



**National Aeronautics
And Space Administration**

**DATE
AO 03-OSS-NN**

DRAFT
Announcement of Opportunity
New Frontiers Program 2003
And
Missions of Opportunity
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Notice of Intent to Propose Due:
Proposals Due:

60 days after AO release
150 days after AO release

NEW FRONTIERS PROGRAM AND MISSIONS OF OPPORTUNITY
ANNOUNCEMENT OF OPPORTUNITY

TABLE OF CONTENTS

- 1.0 Description of the Opportunity
 - 1.1 Introduction
 - 1.2 Overview of Proposal Evaluation and Selection

- 2.0 Science Objectives
 - 2.1 Science Objectives
 - 2.1.1 *Overview*
 - 2.1.2 *Venus In Situ Explorer*
 - 2.1.3 *South Pole-Aitken Basin Sample Return*
 - 2.1.4 *Jupiter Polar Orbiter with Probes*
 - 2.1.5 *Comet Surface Sample Return*
 - 2.2 Ancillary Program Objectives

- 3.0 Program Background

- 4.0 Proposal Opportunity Period

- 5.0 Requirements and Constraints
 - 5.1 General
 - 5.2 Science
 - 5.2.1 *Scope of Proposed Investigations*
 - 5.2.2 *Protocols and Policies for Handling Returned Samples*
 - 5.2.3 *Forward and Back Contamination*
 - 5.2.4 *Data Rights Policy*
 - 5.2.5 *Data Analysis Activities*
 - 5.3 Technical Approach
 - 5.3.1 *Adherence to Accepted Management Processes and Practices*
 - 5.3.2 *Use of Radioactive Materials*
 - 5.3.3 *Command and Control Issues*
 - 5.4 Management
 - 5.4.1 *Single Principal Investigator*
 - 5.4.2 *Management Plans and Structure for Flight Investigations*
 - 5.4.3 *NASA Program and Project Management*
 - 5.4.4 *Risk Management*
 - 5.5 Co-Investigators
 - 5.6 Education and Public Outreach
 - 5.7 Technology Infusion/Transfer
 - 5.8 Small Disadvantaged Businesses and Minority Institutions
 - 5.9 Cost
 - 5.9.1 *NASA OSS Cost and Total Mission Cost*

- 5.9.2 *Full Cost Accounting for NASA Facilities and Personnel*
 - 5.9.3 *Contributions*
 - 5.10 International Participation
 - 5.11 Specific Requirements and Constraints for New Frontiers Mission Investigations
 - 5.11.1 *Overview*
 - 5.11.2 *Launch Services: ELV Option*
 - 5.11.3 *Launch Services: Space Shuttle Free Flyer Option*
 - 5.11.4 *Baseline Mission and Performance Floor*
 - 5.11.5 *Schedule*
 - 5.11.6 *NASA OSS Cost Requirements and Cost Caps*
 - 5.11.7 *Total Mission Cost*
 - 5.11.8 *Concept Study*
 - 5.11.9 *International Participation*
 - 5.12 Specific Requirements and Constraints for Mission of Opportunity Investigations
 - 5.12.1 *Overview*
 - 5.12.2 *Partner Missions*
 - 5.12.3 *Extended Missions*
 - 5.12.4 *New Science Missions*
 - 5.12.5 *Science Data Requirements*
 - 5.12.6 *Funding Policies*
 - 5.12.7 *NASA OSS Cost Requirements and Cost Cap*
 - 5.12.8 *Schedule*
- 6.0 Proposal Submission Information
- 6.1 Preproposal Activities
 - 6.1.1 *New Frontiers Program Library*
 - 6.1.2 *Preproposal Conference*
 - 6.1.3 *Notice of Intent to Propose*
 - 6.2 Point of Contact for Further Information
 - 6.3 Proposal Format
 - 6.3.1 *Structure of Proposal*
 - 6.3.2 *Requirement for PI and Authorizing Institutional Signatures*
 - 6.3.3 *Number of Copies of Proposal to be Submitted*
 - 6.3.4 *Address for Submittal of Proposal*
 - 6.4 Special Instructions for Proposals Involving non-U.S. Organizations
- 7.0 Proposal Evaluation, Selection, and Implementation
- 7.1 Evaluation and Selection Procedures
 - 7.2 Evaluation Criteria
 - 7.2.1 *Overview*
 - 7.2.2 *Scientific Merit of the Investigation*
 - 7.2.3 *Technical Merit and Feasibility of the Investigation*
 - 7.2.4 *Feasibility of the Proposed Approach for Mission Implementation*

Including Cost Risk

7.3 Plans for Implementation

7.3.1 Notification of Selection

7.3.2 Contract Administration and Funding

7.3.3 Confirmation of Investigations for Implementation

7.3.4 Confirmation of Investigations for Phases Subsequent to Phase A

7.4 Opportunity for Debriefing of Nonselected Proposers

8.0 Schedule of Solicitation

9.0 Conclusion

APPENDIX A: General Instructions and Provisions

APPENDIX B: Guidelines for Proposal Preparation

APPENDIX C: Regulations Governing Procurement of Foreign Goods
or Services

APPENDIX D: New Frontiers Program Library

APPENDIX E: Certifications

APPENDIX F: New Frontiers Program Planning Budget Profile

APPENDIX G: Proposal Checklist

1.0 DESCRIPTION OF THE OPPORTUNITY

1.1 Introduction

The Office of Space Science (OSS) of the National Aeronautics and Space Administration (NASA) announces an opportunity to propose for two different types of scientific investigations through the New Frontiers Program: New Frontiers Mission investigations specifically for the planet Venus, the Earth's moon, Jupiter, or a comet nucleus, (see Section 2.1) and Mission of Opportunity investigations.

New Frontiers Mission investigations are to be completed through space flight missions launched on Expendable Launch Vehicles (ELV's) or the Space Shuttle no later than December 31, 2009, in order to accomplish science objectives in compliance with those stated in Section 2.1 of this Announcement of Opportunity (AO) for a total NASA OSS Cost through mission completion not to exceed \$650M in Fiscal Year (FY) 2003 dollars (see Sections 5.1 through 5.11 for a description of both general and specific restrictions). Proposals submitted in response to this AO for New Frontiers Mission investigations must be for complete investigations, defined as a concept study (Phase A), preliminary design (Phase B), final design and development of all flight experiment hardware, spacecraft bus, and mission operations software and equipment (Phase C), spacecraft Assembly, Test and Launch Operations (ATLO) (Phase D), mission operations and data analysis (Phase E), and, if applicable, extended mission operations (Phase F). Missions must include analysis and publication of data in the peer reviewed scientific literature, delivery of the data to NASA's Planetary Data System (PDS), and full implementation of an Education and Public Outreach (E/PO) program related to the mission. Section 5.11 contains information only applicable to Mission investigations. Proposals that describe only portions of investigations (such as the provision of an instrument as part of a non-U.S. mission) may, if appropriate, be proposed as Mission of Opportunity investigations.

New Frontiers Mission of Opportunity (MO) investigations are part of non-OSS space missions of any size that require a commitment from NASA before December 31, 2005, (see section 5.12.8), that may be accomplished within a cost to NASA OSS of \$35M (FY 2003 dollars), and that address any of the OSS Solar System Exploration (SSE) science objectives except those of the study of Mars, for which there is a separately funded Mars Scout program (see the recently completed NASA AO 02-OSS-02). Such MO investigations may involve: (i) the provision of flight hardware followed by data analysis, (ii) the development of physical models and their application to both the design and interpretation of instrumental data in phases B, C, D, and E, or (iii) only the analysis of science data taken by the "parent" mission although, in general, MO investigations are not to be a substitute for a Data Analysis program that comes more appropriately after data are placed in the archive. In any event, MO investigations are generally conducted on a no-exchange-of-funds basis with the organization sponsoring the parent mission. MO investigations may be approved through the New Frontiers Program when their perceived value is high and their proposed cost to NASA OSS is within the above funding limits. NASA is not required to select an MO investigation under this

solicitation, but if such an investigation is selected, a reduced flight rate of New Frontiers Mission investigations may result. NASA also expects Mission of Opportunity investigations to meet other New Frontiers program objectives for reducing cost, infusing and transferring new technology, and enhancing education and the public understanding of science. Section 5.12 contains information only applicable to MO investigations.

New Frontiers investigation teams for either full Mission investigations or for Missions of Opportunity must be led by a single Principal Investigator (PI) who may come from any category of U.S. or non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA field centers, the Jet Propulsion Laboratory (JPL), and other Government agencies.

Contributions in the form of property, cash, and/or services from non-OSS U.S. as well as non-U.S. sources are welcome, including contributions to the payload, to the spacecraft, and/or to the launch services, subject to the following exceptions and limitations: (i) non-U.S. launch services for payloads containing nuclear power sources of any kind are prohibited; (ii) non-U.S. nuclear power sources are prohibited; and (iii) the sum of contributions of any kind to the entirety of the flight experiment hardware for a New Frontiers Mission investigation may not exceed one third (1/3) of the estimated total cost in U.S. dollars for that hardware (see Section 5.9.3 below for a further discussion of contributions).

Regardless of the type of investigation offered, proposals to the New Frontiers Program will require careful tradeoffs between science and cost to produce investigations with the highest possible science value for the cost. Investigations proposed at or near the respective cost caps may be selected only if the science is especially compelling since NASA is seeking program balance between lower and higher cost investigations that will allow a mission launch approximately every 36 months within the New Frontiers Program funding profile. All missions must include adequate reserves at every phase of the mission lifecycle. In particular, mission investigations should plan to maintain a reserve through the end of phase B of at least 25% of all costs through the end of phase D, except the cost of the ELV and any Radioisotope Power Sources (RPS).

A major goal of all of NASA's space science programs is to enhance the public awareness of, and appreciation for, space exploration and to incorporate Educational and Public Outreach (E/PO) activities into its science investigations (see Section 5.6 of this AO). Additionally, the New Frontiers Program requires proposers to set goals for the participation of small disadvantaged businesses, women-owned small businesses (WOSB's), Historically Black Colleges and Universities (HBCU's), and other Minority Educational Institutions (MEI's) in proposed procurements (see Section 5.8). Participating Scientist Programs, Data Analysis Programs, and/or Guest Observer programs that involve more members of the community in the data analysis and/or mission operation are encouraged, as described in Section 5.2.5.

Proposals for both New Frontiers Mission investigations and Mission of Opportunity investigations must comply with the requirements and constraints specified in this AO (see also checklist provided in Appendix G). Proposals that are judged *not* to be in compliance will be returned to the proposers without further review.

Many documents that may be useful in the preparation of proposals may be found in the New Frontiers Program Library (NFPL), Appendix D.

1.2 Overview of Proposal Evaluation and Selection

Investigations proposed in response to this AO will be evaluated on the basis of their scientific and technical merits and feasibility (including cost risk) as evaluated by peer review (see Section 7.2 in this AO). In accordance with NASA's desire to fly missions as frequently as possible, the proposed cost to NASA OSS will be used as an important criterion at the time of selection to help discriminate between proposals of otherwise comparable merits. Additional selection factors will be the investigation's demonstrated commitment to education and public outreach, to technology infusion/transfer, and to participation of small disadvantaged businesses, including WOSB's, HBCU's, and other MEI's. Pending the submission of proposals of adequate merit, it is anticipated that up to three New Frontiers Mission investigation proposals will be selected for further study as a result of this evaluation. One or more Mission of Opportunity investigation proposals may also be selected, although NASA is *not* required to make such a selection under this solicitation.

Each of the selected investigation teams will be funded to perform a Phase A Concept Study of up to seven months at a level up to \$1.2M in Real Year (RY) dollars, which must be budgeted in the initial proposal. NASA may select a Mission of Opportunity investigation for implementation without a Concept Study if it is satisfied with its readiness for development and implementation as proposed (see Section 5.1). If a Concept Study is deemed necessary for a Mission of Opportunity investigation, funding will be determined on a case-by-case basis but will not exceed \$250K (RY\$). At the conclusion of the Concept Studies, NASA will conduct rigorous reviews to evaluate the detailed implementation of the selected investigations. As a result of this Phase A evaluation, one New Frontiers Mission investigation and possibly one or more Mission of Opportunity investigations will be confirmed for implementation leading to flight, mission operations, data analysis, and execution of the approved education and public outreach program(s).

2.0 SCIENCE OBJECTIVES

2.1 Science Objectives

2.1.1 Overview

Following the recent publication of the Decadal Solar System Exploration Survey, administered by the Space Studies Board of the National Research Council, entitled *New Frontiers in the Solar System: An Integrated Exploration Strategy* (hereafter called simply the Decadal Survey, and listed in the NFPL), the Office of Space Science identified four of their five medium-class missions for immediate consideration for this first opportunity within the New Frontiers Program. These four “strawman” missions are, in no order of priority:

- a Comet Surface Sample Return mission;
- a Jupiter Polar Orbiter with Probes;
- a Lunar South Pole Aitken Basin Sample Return mission; and
- a Venus *In Situ* Explorer.

The scientific objectives of each of these missions are outlined below, and “strawman” mission concepts for each may be found in the Decadal Survey. However, NASA will consider any mission concept for any of these archetype missions that goes to the appropriate object and effectively addresses most or all of the science objectives identified below for each generic type of mission.

Mission of Opportunity proposals may be for any objective within the purview of the OSS SSE program (see *The Space Science Enterprise Strategic Plan*, referenced in the NFPL), except Mars. However, all proposals for a New Frontiers Mission investigation that do not propose orbiting or flyby measurement and/or sample return of the Earth’s Moon, Venus, Jupiter, or a comet nucleus and that do not address most or all of the scientific objectives for a mission to each object (or the class of objects as in the case of comet missions) as given below will be considered nonresponsive to this AO and will be returned without further review.

2.1.2 Venus In Situ Explorer

Although the exploration of the surface and lower atmosphere of Venus provides a major technical challenge, the scientific rewards are major since Venus is Earth’s sister planet. However, Venus’s tectonics, volcanism, surface-atmospheric processes, atmospheric dynamics, and chemistry are all remarkably different than on Earth, which has resulted in remarkably different end states for its surface crust and atmosphere. While returning physical samples of its surface and/or atmosphere may not be possible within the New Frontier cost cap, innovative approaches might achieve most or all of the following objectives:

- Understand the physics and chemistry of Venus’s atmosphere through measurement of its composition, especially the abundances of its trace gases, light stable isotopes, and noble gas isotopes;
- Understand the physics and chemistry of Venus’s crust through analysis of near-IR descent images made through the lowest 10 km of its atmosphere and measurements of elemental abundances and mineralogy from a core sample;
- Understand the dynamics of Venus’s atmosphere through measurement of its zonal cloud-level winds over at least two Earth days; and
- Understand the texture of its crust in the context of the dynamics of the atmosphere of Venus and the composition and structure of its surface materials.

The strawman mission proposed by the Decadal Survey to accomplish these objectives utilized an orbiter and a lander that carried a drill to obtain a core sample, which was then returned from the surface to at least Venus’ middle atmosphere for remote analysis. However, any mission architecture that achieves most or all of the science objectives stated above for a cost within the New Frontiers cost cap will be considered responsive to this AO.

2.1.3 Lunar South Pole-Aitken Basin Sample Return

The surface of the Aitken basin located on the Moon’s far side southern polar region is likely to contain some fraction of the mineralogy of the Moon’s lower crust. Samples of these ancient materials that are not biased by nearside impact basin formation are highly desirable to further understand the history of Earth’s celestial companion. Therefore, a mission to return sufficient sample of material from the heretofore-unsampled Aitken basin terrain should accomplish (following analysis on Earth) most or all of following science objectives:

- Validate by “ground truth sampling” the determination of surface composition by the technique of remote sensing over a major region of the lunar surface for which no representative samples exist from the Apollo missions or among the meteorites of lunar origin;
- Elucidate the sources of thorium and other heat-producing elements in order to understand lunar differentiation and thermal evolution; and
- Investigate the nature and evolution of the Moon’s lower crust by direct measurement of its composition.

The strawman mission considered by the Decadal Study is a rover sufficiently instrumented to provide context to sampled areas and to return at least 1 kg of sampled materials. The clear priority in the Decadal Survey description of this mission is for the return of useful samples from the deep crust of the early Moon at the time of the impact. However, any mission architecture that achieves most or all of the science objectives stated above for a cost within the New Frontiers cost cap will be considered responsive to this AO.

2.1.4 Jupiter Polar Orbiter with Probes

NASA's Galileo mission to Jupiter provided extensive knowledge about its upper atmosphere. However, further study of Jupiter is crucial not only to the understanding of its origin and nature of the Solar System, as well as of giant extrasolar planets in general. Therefore, this AO solicits proposals for medium class mission investigations that can achieve most or all of the following objectives for Jupiter:

- Understand its gross dynamical and structural properties through determination of the mass and size of its core, its gravitational and magnetic fields, and its deep winds and internal convection;
- Achieve the next major advance beyond that of Galileo probe in understanding the physics and chemistry of Jupiter's atmosphere by measurement of the elemental abundances of H, He, O, C, N, S and other species to greater depths than the Galileo probe, as well the absolute abundances of important molecules such as water and ammonia; and
- Investigate and characterize the three dimensional structure of Jupiter's polar magnetosphere.

The strawman mission considered by the Decadal Study consisted of a highly instrumented spacecraft in polar orbit around Jupiter for the main portion of the mission and that would deploy three atmospheric probes to make *in situ* measurements of the atmosphere. However, any mission architecture that achieves most or all of the science objectives stated above for a cost within the New Frontiers cost cap will be considered responsive to this AO.

