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and Space Administration

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Announcement of Opportunity

Explorer Program:

Small Explorers (SMEX)
and
Missions of Opportunity

Notice of Intent to Propose Due Date: **November 16, 2007**
Proposal Due Date: **January 15, 2008**
OMB Approval Number 2700-0085

SMALL EXPLORER AND MISSIONS OF OPPORTUNITY
ANNOUNCEMENT OF OPPORTUNITY

FOREWORD

The National Aeronautics and Space Administration (NASA) Science Mission Directorate (SMD) is releasing this Announcement of Opportunity (AO) to solicit investigations for the Explorer Program. The Explorer Program conducts Principal Investigator (PI)-led space science investigations in SMD's astrophysics and heliophysics programs. Two types of investigations are being solicited – Small Explorer (SMEX) missions and Missions of Opportunity (MOs).

The PI Mission Cost cap for a SMEX mission is $105M in Fiscal Year (FY) 2008 dollars, not including the cost of the Expendable Launch Vehicle (ELV) or any contributions. NASA expects to select up to three SMEX missions to proceed into Phase B and subsequent mission phases. Mission launches will be phased approximately one year apart. One additional SMEX mission may be designated as an unfunded backup until all selected missions pass or fail their Confirmation Reviews to enter Phase C. NASA desires to launch the first of three SMEX missions by late 2011 or 2012; the launch-by date for all three SMEX missions is September 30, 2015.

NASA expects to also select one or more MOs as long as they can be accommodated within the $70M budget allocated for this purpose. Although NASA would prefer to select more than one MO within the allocated budget, a single MO investigation may be selected if it is scientifically and technically compelling enough to justify using the entire budget allocated to MOs. The partner commitment ("need-by") date for MOs, where applicable, is December 31, 2012.

Section 1, Description of Opportunity, provides a brief introduction describing the scope of the solicitation, the two types of investigations that may be proposed in response to this AO, a summary of the selection process, and the schedule. Section 2, NASA's Safety Priorities; Section 3, Explorer Program Goals, Objectives, and Background; and Section 4, Explorer Program Constraints, Guidelines, and Requirements, are applicable to both SMEX investigations and MO investigations. Section 5 describes SMEX investigations and SMEX-specific requirements. Section 6 describes MO investigations and MO-specific requirements. Section 7, Proposal Preparation and Submission; Section 8, Proposal Evaluation, Selection, and Implementation; and Section 9, Conclusion, are applicable to both SMEX investigations and MO investigations.

Proposers interested only in SMEX investigations should read Sections 1, 2, 3, 4, 5, 7, 8, and 9 and any Appendices referenced in those sections.

Proposers interested only in a MO should read Sections 1, 2, 3, 4, 6, 7, 8, and 9 and any Appendices referenced in those Sections.

Proposers should be aware of the following major changes in this AO from previous Explorer solicitations.

- Costs throughout this AO are in FY 2008 dollars unless otherwise noted.

- NASA is instituting minimum experience requirements for the proposed PI for this and all future selections of PI-led missions. Proposed investigations that are led by PIs lacking demonstrated, relevant, and appropriate experience sufficient to meet these requirements will be declared noncompliant and will not be reviewed or selected (Section 4.5.1). NASA offers the opportunity of pre-screening Principal Investigator (PI) experience requirements to prospective proposers (Section 7.1.7).
- For the purpose of this AO, an adequate unencumbered reserve on the PI Mission Cost is measured against the cost to complete through Phases A/B/C/D/E/F and is a minimum of 30% including funded schedule reserve (Section 4.6.4).
- The value of contributions to a SMEX investigation may not exceed one-half of the PI Mission Cost (Section 5.4.3).
- Standard launch services on an expendable launch vehicle will be provided for SMEX missions at no charge against the mission cost cap. Only the launch services described in the Explorer Program Library's launch services document will be provided for SMEX missions. There will be a charge against the mission cost cap for mission unique and special launch services beyond the standard launch services offered (Section 5.2).
- The provision of launch services, as a contribution to a SMEX mission by a U.S. or non-U.S. partner, may be proposed only on a no-exchange-of-funds basis (Section 5.2).
- MO investigations on the International Space Station (ISS) may be proposed only if the non-SMD mission sponsor is providing transportation to the ISS (Section 6.2).
- The scope for MOs has been expanded to include small complete missions (including micro and nanosats) costing much less than a SMEX mission (Section 6.4).
- MO investigations may not be proposed to be launched using the Crew Exploration Vehicle (CEV), Commercial Orbital Transportation Services (COTS), or the Space Shuttle (Section 6.1).
- MO proposals for suborbital missions, including long duration balloon missions, will not be considered. MO proposals traditionally considered as "data buys" will also not be considered (Section 6.1).
- Phase F now means the closeout required at the end of mission and not an extended mission as in the past (Section 1.1). Optional mission enhancements are now called Science Enhancement Options (SEOs). Proposed costs for SEOs (e.g., extended missions, guest investigator programs, general observer programs, participating scientist programs, interdisciplinary scientist programs, or archival data analysis programs) will not count against the mission cost cap (Section 4.3.2).
- NASA has canceled NASA Procedural Requirements (NPR) 7120.5C (*NASA Program and Project Management Processes and Requirements)* and replaced it with NPR 7120.5D (*NASA Space Flight Program and Project Management Requirements*). NPR 7120.5D can be downloaded via links in the Explorer Program Library (EPL) and should be reviewed, as its policies are in effect for missions selected in response to this AO (Section 4.4.1). For instance, an Earned Value Management System must be part of each mission's plan (Section 4.6.5).

- NASA intends SMEX investigations and MO investigations to be implemented as Category 3 (per NPR 7120.5D) Class D (per NPR 8705.4) payloads (Section 4.4.2).
- The allocation for Education and Public Outreach (E/PO) is 0.25-1% of the PI mission cost. An additional Student Collaboration (SC) option is offered (Section 4.8).
- The requirements for international contribution and international letters of commitment have been clarified (Section 4.7).
- The weighting of evaluation criteria has been changed (Section 8.2.1).
- The page limit for the proposal has been increased (Appendix B).

Proposers should be aware of the following major changes in this AO from the Draft SMEX AO released for community comment on June 8, 2007.

- The minimum experience requirements for the proposed mission PI have been clarified (Section 4.5.1) and an opportunity for pre-screening PI experience requirements has been added (Section 7.1.7).
- Section 4.5.4 has been re-written to clarify the nature of the letters of commitment required.
- Section 4.6.4 has been rewritten to clarify the requirements for cost reserves.
- Section 4.6.5 on *Earned Value Management* has been added.
- The maximum allowed allocation for E/PO has been raised to 1% of the PI mission cost and the evaluation criteria for any SC have been clarified. Section 4.8.2 has been re-written to clarify the nature of SC contributions being solicited. New Section 8.2.5: *Overall Merit of E/PO and Student Collaboration* added to describe the evaluation criteria for SC.
- Sections 4.4.3 (*Space Operations and Communications)*, 8.4.2 (*Awards Administration and Funding),* Appendix B, Section H *(Plan for Education and Public Outreach and Small Business Participation)* have been clarified.
- A new section (I.4: *Summary of Proposed Program Cooperative Contributions*) has been added to Appendix B.
- The policy for Orbital Debris Generation has been revised (Appendix B, Section I.7).
- A new requirement for Full Time Equivalents, Work Year Equivalents, and effective direct costs has been added (Appendix B, Section G and Table B8).

In addition to the listed major changes, this AO incorporates a large number of additional changes relative to previous Explorer Program AOs including both policy changes and changes to proposal submission requirements. All proposers must read this AO carefully, and all proposals must comply with the requirements, constraints, and guidelines contained within this AO.

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1.0 DESCRIPTION OF OPPORTUNITY

1.1 Introduction

The National Aeronautics and Space Administration (NASA), Science Mission Directorate (SMD), announces the opportunity to conduct space science investigations through the Explorer Program. For the purposes of this announcement, the term "space science" encompasses the scientific objectives of the SMD heliophysics research program and the astrophysics research program. Explorer missions, therefore, are intended to obtain an understanding of the Sun and its effects on Earth and the Solar System and/or to discover the origin, structure, evolution, and destiny of the Universe and search for Earth-like planets. Additional information concerning these areas of investigation is provided through appropriate links found on the SMD homepage at http://science.hq.nasa.gov/ and in documents cited in Sections 2 through 4 of the Explorer Program Library (EPL) listed in Appendix C.

Proposals submitted in response to this Announcement of Opportunity (AO) must be for investigations encompassing all appropriate mission management processes. NASA mission management processes, as defined by NASA Procedural Requirements (NPR) 7120.5D, *NASA Space Flight Program and Project Management Requirements*, are Formulation, Approval, Implementation, and Evaluation. For the purposes of this AO, the NASA mission management processes are divided as follows. Formulation is divided into: Phase A – Concept and Technology Development; and Phase B – Preliminary Design and Technology Completion. Approval is the process for transitioning into Implementation, which for Explorer missions is the step leading to a Confirmation Review with the Associate Administrator for SMD. Implementation is divided into: Phase C – Final Design and Fabrication; Phase D – System Assembly, Integration and Test, and Launch (extending through in-orbit checkout, usually launch plus 30 days); Phase E – Operations and Sustainment; and Phase F – Closeout. Phase E is to include analysis and publication of data in the peer reviewed scientific literature and delivery of the data to an appropriate NASA data archive. The Evaluation process is the ongoing independent review and assessment of the project's status during both Formulation and Implementation. The document NPR 7120.5D may be found in the EPL (Appendix C).

This AO invites proposals for Small Explorer (SMEX) missions and for Missions of Opportunity (MOs).

- SMEX investigations are free flyers launched on expendable launch vehicles. Further description of SMEX investigations is given in Section 5. Depending on the availability of proposals of appropriate merit, NASA intends to select three SMEX missions, the first one to launch by late 2011 or 2012, the second one to launch by 2013, and the third one to launch by September 30, 2015. A fourth mission may be designated as an unfunded backup until all selected missions pass or fail their Confirmation Reviews to enter Phase C and with no guarantee of being approved for continuing into subsequent mission phases.

- A MO investigation may be undertaken through the Explorer Program when the perceived value is high and the proposed cost to NASA SMD is within the funding limits of the Explorer Program. For this AO, investigations involving participation in space missions that

are sponsored by organizations other than SMD, both U.S. and non-U.S., may be proposed as MOs. Investigations that propose a scientific new use of existing NASA spacecraft and small complete missions may also be proposed as MOs. Further information on MOs is given in Section 6. Depending on the availability of proposals of appropriate merit, one or more MOs may be selected within the budget allocated for this purpose. Although NASA would prefer to select more than one MO within the allocated budget, a single MO investigation, which is so scientifically and technically compelling so as to justify using the entire budget allocated to MOs, may be selected. Selection of any MO requiring early funding will delay the launch of the selected SMEX mission(s).

The following terms are used throughout the AO to differentiate among the various methods of accounting for the cost of an investigation.

Principal Investigator (PI) Mission Cost	The cost to SMD of the portion of the mission that is under PI management responsibility. This is the cost that is subject to the cost cap. The cost of the launch vehicle is not included in the PI Mission Cost. (Section 4.6.3, Section 5.4.2)
Value of any Contributions	The value of non-SMD contributions to the mission. For SMEX investigations, there is a cap on the value of any contributions. (Section 4.6.2, Section 5.4.3)
Total Mission Cost	PI Mission Cost + Value of any Contributions
Science Enhancement Option (SEO) Cost	The cost of any proposed SEO. (Section 4.3.2)
Total Enhanced Mission Cost	Total Mission Cost + SEO Cost
Expendable Launch Vehicle Cost	The cost to SMD for standard launch services provided to a SMEX mission; this cost is not specified in the AO.
Total SMD Cost	PI Mission Cost + Expendable Launch Vehicle Cost; this is the cost to the Explorer Program.
Total Enhanced SMD Cost	Total SMD Cost + SEO Cost
Total Cost with Contributions	Total SMD Cost + Value of any Contributions

Accordingly, the PI Mission Cost for all phases of the investigation will be a determining factor in selection through this AO and in final confirmation for flight of selected investigation(s).

