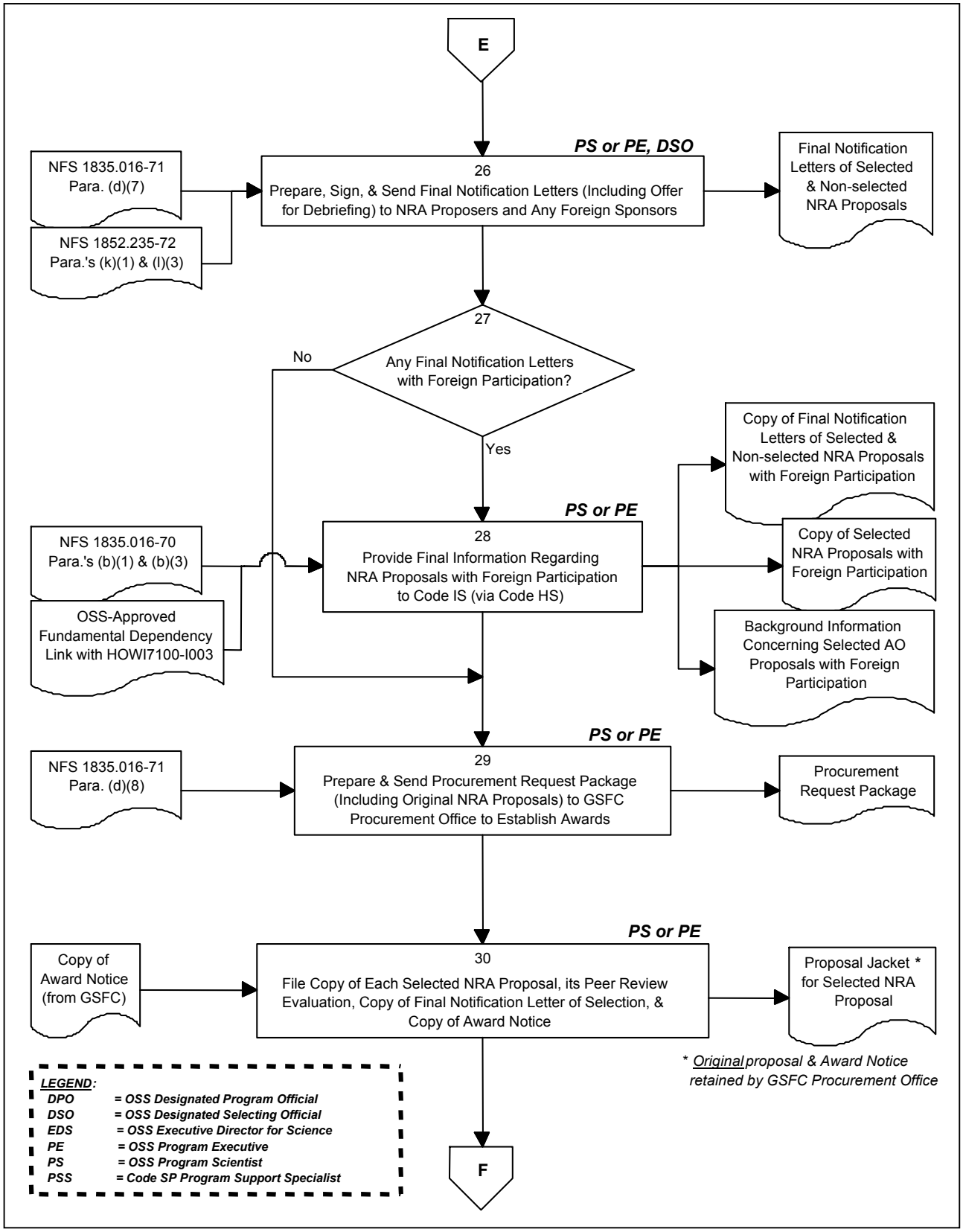


Figure F.2-10 Notification and Establishment of Awards