2.1.5 Comet Surface Sample Return

Detailed study of comets promise the possibility of understanding the physical condition and constituents of the very early solar system, including the early history of water and the biogenic elements and the compounds containing them. Therefore, a mission that will sample and return the dust and organics from at least one if not several locations on the surface of a comet nucleus, including one in the vicinity of an active vent, is of prime interest in order to achieve most or all of the following science objectives:

- Understand the structure and composition of a comet through measurement of its chemical complexity, grain micro texture and its cohesive forces, age of compositional grains, and organic and silicate components;
- Understand the real time dynamics and evolution of a comet's surface under the influence of sunlight by study of the diurnal conditions of its atmosphere and surface;
- Investigate a comet's overall physical structure through gravity modeling in order to assess its internal heterogeneity; and
- Map surface structures, composition, and mineralogy.

The strawman mission envisioned “touch and go” sampling and an extensively instrumented platform including cameras, an IR spectrometer, and mass spectrometers, as well as a simple sample collection and storage mechanism. The return to Earth of samples might rely on the techniques developed for NASA’s Stardust and Genesis missions. However, any mission architecture that achieves most or all of the science objectives stated above for a cost within the New Frontiers cost cap will be considered responsive to this AO.

2.2 Ancillary Program Goals

While the principal objective of the New Frontiers Program is to provide regularly scheduled opportunities for high quality, cost effective scientific investigations that fulfill the OSS program for Solar System Exploration, there are several ancillary goals that are considered of high intrinsic value by NASA for the science community, the U.S. aerospace industry, and the nation at large, as follows.

Ancillary Goal 1: Pursue innovative ways of doing business.

The development schedule and cost limits associated with New Frontiers suggest and encourage innovative teaming arrangements among industry, university, and/or Government partners. Competitively selected teams will have the responsibility and authority to accomplish the entire mission investigation by utilizing innovative approaches to stay within the strict cost and schedule limits of the program. NASA oversight and reporting requirements will be limited to those that are essential to assure the success of the science investigation in compliance with committed cost, schedule, performance, reliability, and safety requirements.

Ancillary Goal 2: Encourage the use of new technologies to achieve program objectives and foster their transfer into the private sector.

The inclusion of new technologies to achieve performance enhancements and to reduce total mission cost is encouraged in New Frontiers proposals provided that appropriate risk mitigation measures are also included. The use of new technologies will enable more aggressive and exciting scientific objectives to be pursued. The teaming of industry, university, and Government as noted in Goal 1 above is meant to foster an environment conducive to technology development, utilization, and commercialization.

Ancillary Goal 3: Enhance general public awareness of and appreciation for solar system exploration, and support mathematics, science, and technology educational reform initiatives at the local, State, and national level.

Contributing to the improvement of science education and the public understanding of science are explicit goals of the New Frontiers Program and of the Office of Space Science as a whole. The New Frontiers Program is committed to incorporating program

elements directed toward informing the public and providing educational opportunities that support local, State, regional, and national educational objectives and reform efforts.

3.0 PROGRAM BACKGROUND

The President's budget for Fiscal Year 2003 (presented in February 2002) includes the New Frontiers Program that is specifically designed to provide a mechanism for identifying and selecting high quality planetary missions that required resources beyond those available in the Discovery program. This effort has benefited from the experience surrounding a successful competition for a Pluto Kuiper Belt (PKB) mission, completed in 2001. The mission selected through the PKB competition, New Horizons, is now considered the first New Frontiers mission. Like the PKB opportunity, New Frontiers is patterned after NASA's highly successful Discovery program. Unlike the Discovery program, however, the choice of destinations and science goals at these destinations for the New Frontiers opportunity is limited.

The New Horizons mission supplies the science called out in the Decadal Survey for a Kuiper Belt/Pluto mission. Accordingly, for this competition for the second New Frontiers mission, the Office of Space Science chose as eligible candidates the remaining medium-class missions identified in the Decadal survey for immediate consideration within the New Frontiers Program. These four "strawman" missions are, in no order of priority:

- a Comet Surface Sample Return;
- a Jupiter Polar Orbiter with Probes;
- a Lunar South Pole Aitken Basin Sample Return; and
- a Venus *In Situ* Explorer.

NASA wishes to fully enable and challenge the creativity of the scientific community with full and open competition, and strongly encourages novel mission implementation strategies not considered by the Decadal Survey. In order to allow such opportunities to emerge, proposed investigations for all four of the archetype missions are allowed to compete here on an equal footing. This AO differs from other AO's such as those for the periodic Discovery and Mars Scout programs in both the size of investigation possible (larger cost cap, larger launch vehicle, and longer period in phases C and D) and in the option to use Radioisotope Thermal Generators (RTG's).

4.0 PROPOSAL OPPORTUNITY PERIOD

This AO is for a singular opportunity to propose science investigations in compliance with the schedule given in Section 8 below. It is the intent of NASA OSS to release other New Frontiers program AO's for future opportunities as allowed by appropriate budget allocations.

5.0 REQUIREMENTS AND CONSTRAINTS

5.1 General

In the New Frontiers Program, the major responsibility for the selected investigation rests solely with the Principal Investigator (PI) who, along with the investigation's Project Manager (PM) and investigation team, will have a large degree of freedom to accomplish its proposed objectives within the stated constraints with essential NASA oversight. Once an investigation has been confirmed for flight, failure to maintain reasonable progress on the agreed upon schedule or failure to operate within the constraints outlined in this section may be cause for its termination by NASA.

Every aspect of a New Frontiers investigation must reflect a commitment to mission success while keeping total costs as low as possible. Consequently, proposed investigations must be designed and scoped to emphasize mission success within cost and schedule constraints by incorporating sufficient cost, schedule, and design margins, reserves, and resiliency.

Only those investigations for which the proposed cost, design/development schedule, and launch vehicle requirements are within the constraints and guidelines identified herein will be considered as candidates for selection.

New Frontiers investigation teams for either full mission investigations or for Missions of Opportunity must be led by a single Principal Investigator (PI) who may come from any category of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA field Centers, the Jet Propulsion Laboratory (JPL), and other Government agencies.

Teaming arrangements among universities, industry, nonprofit institutions, NASA field centers and JPL, and/or Government agencies (both foreign and domestic) are encouraged. Teams are encouraged to utilize industry participation to the fullest extent reasonable.

For investigations selected through this AO for Phase A Concept Studies, specific guidance relative to Concept Study preparation is contained in a document entitled *Guidelines and Criteria for the Phase A Concept Study*, located in Appendix D.

5.2 Science

5.2.1 Scope of Proposed Investigations

The New Frontiers Program is intended to perform focused planetary science investigations on high-priority targets that conclude with published articles in the peer-reviewed archival literature, as well as deposition of appropriately reduced and calibrated data in designated data archives. The relationship between the scientific objectives, the

data to be returned, and the instrument payload to be used in obtaining the desired data must be unambiguous and clearly stated. New Frontiers investigation teams will be responsible for initial analysis of the data, subsequent delivery of the data to the PDS, the publication of scientific findings, implementation of educational programs, and communication of results to the public; information on the PDS, its formats, and its requirements are included in the NFPL, Appendix D.

Options for extended missions (Phase F), if applicable, must be included in proposals to this AO. Costs for such options must be included in the estimate of NASA OSS Cost (Section 5.9.1). However, selected proposers must understand that inclusion of such options in their original proposal does not imply a commitment from NASA to select them (see Section II of Appendix A of this AO for a statement concerning partial selections).

5.2.2 Protocols and Policies for Handling Returned Samples

Any samples of extraterrestrial planetary materials returned by New Frontiers missions must be delivered to the NASA Astromaterial Curatorial Facility located at NASA's Johnson Space Center (JSC); contact Dr. Carlton Allen, Astromaterials Curator, telephone (281) 483-5126. Costs for use of this facility must be included in the NASA OSS Cost. Investigation teams will be responsible for all aspects of the delivery of such materials to this facility, which will be given the task of providing for the physical security, inventory accountability, environmental preservation, and distribution of the samples in support of scientific research programs organized around each mission, including sample processing in support of the mission science team. The science team will be allocated no more than 25 percent (by mass) of the returned sample unless a larger fraction has been fully justified by the proposed investigation. NASA shall keep the remainder in pristine condition for research competitively proposed by the community at large.

As a proportionate return for investment by foreign participants in a mission that returns extraterrestrial materials, a fraction of the total returned sample may be forwarded to the national curatorial facility of the contributing country six months after return to the NASA Astromaterial Curatorial Facility. It is expected that the amount of sample so transferred will be approximately proportional to the magnitude of the non-U.S. contribution but in no case will be more than 33 percent of the total sample. The terms and conditions of selection of a sample fraction for transmission to the contributing country must be specified in the proposal. However, in the event of selection, the final arrangements for the transfer of a fraction of the sample to the contributing country must be established through an exchange of letters or a Memorandum of Understanding between NASA and the contributing foreign participant.

5.2.3 Forward and Back Contamination

New Frontiers investigations will also be subject to the established protocols that address forward and back contamination with respect to other solar system bodies. In particular, it should be noted that the forward contamination of Jupiter's satellites is of concern, and the return of samples from certain target bodies may be subjected to rigorous containment and biohazard testing protocols in accordance with NASA planetary protection policy (NASA Policy Directive 8020.7E or current revision as listed in the NFPL). Therefore, investigators proposing sample return missions must address their plans to comply with planetary protection requirements (also see Appendix B, Section I.6 of this AO). For additional information, proposers may contact the NASA Planetary Protection Officer, Dr. John D. Rummel (telephone (202) 358-0702; E-mail: jrummel@hq.nasa.gov).

5.2.4 Data Rights Policy

Data must be made fully public, in a usable form, in a reasonable time (and not to exceed six months). New Frontiers teams will be responsible for collecting the scientific, engineering, and ancillary information necessary to validate and calibrate the scientific data prior to delivery to the PDS. Archival data products shall include low level (raw) data, high level (processed) data, and derived data products such as maps, ancillary data, calibration data (ground and in-flight), documentation, and related software or other tools necessary to interpret the data. All data products shall be documented, validated, and calibrated in physical units useable by the scientific community at large.

The time required to complete this process shall be the minimum necessary to provide appropriate data to the scientific community and the general public and must be described in the proposal. However, a short proprietary period for data may be proposed with justification. The proposed proprietary period should be the shortest period that is consistent with optimizing the science return from the mission and, except under exceptional circumstances, may not exceed six months, since any follow-on NASA data analysis programs (DAP's) cannot be initiated until the data have been delivered to the PDS.

5.2.5 Data Analysis Activities

Investigation teams must also include an adequately funded data analysis period, independent of PDS archiving activities as part of their proposed Phase E activities. Data analysis should be understood to include publication of scientific results of the investigation in refereed journals.

It is OSS policy to emphasize and encourage the addition of Participating Scientist Programs (PSP's) and Data Analysis Programs (DAP's) to broaden the scientific impact of missions. These programs are usually initiated no earlier than Phase E. Historically, OSS has funded DAP's at an annual level of between one and three percent of the mission's Phases C and D development costs. Although OSS will independently solicit

and administer these programs using competitive peer review, if such a program is proposed, the costs of implementing it must be included in the proposer's estimate of the NASA OSS Cost (Section 5.9.1). Investigations that include adequately funded PSP's and DAP's, where these are appropriate, will receive additional consideration at the time of selection.

5.3 Technical Approach

5.3.1 Adherence to Accepted Management Processes and Practices

New Frontiers projects must encompass all technical aspects of the investigation from Phase B through delivery of the data to the PDS and their analysis during Phase E. The document NPG 7120.5B, *NASA Program and Project Management Processes and Requirements*, delineates activities, milestones, and products typically associated with Formulation and Implementation of projects and may be used as a reference in defining a team's mission approach. All missions must adhere to NPG 7120.5B in order to receive approval for implementation. While NPG 7120.5B does not define sub phases, the Office of Space Science has defined "Formulation" as Phases A and B, and "Implementation" as Phases C, D, and E.

While mission teams have the freedom to use their own processes, procedures, and methods to meet the requirements of NPG 7120.5B, they must plan to obtain Independent Verification and Validation (IV&V) from the NASA IV&V Facility in Fairmont, West Virginia, for all flight and ground software. IV&V must be accomplished in accordance with NASA Policy Directive 8730.4 (found, with NPG 7120.5B, in the NFPL). The cost of IV&V can be significant and must be included in the cost proposal if applicable. The NASA IV&V Facility provides an on-line self-assessment process, available at <http://ivvcriteria.ivv.nasa.gov/>, as a starting point for the proposal team to understand the risk and specific software development characteristics of their mission. If the self-assessment indicates that some level of IV&V will be needed, it is recommended that proposals to this AO include 15% of their software costs for IV&V activities.

Finally, each New Frontiers project shall have a cost-effective mission assurance program that is consistent with the ISO 9000 series, American National Standard, *Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation, and Servicing*, ANSI/ASQC Q9001-1994 (see Appendix D).

5.3.2 Use of Radioactive Materials

Radioisotope sources of electrical power, such as Radioisotope Power Systems (RPS's) (e.g., Radioisotope Thermoelectric Generators (RTG's)), are permitted. If such devices are proposed for a selected and confirmed investigation, they will be provided by NASA as Government Furnished Equipment (GFE) through the Department of Energy; however, their costs must be included in the proposal as described in Sections 5.9.1 and Appendix G of this AO. The technical and cost parameters of such available units are described in

the NFPL. Other, smaller, radioactive sources (*e.g.*, radioisotope heater units and/or instrument sources) are also permitted. Use of any such sources will require environmental documentation (see *Environmental Quality Regulations, 40 CFR Parts 1500-1508*, in the NFPL), including timely National Environmental Policy Act (NEPA) documentation and additional approvals for the launch of radioactive materials.

Use of an RPS will require preparation of an environmental impact statement to satisfy NEPA requirements and a very detailed and rigorous nuclear material launch approval process.

Sufficient resources (cost and schedule) must be budgeted in the proposal to secure these units and support the development, submittal, and approval of the necessary NEPA process and the Nuclear Safety Launch Approval process. More information may be found in the *Specifications for Space Radioisotope Power Systems (RPS) for New Frontiers* document and the *New Frontiers Launch Services Information* document listed in the NFPL. Questions may be posed to the NASA NEPA Coordinator, Ken Kumor (telephone: (202) 358-1112; E-mail: kenneth.kumor@nasa.gov), or Environmental Specialist Ann Clarke (telephone: (202) 358-0007; E-mail: ann.clarke@nasa.gov).

5.3.3 Command and Control Issues

The Jet Propulsion Laboratory (JPL) will provide tracking, control, and communication services for all New Frontiers Program missions. Navigation services may be provided by JPL if the proposer so requests. Cost information for these services (*NASA's Mission Operations and Communications Services*) is provided in the NFPL.

5.4 Management

5.4.1 Single Principal Investigator

A single PI must be designated in each proposal and is the central person in charge of each New Frontiers investigation, with full responsibility for its scientific integrity and for the integrity of all other aspects of the mission including the E/PO program. The PI is responsible for assembling a team to propose and implement a New Frontiers investigation. The PI is accountable to NASA for the scientific success of the investigation and must be prepared to recommend project termination when, in his/her judgment, the successful achievement of established minimum science objectives, as defined in the proposal as the Performance Floor, is not likely to be achievable within the committed cost and schedule reserves.

5.4.2 Management Plans and Structure for Flight Investigations

NASA intends to give the Principal Investigator and his/her team the ability to use their own management processes, procedures, and methods to the fullest extent possible. Therefore, proposers to this AO should define the management approach (compliant with

NPG 7120.5B) best suited for their particular teaming arrangement commensurate with the investigation's implementation approach, while retaining a simple and effective management structure that assures adequate control of development within the cost and schedule constraints. The investigation team must develop a Work Breakdown Structure (WBS) that best fits its organizational approach and mission design concept (see also Appendix B).

Each New Frontiers investigation proposal must have a fully qualified and experienced Project Manager (PM) who will oversee the technical implementation of the project. The role, qualifications, and experience of the PM must be adequate to ensure that the technical and managerial needs of the investigation will be met (see the *New Frontiers Program Plan* in the NFPL for additional details). If project management and end-to-end systems engineering are to be implemented from a NASA field center, then these functions must be performed by either the Jet Propulsion Laboratory (JPL) or the Goddard Space Flight Center (GSFC), as directed by OSS.

5.4.3 NASA Program and Project Management

Program management for New Frontiers will reside within the OSS Solar System Exploration Division (SSED) at NASA Headquarters. A New Frontiers Program Director and a New Frontiers Program Scientist will be appointed. The New Frontiers Program Director will have overall responsibility for program policy, budget, and program oversight. The New Frontiers Program Scientist will develop and promulgate the periodic Announcements of Opportunities for New Frontiers Missions, plan and organize scientific and technical review of proposals submitted in response to these AO's, and formulate recommendations for selections. The New Frontiers Program Scientist also develops recommendations of selected Concept Studies for full implementation and is responsible for strategic planning activities as they relate to the New Frontiers Program.

Owing to the high cost and the expected greater complexity expected of New Frontiers missions, NASA intends to maintain a significant degree of insight into mission development through the assignment of a Program Manager in the NASA Management Office (NMO) located at the Jet Propulsion Laboratory who will be responsible for mission implementation oversight; coordination of Government-furnished services, equipment, and facilities; and contract management of selected New Frontiers investigations. The New Frontiers Program Manager will report to the New Frontiers Program Director. In addition, a Program Executive and a Program Scientist will be appointed from SSED personnel for each active New Frontiers investigation.

5.4.4 Risk Management

Every New Frontiers investigation must also define the risk management approach it intends to use to ensure successful achievement of the investigation objectives within established resource and schedule constraints. Included in this discussion of risk management must be risk mitigation plans for new technologies and the need for any

long-lead items that need to be placed on a contract before the start of Phase C, to ensure timely delivery of flight hardware and software, as well as a discussion of the role of potential descopes in risk mitigation. Proposals, which include international participation, must assess the address the risk resulting from any international contributions to the proposed mission (section 5.10). In addition, any manufacturing, test, or other facilities needed to ensure successful completion of the proposed investigation must be identified in every New Frontiers proposal.