1.2 Overview of Proposal Evaluation and Selection Process

The selection process will be done in two stages. In Stage 1, proposals will be assessed against criteria given in Section 8.2 by panels of individuals who are peers of the proposers in the relevant scientific and technical areas. Proposals will be categorized in accordance with the NASA Federal Acquisition Regulation (FAR) Supplement (NFS) Part 1872.403-1. The results of

the proposal evaluations and categorizations will be reviewed by the SMD AO Steering Committee that will conduct an independent assessment of the evaluation and categorization processes. After this review, the final evaluation and categorization results and the proposed PI Mission Cost will be presented to the Associate Administrator for the SMD and the SMD Science Management Council. The Associate Administrator for SMD is the Selection Official and he will make the selections for four-month Phase A concept studies. It is anticipated that approximately 6-8 SMEX missions will be selected for concept studies. Each SMEX Phase A concept study will be funded up to $750K in real year dollars. NASA may also select MO investigations to conduct concept studies; however, NASA is not required to make such a selection under this solicitation. Each MO Phase A concept study selected will be funded between $150K and $300K in real year dollars depending on the scope and proposed cost of the proposed MO investigation. Sections 8.1, 8.2, and 8.3 provide additional details on these activities.

For Stage 2, NASA will conduct a detailed review of the Phase A concept study results to evaluate the implementation details of the selected investigations, namely, any modifications of the scientific objectives, the proposed cost to NASA, design details of the investigation hardware, plans for mission implementation, including all technical and management factors, details of the education and public outreach programs, plans for any new/advanced technology, and plans for participation of small disadvantaged businesses and minority institutions. As a result of this second evaluation, NASA intends to downselect for Phase B three SMEX missions, and possibly one or more Mission(s) of Opportunity, for implementation leading to flight. Investigations that are not ready to enter Phase B may be downselected for a funded Extended Phase A so they can retire one or more risks before being considered again for approval to enter Phase B. There is no guarantee that the investigation will be approved to enter phase B, even if all risks have been retired during the extended Phase A. NASA may also designate one additional SMEX mission as an unfunded backup until all selected SMEX missions pass or fail their Confirmation Reviews to enter Phase C, in case one of them runs into technical or cost difficulties requiring termination. In that event NASA will consider, but is not obligated, to start the designated backup SMEX mission. Section 8.4 provides additional details on these activities.

1.3 Proposal Opportunity Period and Schedule

NASA is soliciting SMEX investigations with mission launch dates no later than September 30, 2015, with one launch anticipated by late 2011 or 2012, the second by 2013, and the third by September 30, 2015. SMEX investigations with an anticipated launch date later than September 30, 2015 should be proposed in response to a subsequent SMEX AO.

NASA is soliciting MO investigations involving participation in space missions that are sponsored by organizations other than SMD through this AO where a commitment from NASA is required by the sponsoring organization by December 31, 2012. The launch dates may be at any time. MO of this type requiring later commitment dates should be proposed in response to a subsequent Explorer Program AO. NASA is also soliciting investigations that propose a new scientific use of existing NASA spacecraft, as well as small complete missions, as MOs.

The following schedule describes the major milestones for this SMEX and MO AO.

AO release.....September 28, 2007
Preproposal Conference (PPC) .....approximately 3 weeks after AO release; see Section 7.1.4
Notice of Intent to Propose due .....November 16, 2007
Proposal submittal due by 4 p.m. ET.....January 15, 2008
Non-U.S. Letter(s) of Commitment due .....January 15, 2008
Selections for Phase A Concept Study (target).....May 2008
Phase A Concept Study Report due (target) .....September 2008
Downselections for Flight (target).....January 2009

NASA will conduct pre-screenings of PI experience versus requirements (Section 7.1.7) every 3 weeks prior to the proposal due date according to the following schedule. Pre-screening is offered as a service to the community and is not required by NASA.

Submissions received by	Will receive a response from NASA by
October 12, 2007	October 22, 2007
October 26, 2007	November 5, 2007
November 19, 2007	December 3, 2007
December 7, 2007	December 17, 2007

2.0 NASA's SAFETY PRIORITIES

Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA's safety priority is to protect:

(1) the public,
(2) astronauts and pilots,
(3) the NASA workforce (including NASA employees working under NASA instruments), and
(4) high-value equipment and property.

3.0 EXPLORER PROGRAM GOALS, OBJECTIVES, AND BACKGROUND

3.1 Space Science Research Goals

The scientific goals of space science research within the SMD are generally contained in the *Science Plan for NASA's Science Mission Directorate 2007- 2016* (January 2007), hereafter referred to as the *NASA Science Plan*. See the EPL (Appendix C) for access information for this and related documents describing SMD scientific goals. The scientific goals in these referenced documents as they relate to the scientific objectives of NASA's program for heliophysics and astrophysics will form the basis of the science evaluation criteria. All proposed investigations must address scientific objectives that advance the strategic goals and research objectives in the *NASA Science Plan*. Further information on the SMD heliophysics and astrophysics programs may be obtained through appropriate links found on the SMD homepage at http://science.hq.nasa.gov/.

SMD pursues NASA's strategic goals using a wide variety of space flight programs that enable the execution of both remote sensing and *in situ* investigations. These investigations are carried out through flight of space missions in Earth orbit, as well as to or even beyond objects in the Solar System, and also through ground-based research activities that directly support these space missions. This AO solicits only those investigations that fall into the category of space flight missions.

3.2 Explorer Program Objectives

Explorers are space science missions intended to address NASA's heliophysics and astrophysics goals to understand the Sun and its effects on Earth and the solar system, and to discover the origin, structure, evolution, and destiny of the universe, and search for Earth-like planets. Explorers are not intended to address NASA goals in other areas such as Earth Science and Planetary Science.

The Explorer Program seeks to conduct scientific investigations of modest programmatic scope. The program intends to provide a continuing opportunity for relatively quickly implemented flight missions and missions of opportunity that conduct focused investigations that complement major flight missions, prove new scientific concepts, and/or make other significant contributions to space science.

The Explorer Program is designed to accomplish frequent, high quality space science investigations utilizing innovative, streamlined, and efficient management approaches. It seeks to constrain cost and improve performance by selecting investigations for which investigators will commit to cost limits, control business and technical processes, and apply new technology. Finally, it seeks to enhance public awareness of, and appreciation for, space science and to incorporate educational and public outreach activities as integral parts of space science investigations.

3.3 Program Background

The Explorer Program provides several classes of flight opportunities for the science program areas described in Section 1.1. Changes to the Explorer Program have been designed to increase the number of flight opportunities in response to recommendations from the scientific community. Explorer Program classes are characterized by the scope of the mission, based on cost, on payload size, and on launch vehicle capabilities. The Explorer Program classes solicited in this and recent AOs are as follows:

- University-class Explorers (UNEX) are investigations characterized by PI Mission Costs not to exceed $15 million (in Fiscal Year 2000 dollars).

- Small Explorers (SMEX) are investigations characterized by PI Mission Costs not to exceed $105 million (in Fiscal Year 2008 dollars) which do not include the cost of the ELV, of non-SMD contributions, or of extended missions and other SEO efforts.

- Medium-class Explorers (MIDEX) are investigations characterized by PI Mission Costs not to exceed $180 million (in Fiscal Year 2002 dollars).

- Missions of Opportunity are traditionally investigations characterized by being part of a non-SMD space mission of any size, but having a cost to the Explorer Program that is typically under $35 million (in Fiscal Year 2008 dollars). These missions are generally conducted on a no-exchange-of-funds basis with the organization sponsoring the mission. NASA intends to solicit proposals for MO with each AO issued. Missions of Opportunity also include small complete missions and new science missions using existing spacecraft. For each AO, the budget available for MO may vary, as may the total cost requirement for individual missions and the types of investigations that may be proposed as a MO.

4.0 EXPLORER PROGRAM CONSTRAINTS, GUIDELINES, AND REQUIREMENTS

4.1 Introduction

Participation in this AO will be open to all categories of organizations (U.S. and non-U.S.), including educational institutions, industry, not-for-profit organizations, Federally Funded Research and Development Centers (FFRDCs), NASA Centers, the Jet Propulsion Laboratory (JPL), and other Government agencies.

The NASA contract with Science Applications International Corporation (SAIC) for evaluation support under this Announcement of Opportunity creates an unmitigatable organizational conflict of interest for SAIC in the event that any business unit of SAIC has a proposed role as prime contractor, subcontractor, or participating organization. Because of this organizational conflict of interest, SAIC is precluded from participating as an offeror in any capacity under this AO.

This section describes the constraints, guidelines, and requirements applicable to all Explorer Program selections. Additional constraints specific to SMEX investigations are in Section 5, and constraints specific to MO investigations are in Section 6. Specific directions for proposal preparation are included in Section 7.

4.2 General Program Constraints and Guidelines

The strategic role of the Explorer Program is to address NASA strategic science goals and research objectives in the *NASA Science Plan* that can be executed within the scope of the Explorer Program cost cap (see Appendix C).

The responsibility for implementing a selected investigation rests with the Principal Investigator (PI) and the investigation team, which will have a large degree of freedom with which to accomplish its proposed objectives with appropriate NASA oversight to ensure mission success (see the *SMEX Program, Low Priority, High Risk Payload (Class D), Mission Assurance Requirements* document, available in the EPL, Appendix C) while keeping the cost within the proposed cost cap. In accordance with NASA's policy of assigning program management responsibility to its Centers, NASA's Goddard Space Flight Center (GSFC) has been assigned program management responsibility for the Explorer Program. In this role, which is separate from its role as a possible partner in the investigation, GSFC is responsible for NASA's fiduciary

responsibility to ensure that Explorer missions are achieved in compliance with the cost, schedule, performance, reliability, and safety requirements committed to by the PI. The level of GSFC's involvement in this role may vary from mission to mission, depending on the implementing organization and other programmatic considerations. The GSFC Explorer Program Office will work with the selected PIs and implementing organizations to define roles and responsibilities to fulfill this responsibility in the most effective manner (see the *Example Mission Definition and Requirements Agreement*, available in the EPL). The program office will assign a Mission Manager for each investigation. The role of the Mission Manager is defined in Goddard Procedural Requirements (GPR) 7120.3 *Management of Principal Investigator Mode Missions* which can be found in the EPL.

Once an investigation has been selected for flight, failure to maintain reasonable progress on an agreed upon schedule, or failure to operate within the cost and other constraints outlined below, or failure to be able to meet the mission's technical objectives may be cause for its termination by NASA. Every aspect of a selected investigation must reflect a commitment to mission success while keeping total costs as low as possible. Consequently, investigations should be designed and planned to emphasize mission success within cost and schedule constraints by incorporating sufficient margins, reserves, and resiliency. Only those investigations whose proposed cost, schedule, and launch vehicle requirements do not exceed the constraints and guidelines identified in this AO will be considered as candidates for selection for flight.

4.3 Science Requirements

4.3.1 General Data Policies

The relationship between the proposed scientific objectives, the data to be returned, and the instrument payload to be used in carrying out the proposed investigation must be unambiguous and clearly stated in the proposal. Explorer investigation teams will be responsible for initial analysis of the data, their subsequent delivery to an appropriate NASA data archive, the publication of scientific findings satisfying all of the mission's proposed objectives, and communication of the results to the public.