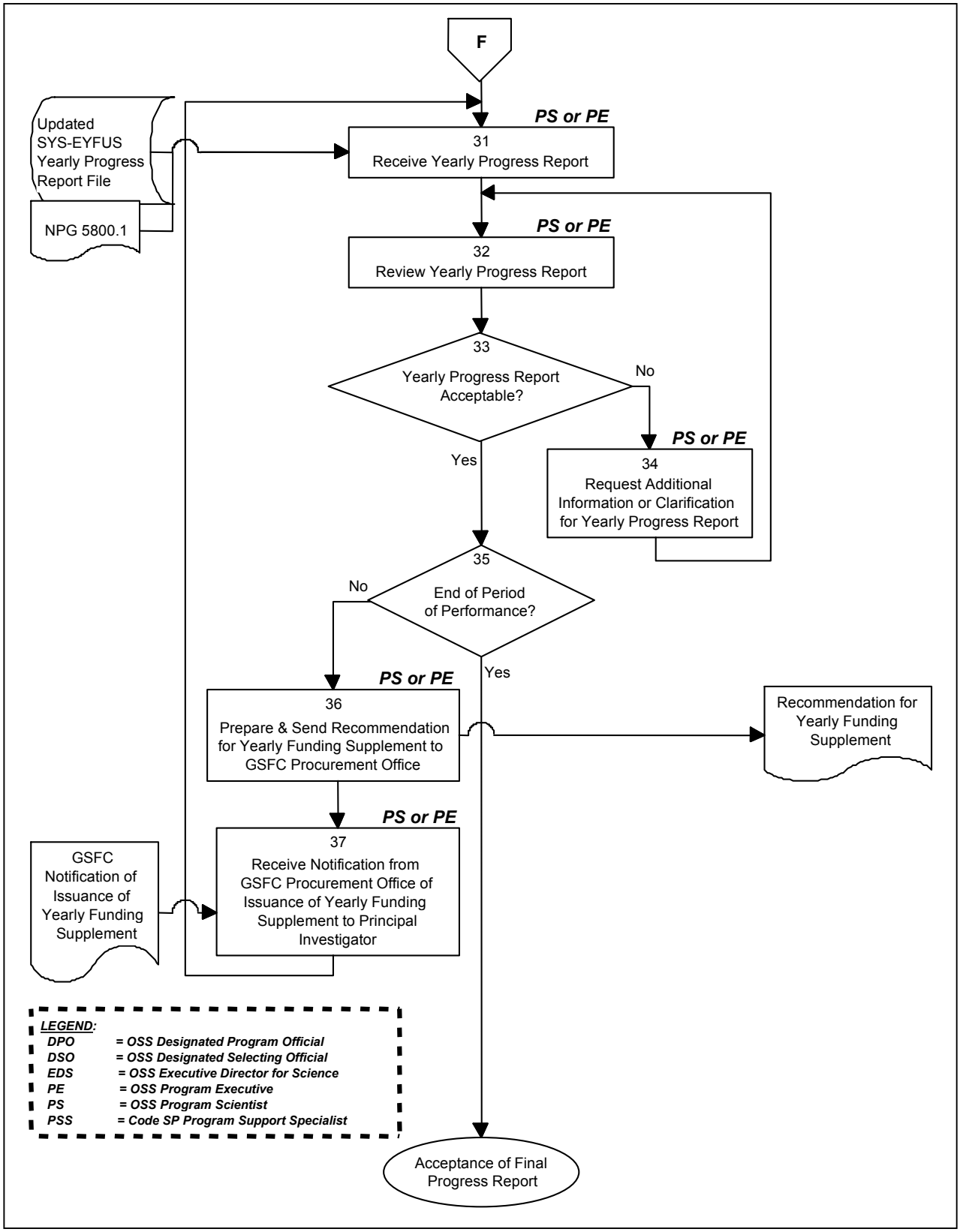


Figure F.2-11 Progress Reports and Yearly Funding Supplements