5.5 Co-Investigators

A Co-Investigator (Co-I) is defined to be an investigator who plays a necessary role in the proposed investigation and whose services are either funded by NASA or are contributed by his/her employer. If funded by NASA, costs must be accounted for in the NASA OSS Cost. If contributed, the costs must be accounted for in the Total Mission Cost and an endorsement letter from the proposed Co-I's institution must be provided with the proposal.

The role of each Co-I must be described in the proposal (see Appendix B for additional details). Note that the identification of an unjustified number of Co-I's may result in downgrading of an investigation and/or the offer of only a partial selection by NASA (see Section II of Appendix A). In this regard, proposers might wish to consider proposing a Participating Scientist Program (see section 5.2.5) in place of Co-I's whose only roles would be extensive data analyses during Phase E.

5.6 Education and Public Outreach

As part of its long tradition of integrating education and public outreach into space science investigations, OSS now requires education and public outreach to be a significant part of every OSS flight program and research discipline and strongly encourages space science researchers to engage actively in education and public outreach as an important component of their NASA-supported professional activities. In order to achieve this goal, OSS has developed a comprehensive approach for making education at all levels (with a particular emphasis on K-14 education) and the enhancement of public understanding of space science integral parts of all missions and research programs.

In accordance with established OSS policies, Education and Public Outreach (E/PO) will be an integral element of the New Frontiers Program; one to two percent of the NASA OSS Cost (excluding launch vehicles) will be allocated to education and outreach. The key documents that establish the basic policies and guide all OSS Education and Public Outreach (E/PO) activities are a strategic plan entitled *Partners in Education: A Strategy for Integrating Education and Public Outreach Into NASA's Space Science Programs* (March 1995), an accompanying implementation plan entitled *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy* (October 1996), and the *Explanatory Guide to the NASA Office of Space Science Education and Public Outreach Evaluation Criteria* (February 2002) and the recently published evaluation of the OSS

E/PO Program of the Space Science Advisory Committee entitled *Implementing the Office of Space Science Education/Public Outreach Strategy: A Critical Evaluation of the Six-Year Mark* (March 2003). These documents are available through the NFPL, by selecting “Education” from the menu on the OSS homepage at <http://spacescience.nasa.gov/>, or by request from Dr. Jeffrey Rosendhal, Office of Space Science, Code S, NASA Headquarters, Washington, DC 20546-0001 (E-mail at jrosendh@hq.nasa.gov). As a consequence of the policies adopted by OSS, a major, national space science E/PO outreach program is now underway. Information on the activities already supported through the OSS E/PO program is available in the *OSS FY 2000, FY 2001 and FY 2002 Education and Public Outreach Annual Reports*, which are also included in the NFPL.

Instructions for the E/PO component of the proposal are contained in Appendix B. A detailed E/PO implementation plan will be developed by each investigation selected through this AO as part of its Phase A Concept Study. Any student experiment to be included on the spacecraft must be declared in the proposal (see Appendix B). As outlined in Section 7.3.3, plans for E/PO will play an explicit role in the evaluation of the Concept Studies leading to the confirmation of investigation(s) for implementation leading to flight. See the document *Guidelines and Criteria for the Phase A Concept Study* in the NFPL for additional information. Also note that significant elements of this AO’s goal for involvement of small disadvantaged businesses and minority institutions (see section 5.8) may be met through an appropriately planned E/PO program.

5.7 Technology Infusion and Transfer

NASA seeks to infuse new technologies into its programs and to strengthen the mechanisms by which it transfers such technologies to the private sector, including the nonaerospace sector. The means by which NASA's Office of Space Science plans to implement new technology is described in *The Space Science Enterprise Integrated Technology Strategy* (October 1998), which is included in the NFPL, Appendix D. The New Frontiers Program represents an opportunity for NASA to develop and test new technologies and applications, as well as strengthen existing technology transfer mechanisms and explore and implement new mechanisms and approaches to economic benefit. This is especially true when such technology enhances the acquisition of an investigation’s science or reduces the costs for the mission. It is important, however, that investigations that depend on new technology must have sound development/qualification plans for the new technology and/or adequate backup plans defined for use in the event that the planned new technology encounters development difficulties that will compromise its readiness for assembly and test of the flight hardware. Investigations that depend on new technology will not be penalized for risk provided that adequate plans are described to mitigate the risk by providing reasonable back-up approaches, or if none exist, providing for the development/qualification such that the success of the investigation is assured.

Instructions for the new technology component of the proposal are contained in Appendix B. A detailed new technology infusion and transfer implementation plan will be developed by each selected investigation as part of its Phase A Concept Study. As outlined in Section 7.3.3, plans for new technology will play an explicit role in the evaluation of the Concept Studies leading to the confirmation for flight (see the document *Guidelines and Criteria for the Phase A Concept Study* in the NFPL for additional information).

5.8 Small Disadvantaged Business and Minority Institutions

Proposers to this AO are expected to use their best efforts to assist NASA in achieving its goal for the participation of small disadvantaged businesses, women-owned small businesses, Historically Black Colleges and Universities, and other Minority Educational Institutions in NASA procurements. Investment in these organizations reflects NASA's commitment to increase the participation of minority concerns in the aerospace community, and it is to be viewed as an investment in the nation's future. Therefore, offerors other than small business concerns are advised that contracts resulting from this AO will be required to contain a subcontracting plan that includes goals for subcontracting with small, small disadvantaged, women-owned, and HUB Zone small business concerns; see Appendix A, Section XIII. Note that substantial involvement of minority colleges and universities in space science missions and research programs is also a key objective of the OSS E/PO program.

Instructions for the Small Disadvantaged Business and Minority Institutions component of the proposal are contained in Appendix B. A detailed implementation plan will be developed by each selected investigation as part of its Phase A Concept Study. As outlined in Section 7.3.3, participation goals and the quality and level of work performed by small disadvantaged businesses and minority institutions will play an explicit role in the evaluation of the Concept Studies leading to the confirmation for flight. See the document *Guidelines and Criteria for the Phase A Concept Study* in the NFPL for additional information.

5.9 Costs

5.9.1 *NASA OSS Cost and Total Mission Cost*

A major goal of the New Frontiers program is to provide the highest science value for the cost. Therefore, the NASA OSS Cost will be one factor in the selection of New Frontiers investigations and in the continuing assessment of ongoing New Frontiers investigations. All proposals must provide an estimate of the NASA OSS Cost.

NASA OSS Cost is defined as the funding that NASA OSS would be expected to provide to complete the investigation, including the cost of the Phase A Concept Study and all costs in Phases B through E, including a reserve through the end of phase B of at least 25% of all costs through the end of phase D except the cost of the ELV and any

Radioisotope Power Sources (RPS) and all contract fees. Generally, all costs must be included as NASA OSS costs unless specifically excluded. Examples of costs to be included in all proposals are: launch services (see Sections 5.11.2 and 5.11.3); radioisotope power sources (see Section 5.3.2); education and public outreach activities (see Section 5.6); new technology infusion and transfer (see Section 5.7); subcontracting costs (including fees); science Co-Investigators; all other personnel required to conduct the investigation, analyze and publish results, and deliver data in archival format to the PDS; insurance; NASA Deep Space Network (DSN) and other SOMO (Space Operations Management Office) support, if required (see *NASA's Mission Operations and Communications Services* document in the NFPL); Navigation and Ancillary Information Facility (NAIF) services; NASA curatorial support (if required; see Section 5.2.2); and all labor (including contractor and Civil Servant).

In addition, proposals must provide an estimate of Total Mission Cost, defined as the NASA OSS Cost plus any additional costs that are contributed or provided in any way other than through OSS. The Total Mission Cost will define the total value of the Mission or Mission of Opportunity investigation and must be included in a required cost table with the proposal (see Appendix B).

Sections 5.11.6 and 5.11.7 of this AO describe additional cost elements and caps on the NASA OSS Cost, Total Mission Cost, and major mission element costs for New Frontiers Mission investigations.

Section 5.12.7 describes additional cost elements specific to Mission of Opportunity investigations and specifies the NASA OSS Cost cap for Mission of Opportunity investigations.

As noted in Section 5.2, costs for Phase F, a PSP, and/or a DAP, if any of these are proposed, must be included in the estimate of NASA OSS Cost but will not count against the cost caps.

The specific cost information required for proposals is described in Appendix B. Since the provision of cost details is not anticipated until the conclusion of the Phase A Concept Study, cost estimates in the proposal may be generated using models or cost estimating relationships from analogous missions. However, for selected investigations, the proposed cost to NASA OSS shall not increase by more than 20 percent from that in the original proposal to that in the Concept Study Final Report and in any case shall not exceed the New Frontiers Program cost constraints (see Appendix F). Experience in NASA's Discovery and Explorer Programs has shown that mission costs tend to grow in Phase A and beyond as costs and challenges are better understood; therefore, proposers are advised to allow for room for this cost growth, up to the New Frontiers cost cap. And New Frontiers investigations must still maintain the required level of at least 25% reserve through the end of phase B, when developing their initial proposals. Since costs and obligation authority may well be different, it is incumbent on proposers to define any obligation requirement that exceeds planned costs.

5.9.2 Full Cost Accounting for NASA Facilities and Personnel

Where NASA-provided services are used, NASA Civil Service labor and supporting NASA center infrastructure must be costed on a full cost accounting basis. If NASA guidance for full cost accounting has not been fully developed by the closing date for proposal submission or for completion of the Concept Studies, NASA field centers may submit full cost proposals based on the instructions in the NASA Financial Management Manual, Section 9091-5, *Cost Principles for Reimbursable Agreements* (see Appendix D). If any NASA costs are to be considered as contributed costs, the contributed item(s) must be separately funded by an effort complementary to the proposed investigation and the funding sources must be identified. Any non-NASA Federal Government elements of proposals must follow their agency cost accounting standards for full cost. If no standards are in effect, the proposers must then follow the Managerial Cost Accounting Standards for the Federal Government as recommended by the Federal Accounting Standards Advisory Board.

5.9.3 Contributions

Contributions in the form of property, cash, and/or services from non-OSS U.S. as well as non-U.S. sources are welcome. These may include contributions to the payload, to the spacecraft, and/or to the launch services, subject to the following exceptions and limitations: (i) non-U.S. launch services for payloads containing nuclear power sources of any kind are prohibited; (ii) non-U.S. nuclear power sources are prohibited; and in order to insure a preponderance of US interest in the mission, (iii) the sum of contributions of any kind to the entirety of the flight experiment hardware for a New Frontiers Mission investigation may not exceed one third (1/3) of the estimated total cost in U.S. dollars for that hardware.

Values for all contributions of property and services shall be established in accordance with applicable cost principles. Such contributions may be applied to any part or parts of a mission, although it should be noted that a contributed item that is in the critical path of mission development may be identified as a risk factor, especially in the case of contribution(s) from non-U.S. source(s) (see provisions for international risk management in section 5.10). Such contributions will not be counted against the NASA OSS cost cap, but they must be included in the calculation and discussion of the Total Mission Costs (Section 5.9.1). A Letter of Endorsement that contains a statement of financial commitment from each responsible organization contributing to the investigation must be submitted with the proposals, to assure NASA that all contributions will be provided as proposed.

The cost of contributed hardware should be estimated as either: (1) the cost associated with the development and production of the item if this is the first time the item has been developed and if the mission represents the primary application for which the item was developed; or (2) the cost associated with the reproduction and modification of the item

(*i.e.*, any recurring and mission-unique costs) if this is not a first-time development. If an item is being developed primarily for an application other than the one in which it will be used in the proposed investigation, then it may be considered as falling into the second category (with the estimated cost calculated as that associated with the reproduction and modification alone).

The cost of contributed labor and services should be consistent with rates paid for similar work in the proposer's organization. The cost of contributions does not need to include funding spent before the start of the investigation (*i.e.*, before initiation of Phase B if confirmed for flight). The value of materials and supplies shall be reasonable and shall not exceed the fair market value of the property at the time of the contribution.

5.10 International Participation

Recognizing the potential scientific, technical, and financial benefits offered to all partners by international cooperation, participation by non-U.S. individuals and organizations as team members in New Frontiers Program investigations is welcome. However, such participation can add to management complexity and risk, and, therefore, proposers should limit such cooperative arrangements to those offering significant benefits while maintaining the clearest and simplest possible technical and management interfaces. The proposal must discuss risks and benefits of proposed cooperative arrangements, and must detail management approaches to mitigating these risks, including descopes, if appropriate.

International participation may include the contribution of scientific instruments, the spacecraft (or a portion thereof) and the subsequent sharing of the data from the mission, at no cost to NASA. However, as noted in Section 5.9.3, contributions of launch services and/or nuclear power source by non-U.S. sources are not permitted, and contributions of foreign launch services are restricted to the launch of payloads which do not contain nuclear materials

The direct purchase of goods and/or services from non-U.S. sources is permitted subject to U.S. laws and regulations, and subject to the restriction that NASA will not purchase non-U.S. launch vehicles for New Frontiers missions, nor may NASA funds provided to a New Frontiers mission team be used to purchase a launch vehicle from a non-U.S. source.

Potential New Frontiers participants are advised that a contract or subcontract using funds derived from NASA by a U.S. team with a non-U.S. participant(s) must meet NASA and Federal regulations. Information regarding regulations governing the procurement of foreign goods or services is provided in Appendix C. Proposers are advised that these regulations place an additional burden on investigation teams that must be explicitly included in discussions of the investigation's cost, schedule, and risk management (see also further below in this Section).

Proposals from non-U.S. organizations must be submitted in English and comply with all other submission requirements stated in this AO. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. and must be received before the established closing date given in Section 8. Proposals from foreign entities that include any U.S. participants, as well as proposals from U.S. entities that include foreign participation must include a cost plan for the U.S. entities, and, at a minimum, the integrated value of the contribution of each foreign entity.

In addition, the institutions and governments that will fund the foreign contribution(s) must endorse participation by foreign individuals and/or institutions as team members or contributors to New Frontiers investigations. Such letter(s) of endorsement must provide evidence that authorized representatives from the institution(s) and cognizant government official(s) are aware and supportive of the proposed investigation and that sufficient funding to undertake the activity as proposed will be made available if the proposal is selected by NASA. The endorsement must be submitted per the schedule in Section 8.0. In exceptional cases, proposals containing a foreign component may be submitted without endorsement if the endorsement is not possible before the announced proposal due date. In such cases, a cover letter with the proposal must indicate when a decision on endorsement can be expected, which in no case should be later than the schedule noted in Section 8 (30 days after the proposal due date). Successful and unsuccessful foreign entities will be contacted directly by the NASA Office of Space Science, and copies of these letters will be sent to the foreign sponsor.

Proposers should be aware that investigations that include international participation, either through involvement of non-U.S. nationals and/or involvement of non-U.S. entities must include in their proposal in an appendix a draft plan discussing compliance with U.S. export laws and regulations; *e.g.*, 22 CFR 120-130, *et seq.* and 15 CFR 730-774, *et seq.*, as applicable to the circumstances surrounding the particular international participation (see Appendix B.I.4). Proposers must also comply with NASA FAR Supplement clause 1852.225-70 entitled "Export Licenses," as found in the NFPL. The discussion must describe in detail the proposed international participation and is to include, but not be limited to, whether or not the international participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, the proposal must discuss whether the license has been applied for or, if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at <http://www.pmdtc.org/> and <http://www.bxa.doc.gov/>. Prospective proposers are advised that under U.S. law and regulation, spacecraft and their specifically designed, modified, or configured systems, components, parts, etc., such as the instrumentation being sought under this AO, are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations, 22 CFR 120-130, *et seq.*

Should a non-U.S. proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the foreign sponsor will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail an exchange of letters between NASA and the foreign sponsor or a formal Agency-to-Agency Memorandum of Understanding (MOU).

In the event that a non-U.S. proposal with U.S. participation or a U.S. proposal with foreign participation is selected, NASA will contract with a U.S. lead entity for performance of the U.S.-funded elements of the investigation.

5.11 Specific Requirements and Constraints for New Frontiers Mission Investigations

5.11.1 Overview

New Frontiers Mission Investigation proposals must be for complete, free-flying missions. The Principal Investigator (PI) is responsible to NASA not only for the scientific integrity of the investigation, but also for the management of the complete mission, including provision of the spacecraft, instrument, and ground system. Proposals submitted in response to this AO for New Frontiers Mission investigations must be for complete investigations from project initiation (Phase A) through mission operations (Phase E), which is to include analysis and publication of data in the peer reviewed scientific literature, delivery of the data to the Planetary Data System (PDS), and full implementation of the mission's Education and Public Outreach (E/PO) program.

5.11.2 Launch Services: Expendable Launch Vehicle Option

New Frontiers Mission investigations may be launched as primary payloads on expendable launch vehicles (ELV's). Although NASA will fund launch service costs directly, these costs must be included in the proposed NASA OSS cost (see Sections 5.9.1 and 5.11.6) and Total Mission Cost (see Section 5.11.7).

NASA will provide launch services only for an Evolved Expendable Launch Vehicle (EELV; *i.e.*, Delta-IV or Atlas-V) or a smaller ELV (*i.e.*, Delta II). Detailed information on ELV launch options, including their nominal costs, is contained in the *New Frontiers Launch Services Information Summary* document listed in the NFPL, Appendix D.

5.11.3 Launch Services: Space Shuttle Option

New Frontiers Mission investigations may not be launched on the Space Shuttle.