In accordance with NASA policy, data are to be released as soon as possible after a brief validation period appropriate for the mission. Explorer mission teams will be responsible for collecting the scientific, engineering, and ancillary information necessary to validate and calibrate the scientific data prior to depositing it in the appropriate NASA data archive. The time required to complete this process should be the minimum necessary to provide appropriate data to the scientific community and the general public and must be described in the proposal.

As part of their funded Phase E activities, investigation teams must include an appropriate period for data analysis independent of archiving activities. The proposal must explicitly demonstrate, analytically or otherwise, that sufficient resources have been allocated to insure that data will be calibrated, analyzed, published, and archived within the proposed mission cost.

4.3.2 Science Enhancement Options for Enlarging Science Impact

The science investigation proposed for this AO must be complete through Phase F -- Closeout (see Section 1.1). This baseline investigation must contain within the PI Mission Cost all mission activities required to accomplish the proposed goals and objectives. Options for enlarging the science impact beyond the baseline mission may be included in proposals to this AO. SEOs include, but are not limited to, activities such as extended missions, guest investigator programs, general observer programs, participating scientist programs, interdisciplinary scientist programs, or archival data analysis programs. The proposal must define and describe any proposed SEO activities. As these proposed activities are options and are not included within the cost capped baseline investigation, the science enabled by SEO activities is not considered as part of the scientific merit of the proposed investigation (Section 8.2.2).

Costs for SEO activities must be included in the estimate of Total Enhanced Mission Cost (Section 4.6.3), but will not count against the PI Mission Cost cap (Section 5.4.2 or 6.5) and shall be listed separately in cost summary tables. Note that funding for SEO activities prior to Phase E should be minimized, and that NASA reserves the right to solicit and select all participants (e.g., guest investigators, archival data analysts, and participating scientists) in such programs.

It is important to note that NASA considers any proposed SEO activities as options. Inclusion of such options in a proposal does not imply a commitment from NASA to fund them even if the baseline investigation is selected. NASA reserves the right to accept or decline proposed SEO activities at any time during the mission; in particular, the decision may not be made at the time the baseline investigation is selected for flight. The process for deciding on SEO activities may involve further reviews (e.g., a “Senior Review”). Extended mission proposals should be consistent with guidelines provided in the *SMD Mission Extension Paradigm* document; this document is included in the EPL (Appendix C).

4.4 Technical Approach Requirements

4.4.1 General Policies

Investigations must encompass all technical aspects from the initial studies through delivery of the data to the appropriate NASA data archive and complete analysis of the data sufficient to accomplish the investigation’s science objectives. The document NPR 7120.5D, *NASA Space Flight Program and Project Management Requirements*, delineates activities, milestones, and products typically associated with each of these phases and may be used as a reference in defining a team's mission approach. This document is included in the EPL (see Appendix C). SMEX investigations and MO investigations selected from this AO have been determined to be Category 3 (per NPR 7120.5D) Class D (per NPR 8705.4) payloads. Specific tailoring resulting from this classification is contained in the *SMEX General Project Plan* document that is included in the EPL (see Appendix C). This is a simplifying change from most recent Explorer AOs. Mission teams have the freedom to use their own processes, procedures, and methods, and the use of innovative processes (e.g., simplified parts approval, reduced formal peer reviews, and limited periodic reporting) is encouraged when cost, schedule, technical improvements, and reliability can be demonstrated. The Explorer Program is responsible for monitoring the PI's progress and maintaining sufficient insight into the development activities to insure that cost,

schedule, and technical performance of the mission remains within established boundaries. These controls for monitoring are established in the *SMEX General Project Plan* document. Mission teams shall abide by all applicable Federal (including NASA), state, and local laws and regulations.

4.4.2 Class D Payload Classification

In this AO the reason for changing the risk classification of SMEX missions from Class C to tailored Class D is to return to the original intent of the Explorer Program's SMEX missions. The purpose is to reduce the growing evolution of requirements and classification creep which has occurred over the years, as well as to improve program implementation, by better defining the PI roles and responsibilities. NASA believes that this classification will allow for more trade opportunities and will allow the PI to be responsible for the mission implementation approach and execution. Therefore, performance, cost, schedule, and risk management are key responsibilities of the PI. The PI will also set design guidelines, conduct peer reviews, and ensure product assurance via good practices, standards, and accountability. These features will promote greater team empowerment, improved cost performance, and a quicker development timeline. The dollars saved in these areas are intended to go to providing additional science return from the mission.

The reasons for reclassifying the SMEX Missions to Class D for this AO were initially described in the letter of July 10, 2007, "Approval of the Reclassification of Small Explorer (SMEX) Mission" that is found in the EPL. Enclosure 2 of the July 10 letter circles the sections of NPR 8705.4 (Appendix B) that apply to and constitute the tailored SMEX "Class D" reclassification.

The fundamental themes expressed in the July 10 letter are as follows:

Clear declaration of NASA's intent (via AO text, *SMEX General Project Plan*) • Some risk is okay • Single string is okay • Space quality parts are required • Comprehensive test program is required • Mission tailoring is allowed
Transferred more responsibility to the PI (via *SMEX General Project Plan, Small Explorer (SMEX) Program, Low Priority, High Risk Payload (Class D), Mission Assurance Requirements*) • PI generates the Mission Integration Plan (MIP) to define the approach to managing the project • PI generates the Product Assurance Implementation Plan (PAIP) to define the processes and practices which will be used • PI assumes responsibility for as-built surveillance, compliance auditing, and certification

Work assumed by NASA (via *SMEX General Project Plan, Small Explorer (SMEX) Program, Low Priority, High Risk Payload (Class D), Mission Assurance Requirements*) • Probabilistic Risk Assessment (PRA) • Failure Modes and Effects Analysis (FMEA) • Fault Tree Analysis • Launch vehicle interface
Simplified/ Streamlined processes (via *SMEX General Project Plan*, System Review Plan) • Combined system Preliminary Design Review (PDR)/Critical Design Review (CDR) reducing the development cycle • Incorporated PI conducted peer reviews per GPR 7120.3B • Consolidated monthly reporting • Earned Value Management (EVM) simplification
Reduced (via *SMEX General Project Plan*) • Fewer contract deliverables [items in the Contract Data Requirements List (CDRL)] of which only 8 of 58 are for approval • Gold Rules, a priori mission exceptions list, initially without waivers
Eliminated (via *SMEX General Project Plan, Small Explorer (SMEX) Program, Low Priority, High Risk Payload (Class D), Mission Assurance Requirements*) • No formal software Independent Verification and Validation (IV&V)

4.4.3 Space Operations and Communications

Common elements for the mission operations of Explorers include spacecraft command uplink and data downlink, radiometric tracking, mission control centers, orbit and attitude determination, and level-0 data processing. NASA Centers offer many services which may be available and cost-effective to proposing missions. Proposers are free to propose the use of services from sources other than those offered through NASA.

The NASA Space Communication and Navigation (SCaN) program provides spacecraft tracking and radiometric data services through its three networks: the Ground Network (GN), the Deep Space Network (DSN), and the Space Network (SN). In addition, the NASA Integrated Services Network (NISN) can provide secure circuits from NASA Centers to mission and science operations centers located at universities and other non-NASA locations.

Traditional spacecraft operations services such as command generation, telemetry processing, mission scheduling, orbit and attitude determination, spacecraft engineering data evaluation and trending are also available through capabilities existing at GSFC and JPL.

Costs for such services, whether obtained from NASA or other sources, must be included in the cost estimate. The proposal must include a letter of commitment from the service provider. Selected projects shall conduct trade studies on the use on NASA-provided services versus any proposed alternatives [see Paragraph (ii) in Section 4.5.4]. Proposed projects may optionally conduct such studies in Phase A, but shall conduct such studies no later than Phase B.

SCaN may assist Explorer proposers in identifying SCaN services, prices, and cost trades. Proposals to this AO involving the use of SCaN services shall have a preliminary Project Service

Level Agreement which will serve as the required letter of commitment from the respective service commitment office(s) as to the nature and level of service that may be provided within the capacity of the applicable network.

Information on NASA-provided mission operation capabilities, including SCaN space communications services, is given in the *NASA's Mission Operations and Communications Services* document, available in the EPL.

4.4.4 Government Furnished Equipment

For purposes of this AO, the following items are considered Government Furnished Equipment (GFE):

- NASA-provided expendable launch services as described in the *SMEX Expendable Launch Vehicle Services Information Summary* document in the EPL.

Standard launch services will be provided for SMEX missions (but not MOs) at no charge against the PI Mission Cost. Mission unique and special launch services must be budgeted for within the proposed PI Mission Cost.

4.5 Management Requirements

4.5.1 Single Principal Investigator

Explorer mission investigation teams must be led by a single PI who may be from any category of U.S. or non-U.S. organization, including educational institutions, industry, not-for-profit organizations, Federally Funded Research and Development Centers (FFRDCs), NASA Centers, the Jet Propulsion Laboratory (JPL), and other Government agencies. Teams may be formed from any combination of these institutions. Note that the level of detail required in the proposal (and the Phase A Concept Study Report) is the same regardless of what organizations are partners in the investigation team, even a NASA Center.

A single PI must be designated in each proposal and is the central person in charge of each investigation, with full responsibility for its scientific integrity, for the integrity of all other aspects of the mission, and for the execution of the investigation within the committed cost and schedule. The PI is accountable to NASA for the full 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 is not likely to be achievable within the committed cost and schedule. Proposal teams may wish to designate a mission chief scientist responsible for the mission science in addition to a PI responsible for mission development and leadership.

The PI is held responsible to NASA if any portions of the project, including scientific results publication, can not be completed within the committed cost and schedule, or if the technical requirements of the mission cannot be met.

PIs for SMEX missions (hereafter called mission PIs) must demonstrate minimum experience qualifications that are designed to demonstrate relevant experience exercising responsibility, authority, and management of a space project in the areas of leadership, planning, implementation, and approval.

The minimum requisite experience that shall be demonstrated for the mission PI is showing that the person proposed for this position has previously carried out the duties of a key position for at least two years in a space project that has launched or is under development for launch. There are three parts to the minimum space flight experience standards for a mission PI: the mission PI must have (a) senior project experience on a (b) project that has gone or will go into (c) space or near-space.

(a) A mission PI must have served for at least two years and carried out the duties of the PI, the Deputy PI, the Project Scientist (PS), the Deputy PS, PM, or Deputy PM on a qualifying space project. It is acceptable to have carried out the duties of one of the named positions (PI, Deputy PI, PS, Deputy PS, PM, Deputy PM) under a different title as long as the position entailed the same roles and responsibilities (see Appendix H).
(b) A qualifying space project can be a full mission, an instrument, or an experiment (e.g., shuttle attached payloads, suborbital projects, and portions of missions/instruments).
(c) The qualifying project must have been a “space” project. A space project is one that goes into the space or near-space environment. Space projects include suborbital projects (sounding rockets, scientific balloons), orbital projects, and deep space projects. For the purpose of this AO, a suborbital experiment that reached greater than 100K feet can be considered to have gone into “space”. The space project must have launched or be under development for launch. Experience with aircraft and ground based project development, with missions that are in Phase A or with those in the proposal stage is not sufficient to provide space flight experience for a prospective mission PI.

See Section I.8 of Appendix B for directions on how to demonstrate that the proposed mission PI meets the minimum space flight experience requirements. Using Table B7 the proposal must demonstrate that the proposed mission PI has relevant experience exercising responsibility, authority, and management of a space project in the areas of leadership, planning, implementation, and approval (see Appendix H).