5.11.4 Baseline Mission and Performance Floor

Every New Frontiers Mission investigation must specify a "Baseline" mission and a "Performance Floor" Mission defined as follows: The Baseline mission is the mission

that, if fully implemented, will accomplish the entire set of scientific objectives proposed for the investigation. Any alteration that results in a reduction of the mission's ability to accomplish the Baseline set of scientific objectives as identified in the proposal will be considered a descope of the investigation. The resulting reduced set of achievable scientific objectives will be reviewed to ensure that the investigation remains at or above the Performance Floor, which is defined as the minimum science return below which the investigation will not be considered justified for the proposed cost. The Performance Floor must be identified and documented for a proposed New Frontiers Mission investigation along with a plan for the prioritized descoping of mission capability from the Baseline to the Performance Floor in the event of cost or schedule growth or for risk mitigation. The differences between the Baseline Mission and the Performance Floor will be assessed to determine the mission's resiliency in the event that development problems lead to reductions in scope. In addition, each selected PI will be required to negotiate a set of performance metrics during the definition phase for program evaluation, including cost, schedule, and others as appropriate. Failure to maintain a level of science return at or above the Performance Floor as determined by NASA will be cause for termination of the investigation.

5.11.5 Schedule

The New Frontiers Program is intended to accomplish important scientific investigations within a limited span of time. Accordingly, every New Frontiers Mission investigation to be selected through this AO is expected to launch no later than March 31, 2010. Proposers must specify the desired launch date and indicate any flexibility in their proposals. Furthermore, schedules must be such that launch takes place within 47 months from the start of the mission design/development phase (Phase C). Since this phase is defined as ending 30 days after launch, the maximum permissible length of any New Frontiers mission from the beginning of Phase C to the end of Phase C is 48 months.

Note that the Office of Space Science defines the Concept Study as Phase A and defines Phase B as a preliminary design phase ending approximately one month after Preliminary Design Review (PDR). No constraint is placed on the length of Phase B or Phase E (operations). Procurement of long lead materials is permitted during the Phase B timeframe but, if proposed, it must be accounted as an Implementation Task (Phases C and D) and, therefore, as an Implementation cost. The Implementation Phase long-lead procurement overlap with Phase B will not be considered when determining the length of Phases C and D. Options for extended missions (Phase F) must be proposed, if appropriate, with the understanding that NASA has no commitment to exercise them (see Section 5.2).

5.11.6 NASA OSS Cost Requirements and Cost Caps

The New Frontiers Program is intended to provide opportunities for planetary investigations of medium scope. Accordingly, NASA OSS will cap its funding for New Frontiers Mission investigations, including all mission phases and launch services, at

\$650M (FY 2003 dollars). The NASA OSS yearly funding profile available for missions selected under this AO is given in Appendix F.

As noted in Section 5.9.1, NASA will provide for launch services, but the cost of these services must be included in the proposal and will count against the cap on the NASA OSS Cost.

NASA will provide for radioisotope power systems and/or heater units as GFE through the Department of Energy (see Section 5.3). As with launch services, however, the cost of such devices must be included in the proposal (their capabilities and costs, for proposal purposes, are described in the document *Specifications for Space Radioisotope Power Systems (RPS) for New Frontiers* in the NFPL).

The specific cost information required for New Frontiers mission proposals is contained in Appendix B.

5.11.7 Total Mission Cost

The Total Mission Cost is defined as all costs that are necessary to complete an investigation, from selection through Phase E or Phase F (if applicable), including NASA OSS costs, other NASA costs, non-NASA Civil Servant costs, and contributions from U.S. and non-U.S. entities. In general, proposers should assume that all costs must be included unless they are specifically excluded. Proposers must estimate the Total Mission Cost in the proposal as described in Appendix B, Table B-1.

The Total Mission Cost, including contributions, may exceed the cap on total cost to NASA OSS (\$650M FY03). However, as noted in Section 5.9.3, total contributions from all sources may not exceed one-third of the cost to NASA OSS.

5.11.8 Concept Study

Each New Frontiers investigation selected through this AO will be awarded funding (up to \$1.2M in real year dollars) to conduct a seven month Phase A Concept Study, which must be budgeted as part of the initial proposal (see the *Guidelines for Concept Study Preparation* available in the NFPL). At the conclusion of the Concept Studies, it is anticipated that one investigation will be confirmed to proceed into subsequent mission phases (see Section 1.2). NASA will not continue funding for those investigations not selected to proceed.

During the Concept Study, the NASA OSS cost shall not increase by more than 20 percent from that offered in the original proposal and, in any event, must not exceed the cap on total cost to NASA OSS. Thereafter, cost shall not increase from that offered in the Concept Study. Each Concept Study must conclude with a commitment from the PI for the cost, schedule, and scientific performance of the investigation. If, at any time, the

cost, schedule, or scientific performance commitments appear to be in jeopardy, the investigation will be subject to cancellation.

5.11.9 International Participation

Any proposed international participation must be described at the same level of detail as that of U.S. partners, to the maximum extent practicable. NASA will seek to validate contribution cost, schedule, and management data during evaluation of the proposal and in subsequent reviews. Failure to provide such information about proposed contributions, or failure to document the commitment of all team partners to those costs and schedules, may cause a proposal to be found unacceptable for selection through this AO.

5.12 Specific Requirements and Constraints for Mission of Opportunity Investigations

5.12.1 Overview

By supporting U.S. participation in Missions of Opportunity (MO's), NASA seeks to allow the U.S. scientific community to conduct a science investigation of interest to OSS as part of missions sponsored by non-OSS organizations and/or existing flight hardware for missions, which have completed their prime science missions. Such "parent" non-OSS missions may be sponsored by non-U.S. governments, other U.S. agencies, NASA organizations other than OSS, the military (only if the satellite is not planned for weapons testing), or private sector organizations, and all are equally qualified. Mission extensions and proposals for new science missions that utilize existing in-flight OSS spacecraft are also allowed in this opportunity. The total cost to NASA for a New Frontiers MO investigation through this AO is limited to \$35M (FY 2003 dollars).

New Frontiers Mission of Opportunity Investigations may take several forms, as detailed in sections 5.12.2, 5.12.3, and 5.12.4 below. In all cases, however, a New Frontiers MO investigation must address one of the science objectives of the OSS Solar System Exploration Division (except those for the study of Mars; see also Section 5.2 and the DPL) and must include appropriate provisions for the analysis of data and publication of results in the peer-reviewed scientific literature. Mission of Opportunity investigations will be evaluated against the criteria described in Section 7.2 of this AO.

Ordinarily, a selected MO investigation will be expected to submit a Concept Study report to NASA for detailed review that must conclude with a commitment by the PI for the cost, schedule, and scientific performance of the proposed MO investigation. If, at any time, this commitment appears to be in jeopardy, the investigation will be subject to cancellation regardless of the impact this cancellation might have on its parent mission. As with other missions proposed to this AO, NASA funding is subject to cancellation if a cost overrun is likely to be charged to NASA for any reason, including one resulting from a launch delay caused by a non-OSS mission sponsor.

As noted in Section 1.2, NASA may select a Mission of Opportunity investigation for immediate implementation (that is, without need for a Concept Study) provided that NASA is satisfied with its readiness for development and implementation as proposed. For such a selection, a MO proposal must (1) conform to these New Frontiers AO guidelines for a Mission of Opportunity, and (2) contain a commitment by the PI for the cost, schedule, and scientific and technical performance of the investigation with detail equivalent to that expected at the end of a Concept Study. The commitment must also be complete for the programmatic considerations included in Section 5 (*e.g.*, Education and Public Outreach). Investigations selected in this manner will be subject to the same conditions for cancellation as described in the preceding paragraph.

A technical and programmatic review will be held prior to the start of phase C. Assuming a positive outcome, NASA will confirm the investigation to proceed to development. As a condition for confirmation, the organization sponsoring the parent mission (for non-OSS missions) must commit to enter into an appropriate agreement with NASA that must include provisions for sharing of flight data necessary for the completion of the selected Mission of Opportunity investigation.

5.12.2 Partner Missions

Proposals to conduct a science investigation of interest to OSS as part of missions sponsored by non-OSS organizations are welcome under this AO as Missions of Opportunity. The “parent” non-OSS missions may be sponsored by non-U.S. governments, other U.S. agencies, NASA organizations other than OSS, the military (only if the satellite is not planned for weapons testing), or private sector organizations, and all are equally qualified.

New Frontiers Mission of Opportunity Investigations may take many forms, such as providing a complete science instrument, providing hardware components of a science instrument sponsored by some organization other than NASA OSS, providing expertise in critical areas of the mission, and/or purchasing of OSS-relevant data from the mission.

NASA will evaluate the proposed investigation, but not the sponsor’s entire mission. While the investigator is not required to document the entire mission of the sponsor, the U.S. investigator must fully document the complete MO investigation in the proposal.

Note that selection by NASA through this AO does not constitute selection of the investigation as part of the parent mission, which necessarily is a decision made by the sponsor of that mission. Instead, selection through this AO only indicates the commitment by NASA to fund the NASA OSS portion of the proposed investigation through the New Frontiers program; funding beyond a limited basic study phase does not begin until detailed design of the parent mission itself is underway by its sponsor. If an investigation is selected both by NASA and by the mission sponsor, the U.S. MO PI is responsible to NASA for the scientific integrity and the management of his/her contribution to the mission.

5.12.3 Extended Science Missions

Approved NASA SSE missions nearing the end of their Prime or Extended Missions may propose a mission extension through this AO. The extended science mission being proposed must commence no later than December 31, 2005. A proposal for an extended science mission must include all costs to NASA for the extension of the mission including mission operations, DSN costs, any proposed data analysis, and adequate resources for archiving new results.

5.12.4 New Science Missions

Under this AO, a mission extension using an existing NASA space asset to conduct a new science mission may be proposed as a Mission of Opportunity if it meets several specific criteria:

- (i) The proposal must make use of a NASA spacecraft or other space asset that has completed its prime mission;
- (ii) The proposed mission extension must constitute a new science investigation and not be an extension, supplement, redirection, or follow-up of the spacecraft's original science mission or any previously approved mission extensions;
- (iii) The new science mission must constitute a science investigation addressing the scientific objectives of the Solar System Exploration Division (excluding Mars; see Appendix III of the NASA 2003 Strategic Plan and other documents in the NFPL);
- (iv) The proposal must be solely for mission operations and data analysis and not propose any hardware or other prelaunch modifications to the spacecraft or its prime mission.

New science mission extensions are Missions of Opportunity in the sense that NASA may or may not select one or more new science mission extensions, and the cost cap for new science mission extensions is the Mission of Opportunity cost cap. Non-U.S. participation is allowed in proposals for new science mission extensions.

In addition to meeting other proposal requirements, a Mission of Opportunity proposal for a new science mission extension must describe how the proposers will transition all aspects of mission operations and data analysis from the current spacecraft mission operations team to the proposed new science mission extension operations team. It is not required that the current mission operations team be a part of the new science mission extension proposal. However, in the case where the current mission operations team is not a part of the new science mission extension proposal, the proposer must show that operations can be transferred to the new science mission extension operations team with acceptable risk and with adequate capture of engineering and operations knowledge and lessons learned.

All mission operations and data analysis costs must be included in the proposed budget.

5.12.5 Science Data Requirements

NASA recognizes that MO investigation teams may justifiably incur data analysis responsibilities defined by the policies of the sponsor of the parent mission. Nevertheless, NASA expects that the mission sponsor will enter into an agreement with NASA to assure that scientific data returned from at least those aspects of the mission in which NASA support is involved, if not from the entire mission, as may be appropriate, will be made available to the U.S. scientific community in a timely way and deposited in the Planetary Data System (PDS) as described in section 5.2.4. NASA will seek to conclude an agreement with the mission sponsor in advance of launch to ensure that this activity will be done.

In those cases where it is proposed to purchase data or to receive data from the parent mission in return for service as a Co-Investigator, the proposal must provide evidence that such data, as delivered, will be suitable for successful completion of the proposed investigation. This data must also be delivered to the PDS for use by the scientific community at large. Such data-buy MO investigations need not specify a performance floor nor provide for a PSP.

5.12.6 Funding Policies

Selection of an MO investigation may result in a contract, a grant, or a cooperative agreement, depending on the nature of the proposal and the institutions involved. Further information on grants and cooperative agreements is contained in NASA Handbook NPG 5800.1D, entitled *Grants and Cooperative Agreements Handbook*, available in the NFPL.

As a matter of NASA policy, its sponsorship of a Mission of Opportunity is always conducted on a no-exchange-of-funds basis with a non-U.S. mission sponsor, although, depending on circumstances, NASA may agree to pay for some level of the integration costs for NASA sponsored experiment hardware. Under no circumstances will NASA pay for non-U.S. launch costs.

For an MO investigation on a U.S. commercial mission or on a U.S. Government mission not sponsored by OSS, the PI may receive NASA funding for costs that include integration, as well as launch services, and will be responsible for payment of these costs through his/her proposed costs.

5.12.7 NASA OSS Cost Requirements and Cost Cap

The NASA OSS cost for an MO investigation may not exceed \$35M (FY 2003 dollars) for all phases of the investigation. Specific cost information required for proposals is contained in Appendix B. NASA's funding for a selected investigation's Concept Study

(if required; see Section 5.12.1) will be limited to \$250K (real year dollars) and must be budgeted as a part of the initial proposal.

It is important for proposers to this program to understand that the MO PI assumes all risk for delays in implementation of the parent mission and must, therefore, propose appropriate reserves for such contingencies. Following the completion of any Concept Study, but prior to final selection by the parent mission's sponsoring organization, NASA funding for additional work will be limited to \$100K (in real year dollars). In any case, NASA funding for all studies prior to the initiation of mission's detailed design (Phase C) will be limited to 25 percent of the total NASA commitment for the requested investigation.

Note that funding for Mission of Opportunity investigations must include provisions for the planning and implementation of an appropriate E/PO program in accordance with OSS policies and guidelines.

Should a Concept Study be funded for an MO proposal, the NASA OSS cost shall not increase by more than 20 percent from that offered in the original proposal to this AO and, in any case, must not exceed the NASA OSS cost cap for New Frontiers MO investigations. Thereafter, the cost shall not increase from that offered in the proposal resulting from the Concept Study.

5.12.8 Schedule

It is incumbent on the proposing investigator to provide evidence in his/her proposal that the sponsoring organization intends to fund the parent mission and that the endorsement of NASA for U.S. MO participation is required by the sponsoring organization prior to December 31, 2005. The launch date itself is not constrained, although it should not be substantially later than the end of 2008 in order to allow NASA's planning for the future New Frontiers Program to proceed in an orderly manner. If a commitment from NASA is not needed by the organization sponsoring the parent mission before December 31, 2005, the proposal should be submitted in response to a subsequent OSS SSE AO that allows for MO's.

6.0 PROPOSAL SUBMISSION INFORMATION

6.1 Preproposal Activities

6.1.1 New Frontiers Program Library

The New Frontiers Program Library (NFPL), Appendix D, provides additional background, technical and management information, and requirements, including information on the New Frontiers Program, Solar System Exploration science goals, the NASA 2003 Strategic Plan, launch vehicles, Deep Space Network capabilities, NASA's technology transfer infrastructure, the OSS Integrated Technology Strategy, the Office of

Space Science's Education and Public Outreach Strategy and its implementation, the Planetary Data System, and existing NASA test and mission operations facilities. In many cases, information provided in these reference documents includes examples of those types of data that may assist evaluators in better evaluating proposals and, therefore, are in the proposer's best interests to provide in their proposals to the best of their ability. In any case of conflict between this AO and these documents, however, the AO takes precedence. All documents in this library are downloadable through the World Wide Web at the URL (<http://newfrontiers.larc.nasa.gov/newfrontiers/NFPL.html>). Hard copies are not available and should not be requested.

6.1.2 Preproposal Conference

A Preproposal Conference will be held on the date shown in Section 8.0 at a hotel in the Washington area. All interested parties may attend but may not use NASA funds provided through any type of research award to defray the costs of attendance and must make their own travel arrangements. The purpose of this conference will be to address questions about the proposal process for this AO. Questions should be sent to the New Frontiers Program Scientist at the address given in Section 6.2. NASA personnel will address all questions received no later than five working days prior to the Conference. Questions submitted after this date may be addressed at the Conference as time permits and as appropriate answers can be generated. Anonymity of the authors of all questions will be preserved. A transcript of the New Frontiers AO Preproposal Conference, including answers to all questions addressed at the conference, will be posted as part of the NFPL (see Section 6.1.1) approximately two weeks after this event.

6.1.3 Notice of Intent to Propose

To assist NASA's planning of the proposal evaluation process, a Notice of Intent (NOI) to propose should be submitted by all prospective proposers in accordance with the schedule in Section 8.0. Material in an NOI is confidential and will be used for NASA planning purposes only. Those submitting an NOI will receive any New Frontiers program updates as may occur, up to the time of the proposal due date (all updates will also be posted on the Web site of this AO).

An NOI is submitted electronically by entering the requested information on the site at the URL <http://proposals.hq.nasa.gov>/Proposers who experience difficulty in using this site should contact the Help Desk by E-mail at proposals@hq.nasa.gov for assistance. This Website will request the following information (to the extent that it is known by the NOI due date):

- (a) Name, address, telephone number, fax number, E-mail address, and institutional affiliation of the Principal Investigator (PI).
- (b) Full names and institutional affiliations of each known Co-Investigator. If any Co-Investigators or other team members are from non-U.S. institutions, the

mechanism by which these people expect to be funded should be identified in the comments box on the form.

(c) Type of proposal (New Frontiers Mission investigation or Mission of Opportunity investigation) and anticipated launch vehicle.

(d) A brief statement (150 words or less) for each of the following:

- (i) the scientific objectives of the proposed mission;
- (ii) identification of new technologies that may be employed as part of the mission; and
- (iii) the Education/Public Outreach objectives in the proposed investigation.

(e) The name of the Lead Representative from each organization (industrial, academic, nonprofit, and/or Federal) included in the proposing team.

SPECIAL NOTICE: As a result of recent AO's for complete mission investigations such as this one, commercial aerospace and technology organizations have requested access to the names and addresses of those who submit NOI's in order to facilitate informing potential proposers of their services and/or products. Therefore, with the permission of the submitters of an NOI to this AO, NASA OSS is willing to make this information publicly available with the understanding that the Agency takes *no* responsibility for the subsequent use of such information. The Web site that requests NOI information allows proposers to check a box that grants this permission.

6.2 Point of Contact for Further Information

Inquiries about this AO and/or the New Frontiers Program may be directed to the New Frontiers Program Scientist at the following address:

Dr. Thomas H. Morgan
Ref. New Frontiers 2003
Solar System Exploration Division
Code SE
Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001
Telephone: (202) 358-0828
Fax Number: (202) 358-3097
E-mail: thomas.morgan@nasa.gov (Note: Subject field should read "NFAO")

6.3 Proposal Format

6.3.1 Structure of Proposal

General NASA guidance for proposals to this AO is given in Appendix A, which is considered binding unless specifically amended in this AO. A uniform proposal format is required from all proposers to aid in proposal evaluation, which is summarized in Appendix B. Failure to follow this outline may result in reduced ratings during the evaluation process and could lead to rejection of the proposal without review.

6.3.2 Requirement for PI and Authorizing Institutional Signatures

All proposals must have a Cover Page, which includes a Proposal Summary, that is to be submitted electronically through the designated Web site, following the instructions given in Appendix B. Once this form is submitted, it must be printed and signed by the Principal Investigator and an official of the PI's institution who is authorized to certify institutional support and sponsorship of the investigation, including the management and the financial parts of the proposal. Note that the authorizing institutional signature on the printout of the electronically submitted Cover Page also certifies that the proposing institution understands and complies with the three required certifications printed in Appendix E of this AO; therefore, it is not necessary to submit these certifications separately with the proposal.

The proposal must also include a letter of endorsement signed by an institutional official from every organization identified as providing no-exchange-of-funds contributions of hardware, software, facilities, and/or services (including those of Co-Investigators), that provides evidence that the institution and/or Government officials are aware of and support the proposed investigation and will pursue funding if selected by NASA.

Signatures of commitment are required for all science team members identified in the science section (including the PI and Co-I's) and for all key project personnel named elsewhere in the proposal including key individuals associated with the E/PO activities. These signatures are to be included at the bottom of the resumes required for each of these individuals and/or included on commitment letters from their institutions (see Appendix B, Section I.2 and I.3). The original, signed documents are to be included in the original copy of the proposal.

Non-U.S. organizations involved in proposals must submit such endorsements to the address given in Section 6.3.4 by the due date given in Section 8.0.

6.3.3 Number of Copies of Proposal to be Submitted

Seventy (70) copies of each proposal, including the original signed proposal, and 70 clearly labeled copies of a CD-ROM containing a single, searchable PDF version of the proposal, must be delivered to the address given in Section 6.3.4 on or before the proposal deadline given in Section 8.0.

6.3.4 *Address for Submittal of Proposal*

All proposals must be received at the following address by the proposal due date given in Section 8.0.

New Frontiers 2003 AO
Office of Space Science
NASA Peer Review Services
Suite 200
500 E Street, SW
Washington, DC 20024-2760
Tel: (202) 479-9030

NASA will notify the proposers that their proposals have been received. Proposers who have not received this confirmation within two weeks after submittal of their proposals should contact the New Frontiers Program Scientist at the address given in Section 6.2.

6.4 Special instructions for Proposals Involving non-U.S. Organizations

See Sections 5.9 and 8.0 for more information on and additional deadlines for proposals involving non-U.S. organizations.

7.0 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

7.1 Evaluation and Selection Process

All proposals will be screened to determine their compliance to the requirements and constraints of this AO (see also the Compliance Checklist in Appendix G). Proposals that do not comply will be returned to the proposer without further review. Compliant proposals will be assessed against the criteria specified in Section 7.2 by panels of individuals who are peers of the proposers. Panelists will be instructed to evaluate all proposals independently, without comparison. These panels may be augmented through the solicitation of mail reviews, which the panels have the right to accept in whole or in part, or to reject. Proposers should be aware that, during the evaluation and selection process, NASA may request clarification of specific points in a proposal; if so, such a request from NASA and the proposer's response shall be in writing.

An *ad hoc* subcommittee of the Space Science Steering Committee (SSSC; see further below), composed wholly of Civil Servants (some of whom may be from Government agencies other than NASA) and appointed by the Associate Administrator for Space Science, will convene to consider the peer review results and categorize the proposals in accordance with procedures required by NASA FAR Supplement Part 1872.403-1. The categories are defined as follows:

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.

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

The results of the evaluations and categorizations will then be reviewed by the SSSC. The SSSC will conduct an independent assessment of the evaluation and categorization processes regarding their compliance to established policies and practices, as well as the completeness, self-consistency, and adequacy of all materials related thereto. After this review, the final evaluation results will be forwarded to the Associate Administrator, who will make the final selection(s). As the Selection Official, the Associate Administrator may consult with senior members of the Office of Space Science concerning the selections.

Regarding the final selections, proposers should recognize that the Associate Administrator is free to use a wide range of planning and policy considerations when selecting among top-rated proposals. While OSS develops and evaluates its program strategy in close consultation with the scientific community through a wide variety of advisory groups, the OSS program is an evolving activity that ultimately depends upon the most current Administration policies and budgets, as well as the scientific priorities identified by the scientific community.

The overriding consideration for the final selection of proposals submitted in response to this AO will be to maximize scientific return within the available budget for this program. Depending on the availability of proposals of appropriate merit, this objective may be achieved by the selection of investigation(s) at the cost ceiling for New Frontiers Mission investigations, or lower cost investigation(s) that would allow more rapid release of the next New Frontiers AO, or a combination of investigations of various costs, including any Mission(s) of Opportunity.

7.2 Evaluation Criteria

7.2.1 *Overview*

The criteria below will be used to evaluate proposals as described in Section 7.1. For a New Frontiers Mission of Opportunity investigation, the proposed investigation is understood to encompass only the proposed contribution to the mission and not that of the entire parent mission. The evaluation criteria, with their approximate percentage weights (the first percentage is for New Frontiers Mission investigations and Mission of Opportunity investigations with hardware; the second is for Mission of Opportunity data-buy only investigations), are as follows:

- The scientific merit of the investigation 40 / 60
- The technical merit and feasibility of the proposed investigation 30 / 40
- The feasibility of the proposed approach for mission implementation, including cost risk (i.e., realism and reasonableness of cost) 30 / 0

These criteria are defined more fully in the following sections. Evaluation findings for each criterion will be documented using narrative text in terms of specific Major and Minor Strengths and Weaknesses, as well as an adjectival summary score.

7.2.2 *Scientific Merit of the Investigation*

The description of the scientific investigation provided in the proposal will be used to evaluate its scientific merit. For a New Frontiers mission investigation, the investigation's goals and objectives will be compared with the scientific goals and objectives described in Section 2.1. For a Mission of Opportunity investigation, the investigation's goals and objectives will be compared with the broad strategic goals of the NASA OSS Solar System Exploration Division, as defined in the NASA 2003 Strategic Plan, Appendix III (in the DPL). This evaluation will also include consideration of how well the investigation promises fundamental progress in the scientific knowledge of the target, how well the investigation may support NASA's other Solar System Exploration missions, and whether it provides ancillary benefits to NASA's space science program in general (e.g., through development of critical new technologies). For New Frontiers Mission investigations, the scientific value of the Performance Floor (see Section 5.11.4) will also be assessed as part of the determination of the overall scientific merit of the investigation. This evaluation will result in narrative text, as well as an appropriate adjectival rating.

7.2.3 *Technical Merit and Feasibility of the Proposed Investigation*

Each investigation will be evaluated for its technical merit, feasibility, resiliency, and the probability of success as expressed in terms of specific major and minor Strengths and

Weaknesses. Technical merit and feasibility will be evaluated by assessing the degree to which the investigation will address the proposed scientific goals and objectives, and the degree to which any proposed instruments can provide the necessary data. Considerations in the evaluation of the data analysis (i.e., calibration/validation) and archiving plan will include an assessment of planning and budget adequacy and evidence of plans for well documented, high level products and software usable to the entire science community and consideration of adequate resources for physical interpretation of data and reporting scientific results in refereed journals. Consideration of whether the data gathered will be sufficient to complete the scientific investigation will be a major factor in this assessment, as will the proposed plan for the timely release of the data to the public domain for enlarging its science impact. For New Frontiers Mission investigations, resiliency will be evaluated by assessing the approach to descoping the Baseline Mission to the Performance Floor in the event that development problems force reductions in scope. The probability of success will be evaluated by assessing the experience, expertise, and organizational structure of the science team and the mission design in light of any proposed instruments. The role of each Co-Investigator will also be evaluated for necessary contributions to the proposed investigation and the inclusion of Co-I's who do not have a well-defined role may be cause for downgrading of the proposal. This evaluation will result in narrative text, as well as an appropriate adjectival rating.

Mission of Opportunity investigations that do not include hardware (e.g., data purchase or data exchange for services as a Co-I) will be evaluated against all the factors above except that the non-NASA provided flight instrument design(s) will not be evaluated for its (their) ability to provide the necessary data. However, such proposals will be evaluated for the evidence that such data will be made available by way of signed commitments for their delivery in a format and time frame suitable for the completion of the proposed investigation. It is assumed that NASA will not pay for these data unless the data, as delivered, are suitable for successful completion of the proposed investigation. In addition, data-buy Mission of Opportunity investigations need not specify a performance floor, nor provide for a PSP and/or DAP (as defined in Section 5.2.5).

7.2.4 Feasibility of the Proposed Approach for Mission Implementation

The technical and management approaches of all submitted investigations will be evaluated to assess the likelihood that they can be implemented as proposed, including an assessment of the risk of their completion within the proposed costs. The evaluation will consider implementation factors such as the proposed launch vehicle including reliability, overall mission design (i.e., "mission architecture"), spacecraft design and design margins, use of the DSN, and the proposers' understanding of the processes, products, and activities required to accomplish development and integration of all elements (flight systems, ground and data systems, etc.). This assessment will also consider the adequacy of the proposed organizational structure, the roles and experience of the known partners, the management approach, the commitments of partners and contributors, and the team's understanding of the scope of work (covering all elements of the mission, including

contributions). The relationship of the work to the project schedule, the project element interdependencies, and associated schedule margins will also be evaluated. Investigations proposing new technology, i.e., technologies having a Technology Readiness Level (TRL) less than 7 (see TRL Definitions in NFPL), will be penalized for risk if adequate backup plans to ensure success of the mission are not described. The proposal must discuss the methods and rationale (cost models, cost estimating relationships of analogous missions, etc.) used to develop the estimated cost and must include a discussion of cost risks. Innovative cost effective features, processes, or approaches will be considered a strength if proven sound. However, even with innovative cost features, proposals that are unable to show an unencumbered reserve at confirmation (end of phase B) of at least 25% of all development costs (less ELV and RPS costs) are likely to be judged a high cost risk and not selected.

Proposals must also define the risk management approach the project team intends to use to ensure successful achievement of the investigation objectives within established resource and schedule constraints. Risk mitigation plans for new technologies, and the need for long-lead items that must be placed on contract before the beginning of Phase C to ensure timely delivery, should be included in this discussion of risk management. Additionally, any manufacturing, test, or other facilities needed to ensure successful completion of the proposed investigation should be identified in the proposal.

Proposals must also identify a Project Manager (PM) who will oversee the technical and managerial implementation of the project. The PM must work closely with the PI in order to ensure that the mission meets its objectives within the resources outlined in the proposal. The role, qualifications, and experience of the PM must be adequate to ensure that the technical and managerial needs of the investigation will be met. If project management and end-to-end systems engineering are to be implemented from a NASA field center, then these functions must be performed by either the Jet Propulsion Laboratory (JPL) or the Goddard Space Flight Center (GSFC), as directed by OSS.

It is recognized that teaming arrangements for implementing the investigation may not be complete before the proposal closing date. Therefore, proposers will not be penalized if the proposal indicates only candidate (but credible) implementation approaches (including cost estimates) for the spacecraft, launch vehicle, communications, and ground systems that will allow successful implementation of the mission. This does not apply, however, to arrangements in which the partners are offering contributions to the investigation, including those described in Section 5.10 above. The commitment of every partner offering a contribution must be documented in letters of commitment. For proposals offering contributions that are critical to the success of the proposed investigation, the evaluated risk will increase if the proposals 1) do not have clear and simple technical and management interfaces in the proposed cooperative arrangements, 2) do not provide evidence in the proposal that the contribution is within the scientific and technical capability of the partner, and 3) do not have the required endorsement on a firm commitment to provide the offered contribution. Adequate contingency plans for coping

with the failure of a proposed cooperative arrangement may help to reduce the evaluated risk.

Since Mission of Opportunity investigations fly on non-OSS missions, factors involving spacecraft and launch vehicle capabilities will be considered in the evaluation only as appropriate. Mission of Opportunity investigations that do not provide hardware (*e.g.*, data buys or exchange for Co-I services) will not be evaluated under this criterion.

For both Mission and Mission of Opportunity investigations, technical, management, and cost evaluation will include an assessment of proposed planetary protection provisions to avoid potential biological contamination (forward and backward) that may be associated with the mission.

7.3 Plans for Implementation

7.3.1 Notification of Selection

Following selection, the PI's of the selected investigations will be notified immediately by telephone, followed by formal written notification, which may include any special conditions or terms of the offer of selection (*e.g.*, partial selections, see Section II of Appendix A). The formal notification will also include instructions for scheduling a debriefing at which any issues noted during the evaluation that may require attention during the Phase A Concept Study will be discussed (see Section 7.4). In addition, any other special instructions for the Concept Study will be communicated.

7.3.2 Contract Administration and Funding

Unique mission management approaches and organizational arrangements in the selected proposals may require different contract administration and funding arrangements. Therefore, each PI should specify the proposed teaming arrangement in his/her proposal, including any special contracting mechanisms that are considered especially desirable for NASA's award to the team. In this regard, NASA strongly encourages cost-type contracts with incentives, particularly where performance incentives are measured based on delivery of calibrated/validated science data products.

It is anticipated that NASA will provide up to \$1M to each selected New Frontiers Mission investigation and up to \$250K for each Mission of Opportunity investigation (if applicable; see Section 5.1) to perform a Phase A Concept Study to be initiated as soon as possible after notification.

7.3.3 Confirmation of Investigations for Implementation

The product of the Phase A studies will be Concept Study reports as specified in the document entitled *Guidelines and Criteria for the Phase A Concept Study* the NFPL. The scientific, technical, management, cost, and other aspects of the Concept Study will be

assessed by a panel composed of individuals who are experts in each of the areas to be evaluated. This assessment of the Concept Study will be similar to the proposal evaluation but will consider the additional detailed information provided. However, in this case, NASA may request in-person presentations and/or site visits to review the Phase A Concept Study with the investigation teams. However, even if innovative cost features are included, selected investigations that are unable to show an unencumbered reserve at the time of their confirmation for development (i.e., at the end of Phase B) of at least 25 percent of all development costs in Phases C and D (excluding the ELV and RPS costs) are likely to be judged as having an unacceptably high cost risk and, therefore, not confirmed for further development.

If any change in scientific scope is introduced as a result of the Concept Study, this evaluation will include a reexamination of the scientific merit of the investigation. In all cases, the total cost to NASA, the technical merit and feasibility of the science investigation, and the feasibility of implementing the mission will be evaluated. A complete assessment of the technical approach, the management, the Phase B plans, and the cost risk will be integrated to evaluate the probability that the implementation approach will support the science objectives. In addition, there will be a detailed evaluation of plans and provisions for education and public outreach, new technology, and small disadvantaged business that are expected to be developed as part of the Phase A Concept Study.

As a result of the evaluation of the Concept Studies, the Associate Administrator for Space Science expects to confirm at least one New Frontiers mission investigation to proceed to Phase B. NASA will not continue funding for investigations that are not selected to proceed; any such investigations are free to repropose to future suitable AO's. Any Mission of Opportunity investigations as may have been selected for Phase A study may or may not be confirmed for implementation.

Missions of Opportunity may or may not have a Phase A or Phase B based on their perceived readiness to proceed.

7.3.4 Confirmation of Investigations for Phases Subsequent to Phase A

At the completion of the Phase B study (*i.e.*, after the Preliminary Design Review) for the selected and confirmed investigation, an independent review team, chartered by the Associate Administrator for Space Science, will conduct a Confirmation Assessment, the results of which will be presented to the Associate Administrator in a formal Confirmation Review in compliance with OSS policy application of NPG 7120.5B Approval process. The organization designated by NASA to implement the investigation may also choose to hold a Confirmation Readiness Review prior to the Confirmation Review. The PI, the independent review team Chairperson, and a representative of the implementing organization will present results of these reviews to the Associate Administrator for Space Science at the Confirmation Review, who will then decide whether or not to confirm the mission(s) for implementation (Phases C and D). This

decision will be based on the project’s readiness to proceed to design and development and programmatic considerations such as cost, schedule, the ability to achieve the scientific objectives delineated in the proposal, and the completeness of the project’s Level One requirements. Missions not confirmed for implementation may be sent back for additional study or may be terminated. NASA will not expend additional funds on nonconfirmed and terminated missions.