NASA offers the opportunity of pre-screening Principal Investigator (PI) experience requirements to prospective proposers (Section 7.1.7).

Proposed SMEX investigations that are led by mission PIs lacking in demonstrated, relevant, and appropriate experience sufficient to meet these requirements will be found noncompliant and will neither be reviewed nor selected. For proposals in which the proposed mission PI has the required space flight experience, the degree of experience of the proposed mission PI will be a factor in the evaluation of the proposal.

Other senior mission science team personnel, such as Mission Deputy PI, PS, Mission Chief Scientist, Science Team Lead, and instrument PIs, that may be involved in proposed PI-led

SMEX missions need not meet the space flight experience standards described above for the mission PI, but their experience level will also be a factor in proposal evaluation.

PIs for MOs are not required to meet the same space flight experience standards that a mission PI must meet. Although there are no specified minimum standards for a MO PI, a MO PI must demonstrate within the proposal that his/her qualifications and experience is sufficient to ensure the success of the investigation. The experience of the proposed MO PI and other key personnel will be a factor in the evaluation of the proposal.

4.5.2 Management Plans and Structure for Flight Investigations

NASA intends to allow the PI and his/her team to use their own management processes, procedures, and methods to the fullest extent possible. Investigation teams shall define the management approach best suited for their particular teaming arrangement. This approach shall be commensurate with the investigation's implementation approach, while retaining a simple and effective management structure necessary to assure the adequate control of development within the cost and schedule constraints.

Each investigation must define the risk management approach it intends to use to ensure successful achievement of the mission objectives within established resource and schedule constraints. Included in this discussion of risk management must be risk mitigation plans for any new technologies and the need for any long-lead items that need to be placed on a contract before the start of the development phase, to ensure timely delivery. In addition, any manufacturing, test, or other facilities needed to ensure successful completion of the proposed investigation should be identified. The proposer must describe the approach for managing risk which will mitigate loss of the mission or serious degradation due to errors by human operators or errors or malfunctions in the mission data systems during the flight phase.

Each SMEX investigation proposal must have a fully qualified and experienced Project Manager (PM). The PM must work closely under the PI in order to ensure that the mission meets its objectives within the resources proposed. The respective roles of the PI and PM must be clearly defined. A PM must be named at the time of proposal. After selection for formulation, the proposed PM will oversee the Formulation Phase of the project. As part of the approval process which allows the project to move into the next Phase, NASA Headquarters (HQ), in coordination with the PI and the implementing organization, will approve a PM for that new phase. The role, availability, qualifications, and experience of the PM must be adequate to ensure that the technical and managerial needs of the investigation will be met during each phase of the project. Furthermore, it is the PM and the implementing institution’s responsibility to provide the quality personnel and resources necessary to meet the technical and managerial needs of the mission. Any replacement of key personnel (including but not limited to the PI, PM, deputy PI, deputy PM, industry lead, and instrument leads) requires concurrence by NASA. Furthermore, the PM must be approved at each transition to the next phase. Commitment and past performance of the PM and his/her implementing institution will be important factors in selection of an investigation.

The investigation team should develop a Work Breakdown Structure (WBS) that follows the standard space flight project WBS defined in Appendix G of NPR 7120.5D up to level 2.

4.5.3 Co-Investigator Roles and Requirements

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. If funded by NASA, costs must be accounted for in the PI Mission Cost. If contributed, the costs must be accounted for in the Total Mission Cost and a commitment letter from the proposed Co-I's institution must be provided with the proposal. Other nonfunded members of the proposal team may be included in the proposal as collaborators. PIs must ensure that all individuals included in the proposal in any category have a specific and significant role in the proposed investigation, and that they have the appropriate skills and qualifications to successfully discharge their responsibilities. The role of each Co-I must be described in the proposal; the proposal should clearly show why the Co-I is necessary to the success of the proposed investigation. Individuals with a minor or honorary role in the proposed investigation should not be included in the proposal. See Appendix B for details.

4.5.4 Letters of Commitment

Letters of commitment signed by an institutional official must be provided from (i) all organizations offering contributions of goods and/or services (including Co-I services, both U.S. and non-U.S.) on a no-exchange-of-funds basis including all non-U.S. organizations providing hardware or software to the investigation and (ii) all major or critical participants in the proposal regardless of source of funding. Personal letters of commitment signed by the individual must be provided from (iii) every Co-I, U.S. or non-U.S. Critical participants are those participants who are assigned tasks considered by the PI to be critical to the success of the mission, including those who provide unique required services. All other participants are non-critical.

(i) Letters of Commitment for Contributions

An institutional letter of commitment for a contribution must contain a statement of financial commitment from each responsible organization contributing to the investigation to assure NASA that all contributions will be provided as proposed. Any proposal failing to provide letters of commitment from both U.S. and non-US partners providing contributions will be judged non-compliant and will be returned without a review.

The required elements in a letter of commitment for a contribution are: a precise description of what is being contributed by the partner and what assumptions are being made about NASA's role; the strongest possible statement of whether the contribution will be funded and/or what further decisions must be made before the funding is committed by the partner; and a signature by an official authorized to commit the partner (if it is not clear from the signer’s title that the signer has the necessary authority then it should be explicitly stated in the letter).

For all U.S. organizations offering contributions, letters of commitment must be submitted from both the organization providing any contributed property or service and from the organization providing any required funding. Letters of commitment must provide evidence that the institution and/or appropriate Government officials are aware and supportive of the proposed investigation and will provide funding for the investigation if selected by NASA. They must be

signed by institutional and/or Government officials authorized to commit their organizations to participation in the proposed investigation.

Institutional letters of commitment are required with the proposal for U.S. Co-Is whose services are contributed. Institutional letters of commitment for U.S. Co-Is , the cost of whose services is a part of the PI mission cost, are not required with the proposal but will be required as part of the Phase A Concept Study Report.

For non-U.S. individuals and/or institutions participating as team members and/or as contributors, requirements for letters of commitment may be found in Section 4.7.3.

(ii) Letters of Commitment for Critical Participants

A letter of commitment is required with the proposal for all major or critical participants in the proposal regardless of source of funding. A letter of commitment for a major or critical participant must contain a statement of commitment for the effort that is assigned to that participant in the proposal. The required elements in a letter of commitment are: a description of what is being provided and a signature by someone authorized to commit the organization. For organizations providing critical or major contributions, only a single letter of commitment is required.

(iii) Personal Letters of Commitment for Co-Investigators

Every Co-I, U.S. or non-U.S., must submit a brief, signed statement of personal commitment that acknowledges his/her intended participation in the proposed effort. In the case of more than one Co-I from the same institution, a single statement signed by all participants may be submitted. In any case, each statement must be addressed to the PI, may be a facsimile of an original statement or the copy of an e-mail (the latter must have sufficient information to unambiguously identify the sender), and is required even if the Co-I is from the PI institution. An example of such a statement follows:

> "I(we) acknowledge that I(we) am(are) identified by name as Co-Investigator(s) to the investigation, entitled <name of proposal>, that is submitted by <name of Principal Investigator> to the NASA Announcement of Opportunity <alpha-numeric identifier>, and that I(we) intend to carry out all responsibilities identified for me(us) in this proposal. I(we) understand that the extent and justification of my (our) participation as stated in this proposal will be considered during peer review in determining in part the merits of this proposal."

4.5.5 Contributions of Critical Goods and Services

All contributions of critical goods and services must be described, the risks of these contributions must be described, and adequate contingency plans for coping with the failure of a proposed cooperative arrangement must be described. The commitment of every partner, U.S. or non-U.S., offering a contribution must be documented in letters of commitment (Section 4.5.4). 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 or a firm commitment to provide the offered contribution.

4.6 Cost Requirements

4.6.1 Full Cost Accounting

NASA Civil Service direct labor, travel, and other direct costs must be included within the cost cap, consistent with current Agency full cost practice. Each of these elements must be separately identified. Demand service pools are to be included in the proposed cost within the cost cap to the extent that SMD Explorer Program funds are required to pay the costs. In general, proposal budgets from NASA Centers must include all costs that will be paid out of the resulting award. Corporate General and Administrative (G&A) estimates, Center Management and Operations (CM&O) estimates, and allocated service pools, which are not paid with SMD Explorer Program funds, are not to be included in the cost proposal.

If any NASA costs are to be considered as contributed costs, the contributed item(s) or service must be separately funded by a non-SMD 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.

4.6.2 Goods and/or Services Offered on a No Exchange of Funds Basis

Contributions of any kind, whether cash or noncash (property and services), to Explorer investigations by organizations other than SMD are welcome. Values for all contributions of property and services shall be established in accordance with applicable cost principles. The value of foreign contributions shall be converted to U.S. dollars using the official exchange rate at the time the proposal is submitted. The official exchange rate can be obtained at http://fms.treas.gov/intn.html. Such contributions may be applied to any part or parts of a mission.

For all contributions, letters of commitment must be submitted with the proposal from both the organization providing any contributed property or service and the organization providing any required funding. See Section 4.5.4 for further requirements on letters of commitment. For non-U.S. components of proposals, see also Section 4.7.3.

The cost of contributed hardware or software must 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 total of any recurring and mission-unique costs associated with reproduction and/or modification of the item 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 must be consistent with rates paid for similar work in the offeror's organization. The cost of contributions does not need to include funding spent before the start of the investigation (before completing a contract, grant, or other funding mechanism with NASA). The value of contributed materials and supplies shall be reasonable and shall not exceed the fair market value of the property at the time of the contribution.

4.6.3 PI Mission Cost

The PI Mission Cost is the funding that NASA SMD would be expected to provide to the investigation team over the course of the investigation, beginning with selection for Phase A and ending with the conclusion of Phase F -- closeout. Examples of costs to be included are education and public outreach activities; new technology; subcontracting costs (including fees); science teams; all personnel required to conduct the investigation, analyze and publish results, and deliver data in archival format; insurance; mission unique and special launch services; ground data system including NASA-provided mission operations and communications services, if required (see *NASA's Mission Operations and Communications Services* document in the EPL); labor (contractor); noncontributed NASA civil servant costs; reserves; and contract fees. The specific total funding limits and limits for major mission elements are specified in Sections 5.4 and 6.5. The PI Mission Cost is a consideration in the selection of investigations and in the continuing assessment of ongoing missions.

Costs for standard launch services for SMEX missions are not included in the PI Mission Cost, but mission unique and special launch services do count against the PI Mission Cost cap as noted in Section 5.2. As noted in Section 4.3.2, costs for SEO activities, if any of these are proposed, must be included in the estimate of Total Enhanced Mission Cost but will not count against the PI Mission Cost cap.

4.6.4 Cost Risk Management

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, mission proposals that are unable to show an adequate unencumbered reserve are likely to be judged a high cost risk and not selected.

For the purpose of this AO, an adequate unencumbered reserve on the PI Mission Cost is measured against the cost to complete through Phases A/B/C/D/E/F and is a minimum of 30% including funded schedule reserve. Adequate unencumbered reserves must be demonstrated in the proposal, in the Phase A Concept Study Report (i.e., at the end of Phase A), and at Confirmation (i.e., at the end of Phase B).

Proposals must also describe 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.

4.6.5 Earned Value Management

A fully validated Earned Value Management System as defined by ANSI/EIA-748, NPR7120.5D shall be applied to any selected mission (NASA center or other PI institution). NASA FAR Supplement Clause 1852.234-2 will be included in all contracts, as applicable, resulting from this announcement. Further definition is included in the *SMEX General Project Plan* in the EPL.

4.7 International Participation

4.7.1 General Policies

Proposals from non-U. S. sources as well as those originating within the U. S. which include non-U.S. participation must be responsive to NFS Part 1852.235-72(l): "Instructions for Responding to NASA Research Announcements."

"NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the AO, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed."
(NFS 1852.235-72(l)(1))

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 Explorer investigations is welcomed. Participation may include, but is not limited to, the contribution of scientific instruments, the spacecraft (or a portion thereof), a launch vehicle and launch services, and the subsequent sharing of the data from the mission, all on a no-exchange-of-funds basis. Carriers and space operations may also be contributed by international partners. Such participation can add to management complexity and risk, however, and proposed cooperative arrangements must offer significant benefits while maintaining clear technical and management interfaces. The proposal must discuss the risks and benefits of proposed cooperative arrangements, as well as management approaches to mitigating these risks.

The direct purchase of supplies and/or services that do not constitute research from non-U.S. sources is permitted except that NASA is precluded from purchasing non-U.S. launch vehicles, nor may NASA funds provided to a mission team be used to purchase a launch vehicle from a non-U.S. source.

Proposers are advised that a contract or subcontract by a U.S. team with a non-U.S. participant using funds derived from NASA must meet all applicable NASA and Federal regulations. Proposers are further advised that these regulations will place additional requirements on investigation teams that must be explicitly included in discussions of the investigation's cost, schedule, and risk management.

Among the Federal regulations that all proposers, their partners, and their subcontractors must follow are the U.S. export laws and regulations including the International Traffic in Arms Regulations (ITAR; see Section 4.7.4) and, if access to NASA facilities and information systems are required, Homeland Security Presidential Directive HSPD-12 (see http://hspd12.nasa.gov/).

4.7.2 Proposal Preparation and Submission

All proposals, including non-U.S. proposals, must be submitted in English and comply with all other submission requirements stated in the AO. All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S. and must be received by the established closing date. All proposals received after the closing date will be treated in accordance with NASA's provisions for late proposals (Appendix A, Section VII). Proposals from non-U.S. entities that include U.S. participation and proposals from U.S. entities that include non-U.S. participation must include a cost plan for the U.S. entities, and, at a minimum, the integrated value of the contribution of each non-U.S. entity. See also Section 5.3 for further guidance for SMEX proposal preparation.

4.7.3 Letters of Commitment for International Participation

Participation by non-U.S. individuals and/or institutions as team members or as contributors to Explorer investigations must be endorsed by the institutions and governments involved. If government funding or support is required, then a government commitment is also required. The letter of commitment must provide evidence that the non-U.S. institution and/or government officials will commit the appropriate technical, personnel, and funding resources to the proposed investigation if selected by NASA. Such commitments must be submitted with the proposal. Proposals without the required letters of commitment will be deemed noncompliant and returned to the proposer without review.

The required elements in a letter of commitment are: a precise description of what is being contributed by the partner and what assumptions are being made about NASA's role; the strongest possible statement of whether the contribution will be funded, or what further decisions must be made before the funding is committed by the partner. The letter of commitment must be signed by an authorized officer or representative of the partner institution.

4.7.4 U.S. Export Laws and Regulations

Proposers should be aware that investigations selected for Phase A 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 a section discussing compliance with U.S. export laws and regulations; e.g., 22 Code of Federal Regulations (CFR) 120-130, *et seq*. and 15 CFR 730-774, *et seq*., as applicable to the scenario surrounding the particular international participation (see Appendix B.I.4). Proposers must also comply with NFS clause 1852.225-70 entitled "Export Licenses." The proposal 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 Phase A Concept Study Report 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.pmddtc.state.gov/ and http://www.bis.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 (ITAR), 22 CFR 120-130, *et seq*.

4.7.5 Agreements with Selected Non-U.S. Participants

Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of External Relations will arrange with the non-U.S. sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsor will each bear the cost of discharging its respective responsibilities.

It is the policy of NASA to establish formal international agreements with non-U.S. partners in cooperation on flight missions. Depending on the scope of the cooperation, NASA's Office of External Relations may choose to pursue a Memorandum of Understanding (MOU), Letter of Agreement (LOA), an implementing agreement under a framework agreement, or some combination of these agreements, in order to allow the cooperation to take place. Additionally, in some cases, interim agreements may be put in place until a more permanent arrangement is reached.

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

Due to the short duration of the concept study phase, it is not possible for NASA to conclude an international agreement prior to the due date for Concept Study Reports. Proposals must show how the Phase A concept study can be completed in the absence of an international agreement.

4.7.6 Requirements for Proposals containing non-U.S. Participation

Contributions, particularly non-U.S. contributions, offer benefits but also represent complexity and risk to a project. Therefore, U.S. proposers must discuss mitigation plans, where possible, for the failure of funding or contributions to materialize when they are outside the control of the PI. Mitigation may include, but is not limited to, descoping the contributed items and/or holding reserves to develop the contribution directly. Note that reserves held for this purpose will be considered by NASA to be encumbered. When no mitigation is possible, this must be explicitly acknowledged. In addition to budget and technical risk, non-U.S. contributions introduce schedule risk for implementing technical assistance agreements and international agreements. An adequate and realistic schedule must be allocated for having international agreements executed. NASA will not initiate development of any international agreements until after the downselect decision is made at the conclusion of Phase A.

Any proposed international participation must be described at the same level of detail as that of U.S. partners, including the provision of cost, schedule, and management data. Failure to document cost and schedule data, management approaches, or failure to document the commitment of team members or funding agencies, may cause a proposal to be found unacceptable.

Proposals with non-U.S. participation are required to include a table listing: (i) non-U.S. participants (individuals, institutions), (ii) roles and responsibilities, (iii) funding organization, (iv) approximate value of contribution and method for estimating value, and (v) cross-reference to letters of commitment in the Appendix. Proposals with non-U.S. participation must clearly describe the flow of design requirements (potentially controlled information) and hardware between U.S. and non-U.S. participants. This description may take the form of a flowchart. See Section I.4 of Appendix B.

4.7.7 Export Controlled Material in Proposals

While explicit inclusion of export control material in proposals is not prohibited, NASA is advising proposers that, under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the ITAR, 22 CFR Parts 120-130. This may, in some circumstances, complicate NASA’s ability to evaluate the proposal since occasionally NASA may use the services of foreign nationals who are not lawful permanent residents of the U.S. to review proposals submitted in response to this AO. In order to enable proper evaluation of proposals, any export-controlled information subject to ITAR in a proposal must be marked with a notice to that effect and prominently displayed on the first page of the proposal that shall state:

> “The information (data) contained in [insert page numbers or other identification] of this proposal is (are) subject to U.S. export laws and regulations. It is furnished to the Government with the understanding that it will not be exported without the prior approval of the proposer under the terms of an applicable export license or technical assistance agreement.”

Note that it is the responsibility of the proposer to determine whether any proposal information is subject to the provisions of ITAR.

Information regarding U.S. export regulations is available at http://www.pmddtc.state.gov and at http://www.bis.doc.gov.

4.8 Education and Public Outreach Requirements

4.8.1 Overview

The SMD invests in Education and Public Outreach (E/PO) to augment the scientific and technical workforce needed to achieve NASA's mission, to attract and retain students in scientific and technical disciplines, and to contribute to public literacy in science and technology and awareness of NASA's mission. SMD's E/PO portfolio includes higher education programs that provide research support and training to outstanding students pursuing degrees in all disciplines engaged in Earth and space sciences; elementary/secondary education activities primarily to contribute to continued improvement in formal education; and informal education and public outreach activities to inspire and engage learners of all ages through partnerships with community-based groups like museums and planetariums, the Girl Scouts, and amateur astronomers/citizen scientists.

SMD also contributes to NASA education outcomes and participates in the agency-wide coordination as outlined in the *Strategic Coordination Framework: A Portfolio Approach* (NP-2007-01-456-HQ, http://www.education.nasa.gov/about/strategy/). *The Explanatory Guide to the NASA Science Mission Directorate Education and Public Outreach Evaluation Factors* at http://www.science.hq.nasa.gov/research/guide.htm (Version 2, December 2006) describes the necessary quality indicators that are used in evaluation of SMD E/PO proposals. These documents are available in the EPL.

SMD's past investments in E/PO have resulted in a continued supply of a competent workforce as well as leaders in Earth and space sciences. In addition, many award winning programs have engaged educators in and informed the citizenry about recent advances in Earth and space sciences, as well as touched millions of learners of all ages. More detailed information may be found at http://science.hq.nasa.gov/education/ and http://science.hq.nasa.gov/research/epo.htm.

In accordance with established SMD policies, E/PO will be an integral element of the Explorer Program. The E/PO program consists of a mandatory basic E/PO element (“core” E/PO) and an optional Student Collaboration (SC) element (see Section 4.8.2). From 0.25 to 1 percent of the PI Mission Cost must be allocated to the mandatory basic E/PO element. There is no cost cap to the optional SC element.

A detailed plan for the mandatory basic E/PO element is not required with the Stage 1 proposal. The proposer must provide a statement that she/he understands NASA SMD requirements for E/PO and is committed to carrying out an E/PO program that meets the SMD E/PO goals. The proposer must also provide a brief overview of the planned E/PO activities and their relationship to the proposed mission. Further details are provided in Section H of Appendix B.

A detailed E/PO implementation plan must be developed by each investigation selected through this AO as part of its Phase A Concept Study Report. As outlined in Section 8.4.4, 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 *Guidelines and Criteria for the Phase A Concept Study* document in the EPL for additional information. Note that significant elements of this AO's goal for involvement of small disadvantaged businesses and minority institutions (see Section 4.9) may be met in part through an appropriately planned E/PO program.

4.8.2 Student Collaboration

SMD recognizes the value of directly involving undergraduate and/or graduate students in a spaceflight experience. PI's are encouraged to propose innovative SCs that inspire the students, engage them directly in the prospective missions, contribute to their learning and appreciation of scientific exploration of space, and provide the opportunity for development of their work skills relevant to NASA missions. The SC may involve development of an instrument, investigation of scientific questions, data analysis or modeling, development of supporting hardware or software, and/or other aspects of the mission. The activities may involve flight or ground systems. For example, the Student Dust Counter aboard the New Horizons spacecraft was provided by a student team and included the students in the full spaceflight instrument experience while creating a real-world vehicle for teaching other students. SC elements involving only analysis of archival data are not allowed.

The proposal must clearly identify a proposed SC as an E/PO element. If a SC is proposed, the proposal must provide details of the development schedule of the SC, including decision points for determining SC readiness for flight. An SC may, but is not required to, have the potential to add value to the science or engineering of the mission. The proposer must describe how the SC can be incorporated into the mission on a non-impact basis. That is the SC may not increase the mission development risk or impact the development or performance of the baseline science investigation in any way that would cause the baseline mission to be compromised in the event that the SC component is not funded, encounters technical, schedule, or cost problems, or fails in flight. The SC must be shown to be clearly separable from the rest of the proposed effort. The inclusion of an adequate plan for the mentoring and oversight of students to maximize the opportunity for teaching, learning, and success in contributing to the mission is strongly encouraged.

Any proposed SC will be evaluated as described in Section 8.2.5 and in the *Explanatory Guide to the NASA Science Mission Directorate Educational Merit Evaluation Factors for Student Collaboration Elements* in the EPL. Although the cost of the SC must be included within the PI Mission Cost cap, the cost of the SC must be identified separately from the proposed investigation. If NASA selects the proposed mission, NASA may or may not fund the SC.

Direct involvement of students at the elementary/secondary levels (e.g., data analysis or display) is within the scope of a mission E/PO plan, but will not be considered as part of the Student Collaboration.