7.4 Opportunity for Debriefing of Nonselected Proposers

Proposers of investigations that are not selected will be notified in writing and offered oral debriefings for themselves and a representative from each of their main partners (if any). Such debriefings may be in person at NASA Headquarters or, if the investigation team prefers, by telephone. In the former case, proposers may not use NASA funds to defray travel costs. In either case, a senior representative from the key institution(s) involved in a proposal may participate in such debriefings in addition to the proposing Principal Investigator.

8.0 SCHEDULE OF SOLICITATION

The following schedule describes the major milestones for this New Frontiers Announcement of Opportunity:

AO release.....	R
Preproposal Conference	R + ~2 wk
Notice of Intent due.....	R + ~60 d
Proposal deadline, 4:30 p.m. ET.....	R + ~150 d = P
Non-U.S. Letter of Endorsement due	P + ~30 d
Selections announced (target)	P + 5 m = Selection
Concept Study due (target).....	Selection +7 months
Confirmation for flight (target).....	Selection + 10 months

9.0 CONCLUSION

The New Frontiers Program represents a challenging new way for NASA to accomplish important scientific exploration of the Solar System. It provides an opportunity to execute science investigations of medium scope at the forefront of planetary science, as well as to generate opportunities to enhance education and engage the public in the excitement of science discoveries. NASA invites both the U.S. and international science communities to submit proposals for New Frontiers Mission investigations and Mission of Opportunity investigations in response to this Announcement.

Colleen N. Hartman
Director
Solar System Exploration Division

Edward J. Weiler
Associate Administrator
for Space Science

APPENDIX A

GENERAL INSTRUCTIONS AND PROVISIONS

I. INSTRUMENTATION AND/OR GROUND EQUIPMENT

By submitting a proposal, the investigator and institution agree that NASA has the option to accept all or part of the offeror's plan to provide the instrumentation or ground support equipment required for the investigation, or NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use of Government instrumentation or property that subsequently becomes available, with or without modification, that meets the investigative objectives.

NOTICE TO ALL OFFERORS: In the event that a Principal Investigator employed by NASA is selected under this Announcement of Opportunity (AO), NASA will award prime contracts to non-Government participants, including co-investigators, hardware fabricators, and service providers, who are named members of the proposing team, as long as the selecting official specifically designates the participant(s) in the selection decision. Refer to Section I of Appendix B of this AO for proposal information that the selecting official will review in determining whether to incorporate a non-Government participant in the selection decision. Each NASA contract with hardware fabricators and service providers selected in this manner will be supported by an appropriate justification for other than full and open competition, as necessary.

II. TENTATIVE SELECTIONS, PHASED DEVELOPMENT, PARTIAL SELECTIONS, AND PARTICIPATION WITH OTHERS

By submitting a proposal, the investigator and the organization agree that NASA has the option to make a tentative selection pending a successful feasibility or definition effort. NASA has the option to contract in phases for a proposed experiment, and to discontinue the investigative effort at the completion of any phase. NASA may desire to select only a portion of the proposed investigation and/or that the individual participates with other investigators in a joint investigation. In this case, the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a NASA selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its leader or contact point. NASA reserves the right not to make an award or cancel this AO at any time.

III. SELECTION WITHOUT DISCUSSION

The Government intends to evaluate proposals and award contracts without discussions with offerors. Therefore, each initial offer should contain the offeror's best terms from a

cost or price and technical standpoint. However, the Government reserves the right to conduct discussions, if later determined by the Contracting Officer to be necessary.

IV. NONDOMESTIC PROPOSALS

The guidelines for proposals originating outside of the United States are the same as those for proposals originating within the United States, except that the additional conditions described in Section 5.10 shall also apply.

V. TREATMENT OF PROPOSAL DATA

It is NASA policy to use information contained in proposals and quotations for evaluation purposes only. While this policy does not require that the proposal or quotation bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the title page of the proposal or quotation and specify the information, subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals and quotations will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

RESTRICTION ON USE AND DISCLOSURE OF PROPOSAL AND QUOTATION INFORMATION (DATA)

The information (data) contained in (insert page numbers or other identification) of this proposal or quotation constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed for other than evaluation purposes; provided, however, that in the event a contract is awarded on the basis of this proposal or quotation, the Government shall have the right to use and disclose this information (data) to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose this information (data), if obtained from another source without restriction.

VI. STATUS OF COST PROPOSALS

The investigator's institution agrees that the cost proposal submitted in response to the Announcement is for proposal evaluation and selection purposes, and that, following selection and during negotiations leading to a definitive contract, the institution may be required to resubmit or execute all certifications and representations required by law and regulation.

VII. LATE PROPOSALS

The Government reserves the right to consider proposals or modifications thereof received after the date indicated for such purpose, if the selecting official deems it to offer NASA a significant technical advantage or cost reduction. (See NFS 18-15.208.)

VIII. SOURCE OF SPACE INVESTIGATIONS

Investigators are advised that candidate investigations for space missions can come from many sources. These sources include those selected through the AO, those generated by NASA in-house research and development, and those derived from contracts and other agreements between NASA and external entities.

IX. DISCLOSURE OF PROPOSALS OUTSIDE THE GOVERNMENT

NASA may find it necessary to obtain proposal evaluation assistance outside the Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal, the investigator and institution agree that NASA may have the proposal evaluated outside the Government. If the investigator or institution desires to preclude NASA from using an outside evaluation, the investigator or institution should so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

X. EQUAL OPPORTUNITY

For any NASA contract resulting from this solicitation, the clause at FAR 52.222-26, Equal Opportunity, shall apply.

XI. PATENT RIGHTS

- A. For any NASA contract resulting from this solicitation awarded to other than a small business firm or nonprofit organization, the clause at NFS 18-52.227-70, New Technology, shall apply. Such contractors may, in advance of a contract, request waiver of rights as set forth in the provision at NFS 18-52.227-71, Requests for Waiver of Rights to Inventions.
- B. For any NASA contract resulting from this solicitation awarded to a small business firm or nonprofit organization, the clause at FAR 52.227-11, Patent Rights--Retention by the Contractor (Short Form) (as modified by NFS 18-52.227-11), shall apply.

XII. RIGHTS IN DATA

Any contract resulting from this solicitation will contain the Rights in Data - General clause: FAR 52.227-14.

XIII. SMALL AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING

- A. Offerors are advised that, in keeping with Congressionally mandated goals, NASA seeks to place a fair portion of its contract dollars, where feasible, with small disadvantaged business concerns as defined in 52.219-8 and 52.226-2 of the FAR. Offerors will be evaluated on the participation in the performance of the mission of small disadvantaged business concerns in the authorized North American Industry Classification System (NAICS) as determined by the Department of Commerce (see FAR 19.201(b)).
- B. Offerors are advised that for NASA contracts resulting from this solicitation, which offer subcontracting possibilities expected to exceed \$500,000, and are with organizations other than small business concerns, the clause FAR 52.219-9 shall apply. Offerors whose investigations are selected for implementation leading to flight will be required to negotiate subcontracting plans which include subcontracting goals for small, small disadvantaged, women-owned, and HUB Zone small business concerns. Note that these specific subcontracting goals need not be submitted with the proposal. Failure to submit and negotiate a subcontracting plan after the Phase II selection shall make the offeror ineligible for award.

XIV. WITHDRAWAL OF PROPOSALS

Proposals may be withdrawn by the proposer at any time before award. Proposers are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances, which dictate termination of evaluation.

APPENDIX B

GUIDELINES FOR PROPOSAL PREPARATION

The following guidelines apply to the preparation of proposals in response to this AO. The material presented is a guide for the prospective proposer and is not intended to be all encompassing. The proposer must, however, provide information relative to those items applicable, as well as other items required by the AO. In the event of an apparent conflict between the guidelines in this Appendix and those contained within the body of the AO, those within the AO shall take precedence.

GENERAL GUIDELINES

All documents must be typewritten in English, use metric and standard astronomical units, and be clearly legible. Submission of any portion of the proposal material by facsimile, electronic media, videotape, or computer disk is not acceptable, nor may a proposal reference a World Wide Web site for any data or material necessary for its completeness or review. In evaluating proposals, NASA will only consider the printed material in the submitted proposal.

The proposal must consist of only one volume, with readily identified sections corresponding to Sections D through I in this Appendix. The restrictions on page count for the various sections are specified in the table below. If the same information is required in more than one section of the proposal (*e.g.*, instrument and/or spacecraft design specifications) to support the subject discussion, it may be included by reference to the primary section where it exists provided that such reference does not unduly impede understanding of the presented material.

70 CD-ROM's containing a single, searchable PDF version of the proposal must also be delivered with the printed copies (see section 6.3.3 of this AO). In order to allow for recycling of proposals after the review process, all proposals and copies must be submitted on plain white paper only (*i.e.*, no cardboard stock or plastic covers, no colored paper, etc.). Photographs and color figures are permitted only if printed on recyclable white paper. The original, signed copy of the proposal (including signed endorsements) must be bound in a manner that makes it easy to disassemble for reproduction should NASA need additional copies. Except for the original, two-sided copies are preferred.

Proposals shall comply with the page limitations noted in the table below, including no more than five fold out pages (28 x 43 cm; *i.e.*, 11 x 17 inches), where each fold out page counts as one regular sized page. All pages other than fold out pages shall be 8.5 x 11 inches or A4 European standard. Each side of paper on which text or figures appears is counted as a page.

Single- or double-column printing format is acceptable. In complying with the page limits, the type font should not be smaller than 12 point (i.e., less than or equal to ~15 characters per inch), using no less than 1 inch (2.5 cm) margins at the top and both sides (note: A4 paper should use 2.5 cm at the top and both sides, and 4 cm at the bottom). Figure captions should be in 12-point font, though smaller font is allowed within figures and cost tables (however, all must be easily readable without optical aid).

The following table provides page count limits for proposals for New Frontiers Mission investigations and Mission of Opportunity investigations except that Mission of Opportunity proposals are limited to 25 pages for the description of the Science Investigation (Section D) and 15 pages for the description of Mission Implementation, including Advanced Development (Section F). One extra page is allotted for description of any optional Participating Scientist Program, Data Analysis Program, and/or Guest Observer Program.

Section	Page Limit
A. Cover Page and Proposal Summary	Printout of electronic Web submission
B. Table of Contents	2
C. Fact Sheet	2
D. Science Investigation	40
E. Plan for Education and Public Outreach including student participation in payload development or operations, Technology Infusion/Transfer, and Small Disadvantaged Businesses	2
F. Plan for Participating Scientist Program, Data Analysis Program, and/or Guest Observer Program (optional)	1
F. Mission Implementation including Advanced Development G. Management and Schedule H. Cost and Cost Estimating Methodology	35 total (plus 5 pages if development of advanced technologies is proposed)

<p>I. Appendices: (no others permitted)</p> <ol style="list-style-type: none"> 1. Statement(s) of Work (SOW) for each contract 2. Letter(s) of Endorsement and Commitment 3. Resumes (signed by each participant) 4. Draft International Participation Plan and Discussion of Compliance with U.S. Export Laws and Regulations 5. Draft Outline of Technical Responsibilities (if international participation is involved) 6. Planetary Protection Compliance 7. Compliance with Federal Procurement Regulations for NASA PI 8. Proposal Acronyms / Abbreviations 9. Reference List (optional) 	<p>No page limit, but small size encouraged</p>
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A. COVER PAGE AND PROPOSAL SUMMARY

A Cover Page and Proposal Summary, prepared as directed below, must preface the proposal. The Cover Page must be signed by the Principal Investigator and an official of the proposing organization who is authorized to commit the organization’s resources to the proposed investigation. This authorizing signature also certifies that the proposing institution has read and is in compliance with the three required certifications printed in full in Appendix E; therefore, these certifications do not need to be submitted separately.

The form for the Cover Page and Proposal Summary is found at the WWW site located at <http://proposals.hq.nasa.gov> and must be submitted electronically to that same site after it is filled out. The full names of the Principal Investigator and the authorizing official, their addresses with zip code, telephone and fax numbers, and electronic mail addresses are required on the specified form, as well as the names, institutions, and E-mail addresses of all participants, the type of investigation proposed (i.e., Mission or Mission of Opportunity), the total NASA OSS Cost, and a 200-word Proposal Summary. A hard copy version of this Cover Page/Proposal Summary must be printed in time to acquire signatures and include with the original hard copy of the proposal for delivery to the address in Section 6.3.4 according to the schedule provided in Section 8.0, both in this AO. Proposers are advised that they must not reformat or correct the printed version of this Cover Page as important NASA-required documentation may be lost. Proposers who experience difficulty in using this site may contact the Help Desk at proposals@hq.nasa.gov for assistance. Note that electronic submission of the Cover Page does not satisfy the deadline for proposal submission.

It is NASA’s intent to enter the Proposal Summaries of all selected investigations for its various programs into a publicly accessible database. Therefore, the Proposal Summary should not contain any proprietary or confidential information that the submitter wishes to protect from public disclosure; in that regard, see also Section V of Appendix A of this AO.

B. TABLE OF CONTENTS

The proposal should contain a Table of Contents that includes the topics provided below in Sections D through I.

C. FACT SHEET

A Fact Sheet that provides a brief summary of the proposed investigation must be included in the proposal. The information conveyed on the Fact Sheet should include the following:

- Science objectives (including the importance of the science to the NASA science themes);
- Education and public outreach objectives;
- Technology development/infusion/transfer objectives;
- Mission overview (including mission objectives and major mission characteristics);
- Science payload;
- Key spacecraft characteristics;
- Anticipated launch vehicle;
- DSN infrastructure usage;
- Mission management (including teaming arrangement as known);
- Anticipated need for curatorial services for returned samples (as appropriate);
- Schedule of proposed investigation;
- Statement of any anticipated significant contributions to the investigation and an estimate of their value; and
- The estimated Total Cost to NASA from Table B-1.

Other relevant information, including figures or drawings, may be included at the proposer's discretion. The Fact Sheet is restricted to two pages (preferably a single, double-sided sheet).

D. SCIENCE INVESTIGATION

The Science Investigation section should contain the following topics for the proposed investigation.

1. Scientific Goals and Objectives. This section should consist of a discussion of the goals and objectives of the investigation; their value to achieving the science objectives stated in this AO, and their relationships to past, current, and future investigations and missions. Provide the history of the need for such a investigation, including an overview of the proposed mission.

The measurements to be taken in the course of the investigation, the data to be returned, and the approach that will be taken in analyzing the data to achieve the

scientific objectives of the investigation must be discussed. This description should identify the investigation to be performed, the quality of the data to be returned (*e.g.*, resolution, coverage, pointing accuracy, measurement precision, etc.), and the quantity of data to be returned (bits, images, etc.). The relationship between the data products generated and the scientific objectives must be explicitly described, as should the expected results. It is assumed that the above information will constitute the Baseline Mission.

A single Performance Floor, defined as the minimum acceptable data and scientific return, must be defined for the mission investigation below, which it would not be worth pursuing. The value of an investigation carried out at the level of the Performance Floor must be discussed. A description of the descope options available, their phasing, and their effect on meeting the scientific objectives of the investigation as it is descope from the Baseline to the Performance Floor must be discussed.

2. Implementation.

- a. Instrumentation. This section must describe the proposed instrumentation and the criteria used for its selection. It should identify the individual instruments and instrument systems, including their characteristics and requirements, and indicate items that are proposed to be developed, as well as any existing instrumentation or design/flight heritage. The quality and quantity of data generated by each instrument, as they relate to the stated science investigation goals and objectives, must be discussed. The flow-down from science investigation goals, to measurement objectives, to instrument performance should be stated clearly and supported by quantitative analysis where possible.

A preliminary description of each instrument design with at least a block diagram showing the instrument systems and their interfaces should be included, along with a presentation of the estimated performance of the instrument. These performance characteristics (which shall be considered as requirements on the flight system) must include mass, power, volume, data rate(s), pointing, and pointing accuracy, as well as resolution, precision/sensitivity, and calibration requirements.

- b. Mission. The science payload observing profile must be discussed, including all mission-relevant parameters, such as orbit and/or surface location, pointing requirements, operational time lines (including observing periods, data transmission periods and techniques, and time-critical events), etc. The manner in which the stated investigation objectives and selected instruments drive the proposed mission design and operations plan should be apparent from this discussion.

- c. Data Analysis and Archiving. The data reduction and analysis activities after the data have been delivered to the ground must be discussed, including the method and format for data reduction, data validation, and preliminary analysis. The process by which data will be prepared for archiving must be discussed, including a list of the specific data products to be produced and the individual team members responsible for this activity. The plan must include a detailed schedule for the earliest possible submission of raw and reduced data to the NASA PDS in the proper formats, media, etc.
- d. Science Team. This section must identify every individual that is considered necessary for the investigation science team and his or her roles and responsibilities. The capabilities and experience of all members of the proposed science team must be described (Note: signed resumes of team members must be included as attachments to the proposal; see Section I below). The role of each Co-Investigator must be explicitly defined and justified, and the funding source (NASA or contributed) for the PI and each Co-Investigator noted. If a Co-Investigator's services are contributed at no cost to the investigation, a letter of endorsement is required from that Co-I's institution (see Section I.3 below).

E. EDUCATION/ PUBLIC OUTREACH, TECHNOLOGY
INFUSION/TRANSFER, AND SMALL DISADVANTAGED BUSINESSES

The proposer must provide a statement that she/he understands NASA OSS requirements for Education and Public Outreach (E/PO) and is committed to carrying out an E/PO program that meets the goals described in Section 5.6 of the AO. The proposer must also provide a brief overview of the planned E/PO activities and their relationship to the proposed investigation. This overview should include a brief discussion of any unique characteristics of the mission that might provide unusual opportunities for E/PO. The proposer must declare any intention to include any student-led experiment on the spacecraft. Detailed plans for implementing the E/PO activities, including identification of and formal commitment from E/PO partner institutions, will be part of the Phase A Concept Study and will be evaluated as part of the confirmation process (see Section 7.3.3 of this AO).

The proposer must provide a statement that she/he understands NASA OSS goals for new/advanced technology transfer and intends to address these goals. Details of the plans for addressing these goals will be part of the Phase A Concept Study and will be evaluated as part of the confirmation process.

The proposer must provide a statement that she/he understands NASA OSS requirements for participation of Small Disadvantaged Businesses and Minority Institutions and intends to comply with these requirements. Details of the plans for addressing these requirements will be part of the Phase A Concept Study and will be evaluated as part of the confirmation process.

F. MISSION IMPLEMENTATION

This section must provide a description of the space flight mission through which the investigation is to be executed, including mission design, instrument accommodation, spacecraft, required launch vehicle, ground systems, communications approach (including usage of DSN infrastructure), and mission operations plan. Specific information should be included that describes the unique requirements placed on these mission elements by the science investigation. In some areas (for example, instruments), the data requested may already be needed and presented in another section of the proposal (*e.g.*, the Science Implementation section). In such cases, proposers may provide a reference to that (those) section(s) and need not repeat the data in this section.

Within this section describe the development approach that will assure mission success. Include the following items to the degree they are known:

- Heritage and maturity of mission elements (instruments, spacecraft, ground systems, and mission design, etc.);
- Approach to the use or nonuse of redundancy and other reliability measures;
- Requirements for burn-in of parts and total operating test time required without failure prior to flight;
- Assembly, integration, and test flows and integration and test approach;
- Environmental test philosophy (test flow and sequence, test margins, and test durations);
- Product and mission assurance activities;
- Systems engineering and trade studies (planned and/or completed);
- Potential risks to the proposed mission activities and plans for mitigating those risks;
- Advanced development plans (new technology) for producing flight qualified hardware/software, including the strategy for bringing advanced development to flight qualification by the end of Phase B and/or backup plans should the advanced development fail to produce adequate maturity for flight;
- Strategy for the management of on-board resources including propellant;
- Planetary protection implementation (forward contamination control and back contamination prevention);
- DSN infrastructure usage; and
- Other Communication and Systems Parameters enumerated in *NASA's Mission Operations and Communications Services* document (see NFPL).

It is recognized that teaming arrangements to implement the investigation may not be complete at the time of the proposal. Proposers will not be penalized for this if it is demonstrated that there are candidate implementation approaches for the spacecraft, launch vehicle, communications, and ground systems that will allow the successful implementation of the investigation within the proposed cost and schedule.

Although the maturity of the proposed design may require the results of later trades during the Phase A Concept Study, in addition to the information above, the specific data

identified below should be provided (preferably in tables) to the extent known at the time the proposal is due and as applicable to the proposed mission configuration.

1. General information.

- Baseline launch date and launch window;
- Launch energy (C3) required for baseline launch window;
- Mission duration (cruise, science, total);
- Date/Time of orbit insertion;
- Orbit type (as applicable);
- Orbit parameters for all science mission phases (semi-major axis, eccentricity, inclination, node time of day, argument of perigee, altitude);
- Epoch time in Gregorian date and duration of each science mission phase (*e.g.*, different orbits, flybys, etc.) corresponding to information above;
- Nonplanetary target (*e.g.*, asteroids, moons, comets) orbital elements and gravitational parameters; and
- Earth-Spacecraft Distance (range) for each major event (orbit insertion, flybys, trajectory maneuver's, etc.).

2. Downlink Information.

- Communications System Parameters and other information (see *NASA's Mission Operations and Communications Services* document in the NFPL for data required for Deep Space Network and commercial downlink options);
- Data rate and volume (kbps or Mbytes per day); and
- Data rate and data volume per day;
- Bit error rate, onboard storage (Mbytes);
- Power available for communications (Watts);
- Number of data dumps per day, spacecraft data destination (*e.g.*, the mission operations center);
- Science data destination (*e.g.*, a science operations center); and
- Maximum time lag between data dump and data arrival at destination if relevant to science needs.

3. Uplink Information.

- Communications Systems Parameters and other Information requested in: *NASA's Mission Operations and Communications Services* document in the NFPL, including data required for Deep Space Network and commercial uplink options;
- Number of uplinks needed per day;
- Number of Bytes per uplink;
- Bit error rate; and
- Approach and schedule for obtaining license(s) for use of proposed frequency bands.

4. Provision of critical event data. Critical events are defined as events that could result in the loss of the mission if anomalies occur (*i.e.*, orbit insertion, entry/descent/landing, etc.), and telemetry is required for mission critical events to

allow the cause of loss of mission to be determined. The approach and plans for how such data are to be measured and returned must be discussed.

5. Contingencies and Margins. Using the definitions in the table below,
- Provide estimates of the contingencies and margins for mass, power, and fuels at both the subsystem; and system levels for the combined instrument payload and spacecraft; and
 - Provide the contingencies and margins for the requirements on the spacecraft, *e.g.*, pointing accuracy, stability, attitude, and maneuvering, necessary for science operations (include design margins, when known) for the instrument payload alone.

Definitions of Contingency and Margin

Contingency (or reserve), when added to a resource, results in the maximum expected value for that resource. Percent contingency is the value of the contingency divided by the value of the resource less the contingency.

Margin is the difference between the maximum possible value of a resource (the physical limit or the agreed-to limit) and the maximum expected value for a resource. Percent margin for a resource is the available margin divided by its maximum expected value.

Example: A payload in the design phase has a currently estimated mass of 115 kg including a mass reserve of 15 kg. There is no other payload on the ELV and the ELV provider plans to allot the full capability of the vehicle, if needed. The ELV capability is 200 kg. The mass reserve is $15/(115-15) = 15\%$, and the mass margin is 85 kg or $85/115 = 74\%$.

Example: The end-of-mission life capability of a spacecraft power system is 200 Watts. The proposed instrument is expected to use 40 Watts, and a 25% contingency is planned. If 75 watts is allotted by the satellite provider, the reserve is $(.25 \times 40) = 10$ Watts while the margin is $75 - (40 + 10) = 25$ Watts, or $25/50 = 50\%$.

Using the term contingency equivalently to the term reserve, and acknowledging that the maximum expected resource value is equal to the maximum proposed resource value (including contingency), the above technical terms can be expressed in equation form as:

$$\text{Contingency} = \text{Max Expected Resource Value} - \text{Proposed Resource Value}$$

$$\% \text{ Contingency} = \frac{\text{Contingency}}{\text{Max Expected Resource Value} - \text{Contingency}} \times 100$$

Margin = Max Possible Resource Value – Max Expected Resource Value

$$\% \text{ Margin} = \frac{\text{Margin}}{\text{Max Expected Resource Value}} \times 100$$

6. Attitude and Control Requirements.

- Control method (3-axis, spinner, gravity gradient, etc.; for a spin stabilized spacecraft provide spin rate and axis in terms of spacecraft body coordinate frame);
- Control reference (solar, inertial, nadir, limb, etc.);
- Attitude requirements as a function of time during all science mission phases;
- Attitude control requirements for bias, drift, stability or jitter, and rate for scanning (each axis);
- Spacecraft attitude knowledge requirements at the instrument interface for bias, drift, jitter, and rate for scanning (each axis);
- Agility (maneuvers, scanning, etc.);
- Deployments (solar panel, antennas, etc.);
- Articulation (1- or 2 -axis solar arrays, antennas, gimbals, etc.);
- On-orbit calibration (alignment, line-of-sight, thermal deformation); and
- Attitude knowledge processing (*e.g.*, real-time versus postprocessing, space-borne versus ground).

7. Instrument Characteristics.

For each science instrument provide the following information:

- Mass (include breakouts of electronics and aperture mass if known);
- Viewing direction in body coordinates;
- Operational modes;
- Operational mode timeline;
- Data demand for each instrument operational mode;
- Onboard recording required from spacecraft;
- Power demand for each instrument operational mode including peak, average, and stand-by power;
- Supplemental power supplied by primary batteries;
- Statement of whether instrument is active or passive;
- Instrument thermal control capability;
- Bias, drift, and noise of instrument data used in pointing control and knowledge determination; and
- Character of significant internally generated jitter and momentum.

8. Spacecraft Characteristics.

To the extent known at the time of proposal submission, and as applicable to the proposed investigation, provide the following information (Note: for Missions of Opportunity, provide the information below that is related to the proposed investigation's requirements on, and interfaces with, the sponsor's instrument/spacecraft):

- Spacecraft Parameters:
 - A block diagram of the spacecraft subsystem components; and
 - Sensor and actuator information (precision/errors, torque, and momentum storage capabilities, etc.).

- Propulsion:
 - Estimated delta-V budget;
 - Propulsion type(s) (monoprop, bi-prop, dual-mode, solar electric, etc.) and associated propellant(s)/oxidizer(s);
 - Propellant mixture ratio (if bi-prop); and
 - Specific impulse of each propulsion mode.

- Communications:
 - Modes of communications operations -
 - For transmit-only mode: Mode timeline, data rate(s), and duration;
 - For receive-only mode: Mode timeline, data rate(s), and duration; and
 - For Rx and Tx modes simultaneously: Mode timeline and duration.

- Command and Data Handling:
 - Spacecraft housekeeping data demand. If known, time-lined data demands shall be provided for each subsystem operational mode, i.e., for Guidance, Navigation, and Communications: standby, fine pointing, and reaction wheel momentum management; and for Communications: transmit, and receive;
 - Data storage unit size (Mbits);
 - Maximum storage record rate; and
 - Maximum storage playback rate.

- Power:
 - Definition of each spacecraft subsystem operational mode over all science phases (Note: provide power demand as well as operational schedule (timeline) for each operational mode);
 - Type of array structure (rigid, flexible, body mounted);
 - Solar array axes of rotation (vector projected in spacecraft coordinates);
 - Array size;
 - Solar cell type and efficiency;

- Expected power generation at Beginning of Life (BOL) and End of Life (EOL);
- Worst case sun incidence angle to solar panels during science mission;
- Battery type and storage capacity;
- Worst case battery Depth of Discharge (DOD); and
- Spacecraft bus voltage.

For the New Frontiers Mission proposals, a specific section of the Mission Implementation section (limit of 5 additional pages) should be devoted to the discussion of any proposed new technologies/advanced developments and the approach that will be taken to reduce their associated risks. Within this section, specific topics to be addressed should include:

- Identification and justification of the Technology Readiness Level (TRL) for each proposed new development and/or advanced development at the time the proposal is submitted (Note: see TRL definitions in the NFPL and New Frontiers Technology Program descriptions);
- Description of the proposed plan for bringing each of the identified items to (at minimum) TRL 6, defined as “system/subsystem model or prototype demonstration in a relevant environment, space, or ground” by Confirmation Review (CR) (include discussion of simulations, prototyping, systems testing, life testing, etc., as appropriate);
- An estimation of the manpower, cost resources, and the schedule required to complete the above plans; and
- If any fallbacks/alternatives exist and are planned (desirable but not mandatory), describe the cost, schedule, and performance liens they will impose on the baseline design and the decision milestones for their implementation.

G. MANAGEMENT AND SCHEDULE

This section should summarize the investigator's proposed management approach for the complete investigation including the E/PO. The management organization (including an organization chart) and decision-making process should be described and the teaming arrangement (as known) should be discussed. The responsibilities of team members, including contributors, and institutional commitments should be discussed. Unique capabilities that each team member organization brings to the team, as well as previous experience with similar systems and equipment, should be addressed. If no relevant previous experience is cited, the proposer must as a minimum, discuss their approach to providing the appropriate services and/or capabilities to assure investigation success. The specific roles and responsibilities of the Principal Investigator and Project Manager must be described, and the PI and PM identified, although other key project personnel need not be identified by name at this time. Risk management and risk mitigation plans must be described. This discussion should include identification of the top three to five perceived risks, descoping strategies (if relevant), and management strategies for control, allocation,

and release of technical, cost, and schedule reserves and margins. When major subcontracts are required, the acquisition strategy, including contract incentive policies, should be described. This section should also include a description of the NEPA and Nuclear Safety Launch Approval (if applicable) requirements for the proposed mission, and a brief description of the implementation plan, including schedule, for satisfying these requirements.

A project schedule to meet the proposed launch date and covering all phases of the investigation should be provided. The schedule should include, as a minimum:

- Proposed major project review dates;
- Instrument development;
- Spacecraft development;
- Instrument-to-spacecraft integration and test;
- Launch vehicle integration;
- Mission operations and data analysis; and
- Planning and implementation of the E/PO program.

The schedule reserve and critical path (i.e., the sequence of major activities and milestones that must be accomplished in the planned sequence and are critical to implementation success) should be clearly identified.

A Level-1 Work Breakdown Structure (WBS) shall be provided as a part of the proposal that clearly links the project organization with the cost information to be provided in Table B-1 and provides the proposer with a template for the project schedule information requested above. Inclusion of additional WBS information (Levels 2 and 3) is encouraged relative to the flight system development (Phase B/C/D) to demonstrate clear understanding of the proposer's implementation plans.

Mission of Opportunity proposals should specifically address how the investigation team will interrelate with the sponsoring organization, organizationally and managerially.

Mission of Opportunity proposals should also address:

- The status of the commitment from the spacecraft builder/owner or sponsoring organization to fly the proposed instrument or conduct the proposed investigation;
- If and how the proposed investigation relates to the spacecraft sponsor's overall mission objectives;
- The investigation development plan and how it fits in the development plan for the sponsor's parent mission;
- How the operations plan for the proposed investigation fits within the parent mission of the sponsoring organization; and
- The investigation organizational interfaces and plans for reporting to NASA.

H. COST AND COST ESTIMATING METHODOLOGY

This section shall include an estimated cost of the investigation that encompasses all proposed activities, including all applicable mission phases, launch services, development of the ground data system, implementation of E/PO, fees, and contributions. These costs shall be consistent with the requirements described in Section 5, 6, and 7 of this AO. The amount of funding required in each Fiscal Year should be identified by providing the data requested in Tables B-1 and B-2 for New Frontiers investigations; Mission of Opportunity investigations should utilize only those lines in the tables which are applicable and ignore those which are for full mission investigations. The top portion of Table B-1 requests cost data relative to the NASA OSS Cost while the bottom portion requests cost data relative to Contributions. Table B-2 summarizes the NASA OSS Cost by Phase. The completed tables will not be counted against the page limit. Table B-3 gives the NASA inflation index to be used to calculate real year dollars. Proposers must submit the requested data in formats shown in Tables B-1 and B-2.

The methodology used to estimate the cost (for example, grass roots estimates, vendor quotes, specific cost models, past performance, and/or cost estimating relationships from analogous missions) should be discussed. Budget reserve strategy, including budget reserve levels as a function of mission phase, should be discussed. All assumptions used in developing cost estimates should be provided, to help facilitate reviewer understanding of the proposed cost.

I. APPENDICES

The following additional information is required to be supplied with the proposal as Appendices unless otherwise specified, and, as such, will not be counted within the specified page limit. NO OTHER APPENDICES ARE PERMITTED.

1. Statement of Work (SOW) and Funding Information. A SOW is required regardless of whether the proposal is submitted from a non-Government or a Government institution. This SOW must include the requirement for a Phase A Concept Study report that is described in the *Guidelines and Criteria for the Phase A Concept Study* document available through the NFPL. This SOW must include general tasks statements for Phases B/C/D and for Phase E for New Frontiers Mission investigations and Missions of Opportunity investigations. All SOW's should include the following as a minimum: Scope of Work, Deliverables (including science data), and Government Responsibilities (as applicable). SOW's need not be more than a few pages in length. If more than one contractual arrangement between NASA and the proposing team is required, funding information must be provided that identifies how funds are to be allocated among the organizations with a separate Statement of Work for each organization.
2. Letters of Endorsement. Letters of endorsement must be provided from all U.S. and non-U.S. organizations offering critical facilities (*e.g.*, integration and test,

thermal vacuum chambers, L-Tool, etc.), goods, hardware, software, and/or services (including those of Co-Investigators), and from the provider of the launch services if the launch is not provided by NASA. These letters must provide evidence that the senior officials of the participating institutions and/or appropriate Government officials are aware and supportive of the proposed investigation and will pursue funding for their stated participation in the investigation if it is selected by NASA and must be signed by officials authorized to commit those organizations as proposed. Failure to provide such Letters of Endorsement from all parties involved in the proposal can be reason for declaring the proposal noncompliant and returned without review.

3. Resumes. Provide resumes for all science team members (PI and Co-I's) identified in the science section, for all key project personnel who are identified by name in the proposal, and for all key E/PO personnel. Each resume should contain the following information in the following order:
 - a) the name and employing organization of the individual;
 - b) a one or two sentence description of the individual's job or role on the proposed investigation;
 - c) a resume that clearly shows the experience related to the responsibilities that the individual will perform for the proposed investigation, including (as appropriate) the analysis and publication of final science results;
 - d) the commitment signature of the individual and date; and
 - e) if any portion of the commitment is by way of a contribution to the proposed investigation (that is, not to be supported by NASA through the proposal), the amount of the contribution in terms of approximate number of Full Time Equivalent (FTE) work years over the nominal duration of the proposed project (i.e., through Phase E) and the signature of an authorizing official of the individual's organization.

The complete resume forms may be no longer than two pages for each participant and should be organized alphabetically after that of the PI.