4.9 Subcontracting Plans

The PI and team members shall agree to use their best efforts to assist NASA in achieving its statutory goals for the participation of Small Disadvantaged Businesses (SDBs), Women-Owned Small Businesses (WOSBs), Historically Black Colleges and Universities (HBCUs), and Other Minority Educational Institutions (OMI) in NASA procurements. Investment in these organizations reflects NASA's commitment to increase the participation of minority concerns in the aerospace community and is to be viewed as an investment in our future. Note that the substantial element of minority colleges and universities in space science missions and research programs is also a key objective of the SMD E/PO program. Offerors, other than small business concerns, are also advised that contracts resulting from this AO are required to contain small business subcontracting plans that include an overall goal for subcontracting with small business concerns and subgoals for subcontracting with various categories of small business concerns and minority institutions (FAR 52.219-9). See Appendix A, Section XIII for information on goals and subcontracting plan requirements.

Of specific importance, subcontracting plans and proposed SDB participation targets, covering Phases B/C/D/E/F, including the proposed goals and targets and the quality and level of work that will be performed by various categories of small business concerns, including SDBs, and minority institutions will be evaluated along with the concept studies in the downselection decision. See the document, *Guidelines and Criteria for the Phase A Concept Study,* in the EPL for further information.

5.0 SMEX OPTIONS, GUIDELINES, AND REQUIREMENTS

5.1 SMEX Requirements

A SMEX proposal must be for a science investigation whose implementation requires a complete, free-flying space mission which is released into space from an expendable launch vehicle. The 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.

5.2 Launch Services

SMEX investigations are launched as primary payloads using Expendable Launch Vehicles (ELVs). Standard launch services on an ELV will be provided at no charge against the PI Mission Cost cap. The *SMEX ELV Launch Services Information Summary* document in the EPL (Appendix C) provides information on the specific ELV opportunities that are available for SMEX missions. There will be a charge against the PI Mission Cost cap for mission unique and special launch services beyond the standard services offered. Examples of mission unique items are the use of an optional additional stage to improve accuracy and/or performance, a new payload attach fitting, and a non standard launch site. Funds allocated to the PI Mission Cost cap can not be used to purchase a launch vehicle or standard launch services.

The provision of launch services, as a contribution to an Explorer mission by a U.S. or non-U.S. partner, may be proposed only on a no-exchange-of-funds basis (i.e., at no cost to SMD).

Contributed launch vehicles and launch services may be proposed as long as the value of the contribution is within the cap on contributions (one-half of PI Mission Cost; see Section 5.4.3). Secondary or co-manifested launch opportunities for SMEX mission investigations are not solicited, even if paid for by a partner. It is the responsibility of the proposer to secure an organization that will contribute a launch if a contributed launch is part of the proposed investigation. The proposer of a mission with a contributed ELV must identify the opportunity and provide evidence in the proposal that the launch service provider agrees to manifest the mission should the proposal be selected and confirmed for flight. The demonstrated reliability and the resultant probability of mission success will be evaluated for both contributed launch services and NASA SMD-funded launch services. However, contributed launch services will be evaluated consistent with National Space Transportation Policy, Public Law, and NASA's Launch Services Risk Mitigation Policy. For any co-operative contributed launch vehicle, the approach for NASA's insight for launch services should be submitted in the proposal. The contributed launch service will be assessed in conjunction with NASA stakeholders as part of the selection process. The NASA Flight Planning Board assuring consistency with Agency risk strategy will approve final mission assignment.

Information on the reliability of ELVs may be obtained from the point of contact listed in the *SMEX ELV Launch Services Information Summary* document in the EPL (Appendix C).

5.3 International Participation

Any proposed international participation in a SMEX mission must be described at the same level of detail as that of U.S. partners. This includes the provision of cost, schedule, technical, and management data. Failure to document cost and schedule data, management approaches, or failure to document the commitment of team members or funding agencies, may cause a proposal to be found unacceptable. For further information, see Section 4.7.

5.4 Cost and Schedule Requirements

5.4.1 Schedule Requirements and Constraints

One of the objectives of the SMEX program is to develop frequent space science investigations of modest scope. The schedule for investigations selected through this AO is expected to be such that launch for the first mission can take place by late 2011 or 2012, for the second mission by 2013, and no later than September 30, 2015 for the third mission. The proposer must specify in the proposal the launch date that the proposal is planned to. It may be necessary for NASA to adjust the launch dates of the selected missions from those proposed to conform to the available Explorer Program budget profile. Therefore, the proposal must also indicate the degree of launch date flexibility by specifying the range of launch dates between the planned launch date and September 30, 2015 that can be accommodated as well as any constraints on the launch date. In particular, the selection of one or more Missions of Opportunity with funding requirements prior to Fiscal Year (FY) 2013 will affect NASA's ability to support these launch dates. Procurement of long lead materials is permitted during the Phase B/C time frame but must be defined in the Phase A concept study. No time constraint is placed on Phase E.

5.4.2 PI Mission Cost

For a SMEX, the PI Mission Cost is limited to $105 million in FY 2008 dollars, including funding for all phases and all elements (e.g., Phase A through Phase F, any GFE except standard launch services, implementation of the E/PO program, mission operations and data analysis, safety reliability and quality assurance activities, and reserves). The proposer may distribute the funds among these elements as best suits the investigation.

NASA plans to fund directly the costs for any non-contributed standard launch services outside of the PI Mission Cost. With the exception of the additional charge for mission unique and special launch services beyond those standard services offered in the *SMEX ELV Launch Services Information Summary* document available in the EPL, these costs are not to be included in the proposal.

For the purpose of this AO, PI Mission Costs must include funding to be used for all NASA-provided services such as mission operations, space communications and tracking, and communication lines.

As noted in Section 4.3.2, costs for SEO activities, if any of these are proposed, must be included in the estimate of the Total Enhanced Mission Cost but will not count against the PI Mission Cost cap.

The specific cost information required for SMEX proposals is contained in Appendix B.

5.4.3 Total Mission Cost including Contributions

The Total Mission Cost is defined as <u>all</u> costs that are necessary to complete an investigation beginning with selection through Phase F, including PI Mission Costs, contributed non-NASA Civil Servant costs, and contributions from U.S. (including non-SMD) and non-U.S. entities. In general, proposers should assume all costs must be included unless specifically excluded. Proposers must estimate the Total Mission Cost in the proposal as described in Appendix B, Table B3.

Contributions, that is, goods and/or services offered on a no-exchange-of-funds basis, may be proposed to any mission element but the total external (non-SMD) contribution is not to exceed one-half of the PI Mission Cost.

5.5 Selection and Cost Limits

It is anticipated that approximately 6-8 SMEX investigations will be selected for a four-month Phase A concept study through this AO, with each awarded a contract or other funding mechanism with a priced option for a four-month bridge phase (see Section 8.4.2). At the conclusion of the concept study, it is planned that up to three investigations will be selected to proceed into subsequent mission phases. NASA may also designate one additional SMEX mission as an unfunded backup until all selected SMEX missions pass or fail their Confirmation Reviews to enter Phase C, for possible selection in case one of them runs into technical or cost difficulties. There is no expectation that the alternate will proceed into Phase B and subsequent

mission phases if the selected missions proceed without termination; even if a selected mission is terminated, NASA reserves the right not to go forward with any designated backup mission. NASA will not exercise contract options nor continue funding for those investigations not selected to proceed. Those investigations not selected to proceed may propose to future Explorer AO's with neither prejudice nor advantage on the part of NASA.

A Phase A concept study will be conducted by each investigation team whose Stage 1 proposal is selected. The cost (up to $750K in real year dollars) of the concept study must be part of the proposal and is included in the PI Mission Cost cap. See the *Guidelines and Criteria for the Phase A Concept Study* document available in the EPL (Appendix C) for information on the concept study to be conducted by the investigation team.

During Phase A, the PI Mission Cost shall not increase by more that 20% from that offered in the original proposal and must not exceed the PI Mission Cost cap given in Section 5.4.2. Thereafter, the PI Mission Cost shall not increase from that offered in the Phase A Concept Study Report.

Each mission's concept study must include a commitment by the PI for the cost, schedule, and scientific performance of the investigation. The Explorer Program does not maintain a budget reserve to which investigations exceeding their cost commitments may have access for cost overruns. If, at any time, the cost, schedule, or scientific performance commitments appear to be in peril, the investigation will be subject to termination or cancellation. A mission that has not been confirmed to go into development may be terminated. A mission that has been confirmed to go into development may be cancelled.

Each mission’s Concept Study Report must demonstrate an adequate unencumbered cost reserve as defined in Section 4.6.4.

The nominal limit for any mission’s spending prior to the entry into Phase C is 25% of the total PI Mission Cost commitment for Phases A/B/C/D. The cost prior to the Phase B/C Confirmation, regardless of percentage of total PI Mission Cost commitment, must be justified.

At the investigation's Phase B/C Confirmation Review (see Section 8.4.5), the PI will be required to demonstrate an adequate unencumbered cost reserve as defined in Section 4.6.4.

5.6 Baseline and Minimum Missions

SMEX missions proposed in response to this AO must have both a proposed Baseline Mission and a proposed Minimum Mission. The proposed Baseline Mission refers to that mission that, if fully implemented, will accomplish the entire set of scientific objectives identified for the mission in the proposal. The proposed Minimum Mission is the minimum science component identified for the mission in the proposal below which the investigation will not be considered justifiable for the proposed cost. In NPR 7120.5D, the Minimum Mission is defined as the “Threshold Science Requirements.” The differences between the proposed Baseline Mission and the proposed Minimum Mission will be assessed in order to determine the mission's resiliency in the event that development problems lead to reductions in scope. In developing the proposed Minimum Mission, the proposer should consider all aspects of the mission (e.g., launch vehicle,

instrument, spacecraft, ground system) and not focus entirely on possible instrument descopes or shorter mission operations.

Any alteration of a SMEX mission that results in a reduction of the mission's ability to accomplish the Baseline Mission set of scientific objectives as identified in the Concept Study Report at the end of Phase A will be considered a “descoping” of the mission. The resulting set of achievable scientific objectives will then be reviewed by NASA to ensure that the mission remains at or above the Minimum Mission.

A detailed plan for the prioritized descoping of mission capability from the Baseline Mission to the Minimum Mission as set forth in the Stage 1 proposal shall be developed during Phase A. The mission team will also propose a set of performance metrics during Phase A for program evaluation, including cost, schedule, and others as appropriate; ultimately these metrics will be negotiated with NASA. Failure to maintain a level of science return at or above the Minimum Mission or violation of the agreed upon metrics will result in the mission being reviewed for possible termination, cancellation, changes in team membership including the PI, or recompetition prior to completion.

6.0 MISSIONS OF OPPORTUNITY BACKGROUND, CONSTRAINTS, GUIDELINES, AND REQUIREMENTS

6.1 Missions of Opportunity Background and Constraints

Missions of Opportunity fall into three categories – Partner MO (Section 6.2), New Science Missions using Existing Spacecraft as MO (Section 6.3), and Small Complete Missions (Section 6.4). By supporting participation in Partner MO investigations, NASA seeks to allow the scientific community the opportunity to conduct a science investigation of interest to SMD as part of a U.S. or non-U.S. non-SMD space mission. New Science Mission using Existing Spacecraft MO opportunity allows proposals for new science missions that utilize existing in-flight SMD spacecraft that have completed their prime flight missions. Small Complete Mission MO opportunity permits targeted, compelling science investigations to be proposed at a lower cost than SMEX missions. Although non-U.S. participation is allowed in MO investigations, none is required.

MO proposals traditionally considered as “data buys” will not be considered. MO proposals for suborbital missions, including long duration balloon missions, will not be considered.