4. Draft International Participation Plan - Discussion on Compliance with U.S. Export Laws and Regulations. Investigations that include international participation, either through involvement of non-U.S. nationals and/or involvement of non-U.S. entities must include a section discussing compliance with U.S. export laws and regulations; *e.g.*, 22 CFR 120-130, *et seq.* and 15 CFR 730-774, *et seq.*, as applicable to the scenario surrounding the particular international participation. The discussion must describe the proposed international participation in detail and include, but not be limited to, whether or not the international participation may require the proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or, if not, the projected timing of

the application and any implications for the schedule. Information regarding U.S. export regulations is available at <http://www.pmdtc.org> and <http://www.bxa.doc.gov>. Proposers are advised that under U.S. law and regulation, spacecraft and their specifically designed, modified, or configured systems, components, parts, etc., such as the instrumentation being sought under this AO, are generally considered "Defense Articles" on the United States Munitions List and, therefore, subject to the provisions of the International Traffic in Arms Regulations, 22 CFR 120-130, *et seq.* (See AO, Section 3.8)

5. Outline of Technical Responsibilities between U.S. and International Partners. These outlines will be used by the Office of External Relations, NASA Headquarters, as the starting point for formalizing the agency-to-agency agreements that will be required if the investigation is selected. (See AO, Section 5.10)
6. Compliance with Planetary Protection Requirements. NASA's Planetary Protection Policy (see NPD 8020.7E and NPG 8020.12B) imposes certain restrictions on mission operations and spacecraft cleanliness depending on the particular type of mission (orbiter vs. lander/life-detection vs. no life detection) and the specific environments to be visited. The proposal should indicate (i) the anticipated planetary protection category of the mission under NASA directives; (ii) the proposed mission operational accommodations to comply with the anticipated requirement; and (iii) the proposed steps to be taken for the preparation of the orbital and (if any) landed portions of the spacecraft to comply with the requirements for overall microbiological cleanliness and recontamination prevention prior to launch. If necessary, the proposal should also indicate the nature of the proposed implementation of back-contamination control and subsequent containment and testing of returned samples, or the proposed rationale for the mission to be relieved from the containment requirement. Proposals should address the organization(s) responsible for implementing those steps.
7. Compliance with Procurement Regulations by NASA PI Proposals. Proposals submitted by NASA employees as Principal Investigators should contain the following information concerning the process by which non-Government participants were included in the proposal. The proposal should: (i) indicate that the supplies or services of the proposed non-Government participant(s) are available under an existing NASA contract; (ii) make it clear that the capabilities, products, or services of these participant(s) are sufficiently unique to justify a sole source acquisition; or (iii) describe the open process that was used for selecting proposed team members. While a formal solicitation is not required, the process cited in (iii) above should include at least the following competitive aspects: notice of the opportunity to participate to potential sources, submissions from and/or discussions with potential sources, and objective criteria for selecting team members among interested sources. The proposal should address how the selection of the proposed team members followed the objective criteria and is

reasonable from both a technical and cost standpoint. The proposal should also include a representation that the Principal Investigator has examined his/her financial interests in or concerning the proposed team members and has determined that no personal conflict of interest exists. The proposal must provide a certification by a NASA official superior to the Principal Investigator verifying the process for selecting contractors as proposed team members, including the absence of conflicts of interest.

8. Acronyms and Abbreviations. An acronym list may be found in the NFPL.
9. References. As an option, the proposal may provide a list of reference documents and materials used in its preparation. These documents and materials themselves may not be submitted except as a part of the proposal and included within the prescribed page count, nor should it be necessary to consult them to adequately review the proposal.

TABLE B-1
TOTAL MISSION COST FUNDING PROFILE
FY Costs in Real Year Dollars (to nearest thousand), Totals in RY and Fixed Year '03 Dollars

Cost Element **	Formulation		SUBTOTAL Formulation*		Implementation			SUBTOTAL Implementation*		TOTAL LIFE CYCLE	
	FY1	FYx	RY \$	FY03\$	FY1	...	FYz	RY \$	FY03\$	RY \$	FY03\$
Start to Launch + 30 Days (Phases A/B/C/D)	Enter each cost element										
Phase A Concept Study											
Proj. Mgmt/Miss. Analysis/Sys. Eng.											
Instrument A											
Instrument B											
Instrument ...											
Instr. Integration, Assembly and Test											
<i>Subtotal - Instruments</i>											
Spacecraft bus											
S/C Integration, Assembly and Test											
Other Hardware Elements (1)											
Launch Ops (Launch +30 days)											
<i>Subtotal - Spacecraft</i>											
Science Team Support											
Pre-Launch GDS/MOS Development											
DSN/Tracking											
Other (2)											
<i>Subtotal Phases A-D before Reserves</i>											
Instrument Reserves											
Spacecraft Reserves											
Other Reserves											
Total Phases A/B/C/D											
Launch + 30 Days to End of Mission (Phase E)	Enter each cost element										
Mission Operations & Data Analysis (including Project Management)											
DSN/Tracking											
Other (2)											
Subtotal Phase E before Reserves											
Reserves											
Total Phase E											
Launch Services											
RTG(s)											
Total NASA Phase A-E Cost											
Phase F (Extended Mission if Applicable)											
PSP											
DAP											
Total NASA Cost											
Contributions (2)											
Total Contributions											
Total Mission Cost = →											

(1) Other Hardware Elements: Probes, Sample Return Canister, Etc.
(2) Specify each item on a separate line; include Education & Public Outreach, Tech Infusion/Transfer, facilities, etc.
* Note: Formulation = Phase A + B; Implementation = Phase C + D + E
** See *Cost Elements* document in the New Frontiers Program Library

TABLE B-2

MISSION PHASE SUMMARY OF NASA OSS COST

FY Costs in Real Year Dollars (to nearest thousand); Totals in RY and FY03 Dollars

Cost Element	FY1	FY2	FY3	E	FYn	RY\$	FY03\$
Phase A Concept Study							
Additional Phase A (if required)							
Phase B							
Phases C and D							
Phase E							
Launch Vehicle/Launch Services							
Total OSS Mission Cost							
Contributions							
Total Mission Cost							

TABLE B-3

NASA NEW START INFLATION INDEX

Fiscal Year	2003	2004	2005	2006	2007	2008	2009
Inflation Rate	0%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
Cumulative Inflation Index	1.0	1.031	1.063	1.096	1.130	1.165	1.201

Use an inflation rate of 3.1% for years beyond 2009.

APPENDIX C

REGULATIONS GOVERNING PROCUREMENT OF FOREIGN GOODS OR SERVICES

The following Federal Acquisition Regulation (FAR) clauses cover the purchase of foreign goods and services and may be included in contracts resulting from this Announcement of Opportunity:

- 52.225-1 Buy American Act -- Supplies (May 2002)
- 52.225-8 Duty-Free Entry (February 2000)
- 52.225-13 Restrictions on Certain Foreign Purchases (July 2000)
- 52.225-15 Sanctioned European Union Country End Products (February 2000)
- 52.225-16 Sanctioned European Union Country Services (February 2000)

Note that additional Federal Acquisition Regulation (FAR) and NASA FAR Supplement clauses may be applicable to specific procurement actions as required by the cognizant Contracting Officer.

The proposer is directed to the Federal Acquisition Regulations and the NASA FAR Supplements for further information on these regulations. Access information for these documents is given in the New Frontiers Program Library (see Appendix D).

APPENDIX D

NEW FRONTIERS PROGRAM LIBRARY

The New Frontiers Program Library includes documents available electronically via the Internet; many documents are also available as a paper copy from their original source. Note that not all documents are actually located in the New Frontiers Program Library. For these documents, an internet hyperlink has been provided via the New Frontiers Program Library to allow download of the document from their home location.

It is incumbent upon the proposer to ensure that the documents used in proposal preparation are of the date and/or revision listed in this Announcement of Opportunity (AO).

The New Frontiers Program Library is accessible on the World Wide Web at the URL:

<http://newfrontiers.larc.nasa.gov/newfrontiers/NFPL.html>

Office of Space Science (OSS) Strategies and Policies

The Space Science Enterprise Strategic Plan (November 2000)

Provides a concise statement of the goals and outlook of NASA's Space Science Enterprise, and of the major ideas described in the context of the overall NASA Strategic Plan.

Solar System Exploration

Website describing NASA's Solar System exploration programs and missions.

The Space Science Enterprise Integrated Technology Strategy (October 1998)

Describes efforts to manage technology infusion into future OSS missions and to promote technology transfer to the private sector.

National Research Council (NRC) Documents

NRC Planetary Science Decadal Survey (July 2002)

Presents NRC decadal recommendations for Solar System exploration.

NRC Committee on Planetary and Lunar Exploration: Exploring the Trans-Neptunian Solar System (1998)

Presents NRC recommendations for the exploration of the Trans-Neptunian Solar System.

The NRC Committee for Planetary and Lunar Exploration (COMPLEX) Report
(November 2001)

Discusses COMPLEX's assessment of planetary exploration science and priorities.

New Frontiers Guidelines and Requirements Documents

NASA's Mission Operations and Communications Services (September 2002)

Describes the functions and costs of Ground Data Systems and Mission Operations and Data Analysis available via NASA.

New Frontiers Launch Services Information Summary (February 2003)

Provides information on capabilities and costs of launch services that are available to launch New Frontiers spacecraft selected pursuant to this AO.

Navigation and Ancillary Information Facility Services for New Frontiers Missions

(January 2003)

Provides information relative to the NASA Ancillary Information Facility and the SPICE capability for mission design, mission planning, observation planning, and interpretation of scientific observations.

Specifications for Space Radioisotope Power Systems (RPS) for New Frontiers

(November 2002)

A series of documents describing the technical specifications for utilizing RPS on New Frontiers missions.

In-Space Propulsion (ISP) (November 2002)

Describes the technical specifications for utilizing ISP on New Frontiers missions.

Anticipated Costs and Capabilities of the NASA Curatorial Facility (January 2003)

Provides information on the NASA Curatorial Facility costs and capabilities.

Guidelines and Criteria for the Phase A Concept Study (February 2003)

Provides proposers who are selected via the AO with guidelines and criteria for preparation of the Concept Study Report.

Cost Elements Definitions (November 2002)

Provides definitions for the major cost elements for proposals.

Technology Readiness Levels (TRL's) Definitions (2001)

Provides definitions for TRL's.

OSS Education and Public Outreach (E/PO) Documents

Implementing the OSS E/PO Strategy (October 1996)

Describes OSS's overall approach to implementing its E/PO strategy.

Explanatory Guide to the OSS E/PO Evaluation Criteria (February 2002)

Answers frequently asked questions, and elaborates on each of the OSS E/PO criteria.

Partners in Education: A Strategy for Integrating E/PO into NASA's Space Science Programs (March 1995)

Describes the overall strategy for integrating E/PO into NASA's Space Science programs.

Explanatory Guide to the OSS E/PO Evaluation Criteria (February 2001)

Answers frequently asked questions, and elaborates on each of the OSS E/PO criteria.

Explanatory Guide to the OSS E/PO Evaluation Criteria (February 2002)

Answers frequently asked questions, and elaborates on each of the OSS E/PO criteria.

Explanatory Guide to the OSS E/PO Evaluation Criteria (February 2003)

Answers frequently asked questions, and elaborates on each of the OSS E/PO criteria.

Implementing the Office of Space Science Education/Public Outreach Strategy: A Critical Evaluation at the Six-Year Mark (March, 2003)

A Report by the Space Science Advisory Committee Education and Public Outreach Task Force (Paul H. Knappenberger, chair) which assesses progress made in implementing the OSS E/PO program, and identifies issues that still need to be addressed.

General Guidelines and Requirements Documents

Example Mission Definition and Requirements Agreement

Provides an example of a mission definition and requirements agreement between principal organizations for supporting an OSS mission.

NPG 7120.5B NASA Program and Project Management Processes and Requirements (November 2002)

Provides a reference for typical activities, milestones, and products in the development and execution of NASA missions.

NPG 7100.10D Curation of Extraterrestrial Materials (February 2003)

Provides information on the curation of extraterrestrial materials via NASA's Curatorial Facility at JSC.

Planetary Data System (April 2001)

Website describing the basic formats and requirements used for the archiving of planetary data products by the NASA Planetary Data System (PDS).

Planetary Protection Requirements

A series of documents containing information on Planetary Protection Requirements for NASA spacecraft missions.

ISO 9000 Series

The following ISO 9000 quality documents describe current national and NASA standards of quality processes and procedures:

ISO 9000:2000, *Quality Management Systems – Fundamentals and Vocabulary*

ISO 9001:2000, *Quality Management Systems – Requirements*

ISO 9004:2000, *Quality Management Systems – Guidelines for Performance Improvements*

Note: These ISO 9000-related documents are copyrighted and cannot be reproduced without appropriate compensation. For copies contact:

American Society for Quality (ASQ)
P.O. Box 3005
Milwaukee, WI 53201-3005
U.S.A.

Tel.: (800) 248-1946

URL: <http://www.asq.org/>

For background on NASA ISO policy and the status of its implementation, visit <http://iso9000.nasa.gov/>.

NASA Technology Transfer Resources

Website providing an integrated information resource for NASA technology transfer and commercialization.

Directives and Procurement-Related Information

NASA Online Directives Information System (NODIS) Library

Provides online access to NASA Policy Directives (NPD's – formerly NMI's), NASA Procedures and Guidelines (NPG's – formerly NHB's), and NASA Policy Charters (NPC's).

Federal Acquisition Regulations (FAR) General Services Administration

(URL: <http://www.arnet.gov/far/>)

NASA FAR Supplement Regulations

(URL: <http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm>)

NASA Financial Management Manual

(URL: <http://www.hq.nasa.gov/fmm/>)

NPG 5800.ID -- Grant and Cooperative Agreement Handbook (July 1996)

(URL: <http://ec.msfc.nasa.gov/hq/grcover.htm>)

Code of Federal Regulations

(URL: <http://www.access.gpo.gov/nara/cfr/index.html>)

NPD 8610.7 – Launch Services

NPD 8730.4 – IV&V

NPD 1001.C NASA 2003 Strategic Plan

Roadmap for the Office of Space Science Origins Theme (February 2003)

(URL: <http://origins.jpl.nasa.gov/library/scienceplan03/index.html>)

Roadmap for the Office of Space Science Solar System Exploration Division (March 2003)

(URL: <http://spacescience.nasa.gov>)

Environmental Quality Regulations, 40 CFR Parts 1500-1508

APPENDIX E

CERTIFICATIONS

The text of the following documents are included for reference only. Submission of the signed printout of web page as directed for the Cover Page/Proposal Summary certifies compliance with these certifications.

1. Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The (*Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant "*) hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

2. Certification Regarding Debarment, Suspension, and Other Responsibility Matters (Primary Covered Transaction)

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 14 CFR Part 1265.

A. The applicant certifies that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three-year period preceding this application been convicted or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification;
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -- Lowered Tier Covered Transactions (Subgrants or Subcontracts)

- (a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.
- (b) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

3. Certification Regarding Lobbying

As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over \$100,000, the applicant certifies that:

- (a) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;
- (b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete Standard Form -- LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by S1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

APPENDIX F

NEW FRONTIERS PROGRAM PLANNING BUDGET PROFILE

The New Frontiers Program funding profile for future missions is subject to a wide variety of pressures. For planning purposes, the five-year forecast of NASA OSS funding for a new mission is provided in the table below (in Real Year Million Dollars). These levels represent the projected highest level of available funding for the years FY 2003-2008, but unused portions of funds in each of these years can be used in the following year(s) if necessary. In addition, these levels represent the total available for selections made through this AO for all costs to NASA OSS, including launch vehicle costs and SOMO services as provided in New Frontiers Launch Services Information Summary, and NASA's Mission Operations and Communications documents located in the New Frontiers Program Library, Appendix D.

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
Total (\$M)	\$0	\$4	\$78	\$98	\$200	\$214

The NASA forecast for specific budgets beyond FY 2008 are not yet available, but future budgets are expected to be sufficient to cover any funding requirements necessary for missions proposed to this AO. Consequently, New Frontiers missions do not need to consider yearly funding limitations for FY 2008 and out.

APPENDIX G

PROPOSAL CHECKLIST

The following proposal checklist will be used to accomplish the compliance check on all proposals received in response to this AO.

Administrative	
1. Proposal delivered on time	§8.0
2. Proposal included copy of electronic cover page and summary	§6.3.2
3. Original PI signature included	§6.3.2
4. Original authorizing official signature included	§6.3.2
5. Correct number of copies	§6.3.3
6. Meets page limits	Appendix B
7. Includes CD with every copy	§6.3.3
8. Meets general guidelines (one volume original easy to disassemble, no more than 5 fold out pages, one inch margins, maximum 15 characters/inch --approximately 12 pt font)	Appendix B
9. Required appendices included, and no additional appendices	Appendix B
10. Budgets submitted in required formats	Appendix B
11. Letters of endorsement from all organizations contributing critical goods and services including Co-I's, from all major participants, and from any required funding organizations	§5.9.3, §6.3.2, Appendix B
12. Letters of endorsement from participating non-U.S. institutions	§5.10, §8.0, Appendix B
Scientific	
13. Addresses a "strawman" mission as solicited in this AO	§2.1
14. Appropriate data archiving plan	§5.12.5
15. For full mission investigation, defines both a Baseline mission and a minimum Performance Floor science mission	§5.11.4
Technical	
16. Complete investigation (Phases A-E) for full mission, or allowed type of Mission of Opportunity	§1.1, §5.11.5
17. Team led by a single PI	§5.4.1
18. Proposed budget within cost cap	§1.1, §5.11.6, §5.11.7, §5.12.7
19. Contributions within contribution limit	§5.9.3
20. Launch services and nuclear power sources provided by U.S. sources, and included within the cost cap	§1.1, §5.11.2, §5.11.3
21. Phase A costs within cost limit	§5.11.8, §5.12.7

22. Launch date (for full mission investigations) prior to Sept. 30, 2009 or commitment date (for MO) prior to Dec. 31, 2005	§1.1, §5.11.5, §5.12.8
23. Includes E/PO, technology infusion/transfer, and SDB commitments	§5.6, §5.7, §5.8, Appendix B