Explorer MO investigations must address one or more of the science objectives of the SMD heliophysics or astrophysics research programs and must include appropriate provisions for the analysis of data and publication of results in the peer-reviewed scientific literature and for the conduct of an E/PO program. MO investigations will be evaluated against the criteria described in Section 8.2 of this AO.

PIs for MOs are not required to meet the same space flight experience standards that a SMEX mission PI must meet (Section 4.5.1). Although there are no specified minimum standards for a MO PI, a MO PI must demonstrate within the proposal and the PI’s résumé that his/her qualifications and experience is sufficient to ensure the success of the investigation.

A selected investigation for an MO may result in a contract, grant, or other funding mechanism, depending on the nature of the proposal. Further information on grants is contained in NPR 5800.1E, *Grant and Cooperative Agreement Handbook*, available from the EPL (see Appendix C).

A MO may be selected for flight without first completing a Phase A concept study, or it may be required by NASA to conduct a Phase A concept study before being considered for flight. Any request for selection without a Phase A concept study must be fully justified in the proposal. For such a selection, an MO proposal must (1) conform to these Explorer AO guidelines for an MO investigation 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. If required, a selected MO investigation will submit a Concept Study Report to NASA SMD for detailed review. Concept studies are expected to address plans for E/PO and for meeting other programmatic objectives of this AO. This report will include a commitment by the PI for the cost, schedule, and scientific performance of the investigation. If, at any time, this commitment appears to be in peril, the investigation will be subject to cancellation regardless of the impact, where applicable, of this cancellation on its "parent" mission. Like other investigations proposed to this AO, NASA SMD funding is subject to cancellation if there is a cost overrun charged to NASA for any reason, including a launch delay caused by the non-SMD partner.

A technical and programmatic Confirmation Review will be held prior to the start of Phase C. Assuming a positive outcome, NASA will approve the investigation to proceed to implementation. As a condition for Confirmation of a MO that is part of a non-SMD space mission, the organization sponsoring the full mission must make a commitment to enter into an appropriate agreement with NASA SMD that shall include provisions for sharing of flight data necessary for the completion of the selected MO investigation (see Section 6.2 below).

NASA provided expendable launch vehicles are not offered for MO investigations. Crew Exploration Vehicle (CEV), Commercial Orbital Transportation Services (COTS), and Space Shuttle launches are not offered for MO investigations.

6.2 Partner Missions of Opportunity

For purpose of this AO, a partner MO is one in which the proposer offers to participate in a non-SMD space mission that is planned or that has been approved by its sponsoring organization. By funding participation in a non-SMD space mission, NASA seeks to allow the scientific community to conduct a science investigation of interest to SMD as part of a non-SMD space mission. Such missions may be sponsored by non-U.S. governments, by other U.S. agencies (including NASA), or by private sector organizations. Partner MO investigations on a military satellite are allowed as long as the satellite is not planned for weapons testing. Participation in an international or commercial mission going to the International Space Station (ISS) is permitted provided that transportation to the ISS is provided by the mission partner at no cost to SMD.

Participation in a non-SMD space mission could take many forms, such as providing a complete science instrument, hardware components of a science instrument, or expertise in critical areas of

the mission. If the provision of hardware is proposed, then that hardware must be either components of a science instrument or a complete science instrument. NASA SMD will evaluate the proposed science investigation content and feasibility, and 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 its complete investigation and how it is accomplished in the sponsor’s mission in the proposal. This documentation must be sufficient to allow an evaluation of the adequacy of the mission to provide all resources required for a successful MO investigation.

Note that selection by NASA SMD through this AO does not constitute selection of a partner MO investigation as part of the non-SMD mission, which necessarily is a decision made by the sponsor of the mission. Instead, selection is a commitment by NASA SMD to fund the NASA SMD portion of the investigation as part of the Explorer Program, although funding beyond basic studies will not begin until detailed design of the mission itself is underway. If a partner MO investigation is selected both by NASA SMD and by the mission sponsor, the PI is fully responsible to NASA SMD for the scientific integrity, as well as the leadership and management, of the PI's contribution to the mission.

The proposing PI must provide evidence that the sponsoring organization intends to fund the primary host mission and that the commitment by NASA for U.S. participation is required by the sponsoring organization by December 31, 2012. The launch date itself is not constrained. If a commitment from NASA is not needed by the sponsoring organization by December 31, 2012, then the proposal must be submitted to a subsequent Explorer Program AO.

As a matter of NASA policy, its sponsorship of an MO investigation 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. For an MO investigation on a U.S. commercial mission or on a U.S. Government mission not sponsored by SMD, 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. Under no circumstances will NASA pay for non-U.S. launch costs.

Explorer missions and MOs are initiated primarily for the conduct and publication of scientific investigations and results. As such, NASA expects that the mission sponsor will enter into an agreement with NASA to assure that data returned from at least those aspects of the mission in which NASA SMD support is involved, if not the entire mission, will be made available to the U.S. scientific community in a timely way and deposited in an appropriate NASA data archive. NASA will seek to conclude an international or interagency agreement with the mission sponsor in advance of launch to ensure that this will be done. NASA recognizes that MO investigation teams may justifiably incur additional data analysis responsibilities defined by the policies of the sponsor of the parent mission.

6.3 New Science Missions using Existing Spacecraft as MOs

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

- The proposal must make use of a NASA spacecraft or other working space asset that has completed its prime (and extended) mission(s).
- The proposed mission must constitute a new science investigation and may not be an extension, supplement, redirection, or follow-up of the spacecraft's original science mission or any previously approved mission extensions.
- The new science mission must constitute a science investigation addressing the scientific objectives of the science research programs identified in Section 1.1.
- 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 missions using existing spacecraft are MOs in the sense that NASA may or may not select one or more. Although non-U.S. participation is allowed, none is required.

In addition to meeting other proposal requirements, a proposal for a new science mission using existing spacecraft 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 using existing spacecraft proposal, the proposer must show that operations can be transferred to the new science mission using existing spacecraft operations team with acceptable risk and with adequate capture of engineering and operations knowledge and lessons learned.

The proposing investigator must provide evidence that a decision by NASA on whether or not to conduct the proposed new science mission using existing spacecraft is required by December 31, 2010. If a commitment from NASA is not required by December 31, 2010, then the proposal must be submitted to a subsequent Explorer Program AO.

All mission operations, data analysis, and archiving costs must be included in the proposed MO budget; see Sections 4.6 and 6.5 for cost requirements. As is the case for SMEX missions generally, provisions must be made for the planning and conduct of an appropriate E/PO program as well.

6.4 Small Complete Missions as MOs

Under this AO, complete but small science investigations may be proposed as MOs. Scientifically valuable proposals at any cost within the budget allocated for MOs are permitted, including micro and nanosats costing much less than a SMEX investigation. Launch dates proposed for Small Complete Missions should be no later than September 30, 2015.

Complete but small science investigations are MOs in the sense that (i) NASA may or may not select one or more small science investigations, and (ii) the cost cap for small science investigations is the MO cost cap. Although non-U.S. participation is allowed in small science investigations, none is required.

No launch vehicle will be provided by NASA. The complete but small science investigation must include access to space, all phases of development, mission operations and data analysis, archiving of data, and the publication of science results within the proposed cost. Contributed launch services will be evaluated consistent with National Space Transportation Policy, Public Law, and NASA's Launch Services Risk Mitigation Policy.

All mission operations and data analysis costs must be included in the proposed budget; see Sections 4.6 and 6.5 for cost requirements. As is the case for SMEX missions generally, provisions must be made for the planning and conduct of an appropriate E/PO program.

6.5 Cost Requirements, Cost Cap, and Funding Policies for MOs

One or more MOs may be selected as long as they can be accommodated within the $70M budget allocated for this purpose. MOs may not be proposed in which the PI Mission Cost exceeds $70M (FY 2008 dollars) for all phases of the investigation. The level of funding available for each selected proposal will be decided on a case-by-case basis and will be capped at that level. Since NASA would prefer to select multiple MOs within the allocated budget, proposers should be aware that the more an MO investigation would cost the Explorer Program, the more difficult it will be to support the MO. A single MO investigation costing $70M may be selected only if it is scientifically and technically compelling enough to justify using the entire budget allocated to MOs.

NASA's funding for a selected investigation's concept study will be between $150K and $300K in real year dollars depending on the scope and cost of the MO. The cost of the concept study must be budgeted as a part of the initial proposal and must be justified and scoped in the proposal.

It is important for proposers to this AO 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 up to $250K/year (in real year dollars) until the MO development begins. 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 proposed investigation.

For the purpose of this AO, PI Mission Costs must include funding to be used for all NASA-provided services such as mission operations, space communications and tracking, and communication lines.

As noted in Section 4.3.2, costs for SEO activities, if any of these are proposed, must be included in the estimate of Total Enhanced Mission Cost but will not count against the PI Mission Cost cap.

Proposers must estimate the PI Mission Cost in the proposal. The specific cost information required for proposals is contained in Appendix B.

During Phase A, the NASA cost shall not increase by more that 20% from that offered in the original proposal and must not exceed the NASA cost cap. Thereafter, cost shall not increase from that offered in the Phase A Concept Study Report.

Each investigation's Concept Study Report must demonstrate an adequate unencumbered cost reserve as defined in Section 4.6.4.

Each investigation's concept study must include a commitment by the proposer 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 peril, the investigation will be subject to termination, cancellation, or recompetition. The Explorer Program does not maintain a budget reserve to which investigations exceeding their cost commitments may have access for cost overruns.

At the investigation's Phase B/C Confirmation Review (see Section 8.4.5), the PI will be required to demonstrate an adequate unencumbered cost reserve as defined in Section 4.6.4.

7.0 PROPOSAL PREPARATION AND SUBMISSION

7.1 Preproposal Activities

7.1.1 Explorer Program Library (EPL)

The EPL provides additional requirements and background information on the Explorer Program, including science goals, technology and education/public outreach strategies, and information on management aspects of flight programs. Information on the EPL is contained in Appendix C. The EPL is accessible at http://explorers.larc.nasa.gov/smexlib.html.

7.1.2 Technical and Scientific Inquiries

All inquiries should be directed to the Explorer Program Scientist, as designated in this section. Inquiries are preferred in writing and may be sent by E-mail; the character string "SMEX AO" (without quotes) should be included in the subject line of all transmissions.

Dr. Hashima Hasan
Explorer Program Scientist
Science Mission Directorate
National Aeronautics and Space Administration
Washington, DC 20546-0001
U.S.A.
Tel.: (202) 358-0692
E-mail: smexao@nasa.gov

Questions, concerns, or requests for information or clarification regarding this AO shall be directed only to NASA's formal point of contact, designated in this section. No communications concerning this AO may be made to any other NASA official.

7.1.3 SMEX Acquisition Additional Information Web Page

A SMEX Acquisition Additional Information web page, available at http://explorers.larc.nasa.gov/smexacq.html, will provide updates and any AO addendum during the SMEX AO solicitation process. It will provide links to the EPL, information about the preproposal conference, a list of potential proposers (see Section 7.1.6), and responses to frequently asked questions.

7.1.4 Preproposal Conference

A preproposal conference will be held in the Washington, DC, metropolitan area according to the schedule in Section 1.3 of this AO. Further information, including date, location, and logistics, will be available on the SMEX Acquisition Additional Information web page at the address given in Section 7.1.3, prior to the preproposal conference. Attendance to the conference is optional and not required by NASA.

Participants are to attend at their own expense and to make their own travel arrangements. The purpose of this conference will be to address questions about the proposal process for this AO, including a discussion of the evaluation criteria, procurement approach, and GFE. The preproposal conference will also address questions that are received by NASA at least one week prior to the preproposal conference. Questions should be addressed to the Explorer Program Scientist at the address given in Section 7.1.2. Additional questions submitted after this date, including those provided in writing at the conference, may be addressed at the conference only as time permits. Anonymity of the authors of all questions will be honored. Material presented at the preproposal conference, including answers to questions submitted in advance, will be posted on the SMEX Acquisition Additional Information web page at the address given in Section 7.1.3.

7.1.5 Notice of Intent to Propose

To assist the planning of the proposal evaluation process, NASA encourages the submission of a Notice of Intent (NOI) to propose by all prospective proposers in accordance with the schedule in Section 1.3. Material in an NOI is confidential, nonbinding on the proposer, and will be used for NASA planning purposes only. Those submitting an NOI will receive any Explorer Program updates as may occur, up to the time of the proposal due date (all updates will also be posted at the address given in Section 7.1.3). NASA shall not be responsible for failure of automatic delivery of Explorer Program updates to NOI registrants. Offerors submitting NOIs should continue to monitor the Explorers Program website cited in Section 7.1.3 for all updates.

An NOI is submitted electronically by entering the requested information at http://nspires.nasaprs.com/. Please see instructions posted at http://explorers.larc.nasa.gov/smexacq.html for guidance on submission of an NOI. Proposers who experience difficulty in using this site should contact the Help Desk by E-mail at nspires-help@nasaprs.com for assistance. The following information (to the extent that it is known by the NOI due date) is requested for the NOI:

(a) Name, address, telephone number, fax number, E-mail address, and institutional affiliation of the PI.
(b) Full names and institutional affiliations of each known Co-I and collaborator. Whether an investigator is a Co-I or a collaborator should be clearly identified. If any Co-Is 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 description box for the Foreign Participation question in the "Business Data" section of the NOI.
(c) Type of proposal (SMEX investigation or MO investigation).
(d) The "Summary" section of the NOI should be used to provide a brief statement (150 words or less) for the following items:
    (i) the scientific objectives of the proposed mission; and
    (ii) identification of new technologies that may be employed as part of the mission.
(e) The name of the Lead Representative from each organization (industrial, academic, nonprofit, and/or Federal) included in the proposing team as may be known by the end of the NOI. Lead Representatives can be identified by selecting that role for an individual within the "Team Member" section of the NOI. Any Lead Representatives (e.g., industrial leads) not yet registered in NSPIRES can be listed in the appropriate "Program Specific Data" question.

7.1.6 Explorer Teaming Interest

As a result of recent AOs for complete mission investigations such as this one, commercial aerospace and technology organizations have requested a forum in order to facilitate informing potential proposers of their services and/or products. NASA SMD is willing to offer this service with the understanding that the Agency takes no responsibility for the use of such information. The organizations listed on the Explorer Teaming Interest web page (see address given in Section 7.1.3) have expressed an interest in teaming with other organizations on Explorer proposals. This is not necessarily a list of organizations that are capable of teaming but is simply a list of those organizations that have asked to be included in this list. Proposing organizations are not required to team with any organization on this list. NASA does not endorse any of these organizations and does not accept responsibility for their capabilities or actions.

7.1.7 Pre-screening of PI Requirements

NASA offers the opportunity to prospective proposers of pre-screening Principal Investigator (PI) experience requirements against the requirements in Section 4.5.1.

Investigators desiring pre-screening should submit a completed copy of Table B7. NASA is offering this opportunity as a service to prospective investigators. A request for pre-screening is thus voluntary and is not required by NASA. In response to a request for pre-screening, NASA will inform the investigator that the submitted Table B7 is, or is not, sufficient to demonstrate that the PI minimum experience requirements as described in Section 4.5.1 have been met. For submissions that do not adequately demonstrate that the PI minimum experience requirements have been met, NASA will indicate which component of the PI minimum experience requirements has not been demonstrated by the submission. NASA’s response will be through an email to the submitter.

NASA will conduct pre-screenings prior to the proposal due date, according to the schedule in Section 1.3. Instructions for requesting a pre-screening are available on the SMEX Additional Information web page at the address given in Section 7.1.3.

7.2 Format and Content of Proposals

7.2.1 Structure of the Proposal

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

7.2.2 Requirement for Electronic Cover Page & Authorized Electronic Cover Page Submission

This AO requires that the proposer register key data concerning his/her intended submission with NASA's master proposal database system located at http://nspires.nasaprs.com/. The system is the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES). Potential proposers are urged to access this site well in advance of the proposal due date to familiarize themselves with its structure and enter the requested identifier information. It is especially important to note that every individual named on the proposal's Cover Page must be registered in this NASA proposal data system and that such individuals must perform this registration themselves; that is, no one may register a second party, even the PI of a proposal in which that person is committed to participate. This data site is secure and all information entered is strictly for NASA's use. It is also important to note that the proposal's Cover Page must be submitted electronically by one of the officials at the PI's organization who is authorized to make such a submission. Every organization that intends to submit a proposal to NASA in response to this AO must be registered in this NASA proposal data system. Such registration must be performed by an organization's Electronic Business Point-Of-Contact (EBPOC) in the Central Contractor Registry (CCR).

7.2.3 Certifications and Commitments

All proposals must have a Cover Page that includes a Proposal Summary that is to be submitted electronically through the NSPIRES proposal database system following the instructions given in Appendix B. Once this form is submitted, it must be printed and signed by 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.

The proposal must also include a letter of commitment 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-Is), that provides evidence that the

institution and/or appropriate Government officials are aware of the proposed investigation, support the proposed investigation, and that sufficient funds will be made available to undertake the activity if selected by NASA (Section 4.5.4).

Signatures of commitment are required for all science team members identified in the science section (including the PI and Co-Is) and for all key project personnel named elsewhere in the proposal, including key individuals associated with the E/PO activities (Section 4.5.4). 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.1). 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 (Section 4.5.4 and Section 4.7.3) to the address given in Section 7.3.2 by the due date given in Section 1.3. Ideally, such letters should be included with the proposal, but if submitted to NASA separately, they must clearly identify the proposal by name of the PI and name of the investigation.

The authorizing institutional signature on the printout of the electronically submitted cover also certifies that the proposing institution has read and is in compliance with the three required certifications printed in full in Appendix D. Therefore, it is not necessary to separately submit these certifications with the proposal.

7.3 Submission Information

7.3.1 Quantity and Media

Proposers must provide 55 copies of their proposal, plus the signed original, by the proposal deadline given in Section 1.3. It is required that the original and each paper copy of the proposal be accompanied by a compact disk (CD) containing an electronic version of the entire proposal in a single, unlocked, searchable file in the Portable Document Format (PDF) that has bookmarks. This file and the hard copies must be identical. In addition, proposers must also submit the Fact Sheet (see Section B in Appendix B) as a separate PDF file on the CD.

Proposers must also submit the data in Tables B3 or B4, as appropriate, Table B5, any other cost table, and the completed Table B7 as separate Microsoft Excel files. Each CD that will accompany the original or a copy of the proposal must include the required files. These CDs and the files in them must be compatible with both PCs and Macs.

7.3.2 Submittal Address

All proposals must be received at the following address by the schedule in Section 1.3:

SMEX AO 2007 Program
Science Mission Directorate
NASA Research and Education Support Services
500 E Street, SW, Suite 200
Washington DC 20024 -2760
U.S.A.
Tel: (202) 479-9030

7.3.3 Deadline

All proposals must be received at the address in Section 7.3.2 by the closing date specified in Section 1.3. All proposals received after the closing date will be treated in accordance with NASA's provisions for late proposals (Appendix A, Section VII).

7.3.4 Notification of Receipt

NASA will notify the proposers in writing or E-mail that their proposals have been received. Proposers not receiving this confirmation within ten days after submittal of their proposals should contact the Explorer Program Scientist at the address given in Section 7.1.2.

8.0 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

8.1 Evaluation and Selection Processes

All proposals submitted in response to this AO will be subjected to a screening to determine their compliance to the constraints, requirements, and guidelines of the AO. Before submittal, proposers should verify the compliance of their proposals using the checklist in Appendix E. Failure to comply with the requirements, constraints, and guidelines of this AO may result in the proposal being returned to the proposer without further review.

Proposals in compliance with this AO will be assessed against the criteria given in Section 8.2 by panels of individuals who are peers of the proposers in the relevant scientific and technical areas. Reviewers will be instructed to evaluate all proposals independently and not to compare larger investigations with smaller ones. These panels may be augmented through the solicitation of mail-in reviews as well, which the panels have the right to accept, in whole or in part, or reject.

Proposers should be aware that during the evaluation and selection process, NASA may request clarification of a specific point or points in a proposal. Such a request and the proposer's response shall be in writing.

An *Ad Hoc* Categorization Subcommittee of the AO Steering Committee (see below), composed wholly of Civil Servants, will convene to consider the peer review results. This Committee will

categorize the proposals in accordance with procedures required by NFS Part 1872.403-1. These 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 which are recommended for acceptance, but at a lower priority than Category I.

Category III. Scientifically or technically sound investigations which require further development of an instrument or a spacecraft subsystem. Category III investigations may be funded for development and may be reconsidered at a later time for the same or other opportunities.

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

The results of the evaluations and categorizations will be reviewed by the AO Steering Committee, which is composed wholly of NASA Civil Servants and appointed by the Associate Administrator for SMD. The AO Steering Committee 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 for SMD, who will make the final selection(s). As the Selection Official, the Associate Administrator for SMD may consult the SMD Science Management Council concerning the selections.

Category III investigations are candidates for Explorer funding. NASA may select one or more investigations for further technology development under the Explorer Program. Any Category III investigation selected for Explorer funding will be invited to submit a revised statement of work and a revised budget for a technology development program that addresses developmental shortcomings identified by the SMEX proposal review panel. The revised statement of work will be reviewed by NASA. The selection of any Category III investigations may impact the launch dates for the selected SMEX missions.

8.2 Evaluation Criteria

8.2.1 Overview

The evaluation criteria below will be used to evaluate and categorize proposals as described in Section 8.1. For a partner MO, the proposed investigation encompasses only the proposed

contribution to the mission, not the entire mission. The evaluation criteria (which are defined more fully in the sections below) are as follows:

- Scientific merit of the proposed investigation;
- Scientific implementation merit of the proposed investigation; and
- Technical, management, and cost feasibility, including cost risk, of the proposed investigation.

The proposal categorizations, discussed in Section 8.1 above, will be based on these criteria. For categorization, each of the first two criteria are weighted approximately 25%, and the third is weighted approximately 50%.

Comments on the strengths and weaknesses of the planned "core" E/PO element, and overall merit of the SC will be evaluated, but will not be included in the overall merit of the proposal and will not be a factor in the categorization of the proposal.

8.2.2 Scientific Merit of the Proposed Investigation

Each proposed investigation will be evaluated for its scientific merit as expressed in terms of specific major and minor strengths and weaknesses. To evaluate the intrinsic scientific merit, the goals and objectives of the proposed investigation will be assessed to determine the impact of the investigation on one or more of the SMD space science research programs as identified in Section 1.1 of this AO and, additionally, on the U.S. space science program (see Section 3). This evaluation will include how well the investigation fills gaps in the understanding of space science and thereby provides for progress in one of the NASA space science research programs identified in Section 1.1, how well the proposed investigation may synergistically support other ongoing space science missions related to these research programs sponsored by NASA or a non-U.S. space agency, and/or whether or not it provides ancillary benefits to the U.S. space science program. A major element in this assessment will be whether the data that are proposed to be gathered will be sufficient to complete the proposed investigation. Scientific merit will be evaluated for the baseline proposed investigation; science enhancements beyond the baseline science mission will not contribute to the assessment of the scientific merit of the proposed investigation. For SMEX investigations, the scientific value of the Minimum Science Mission 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.

8.2.3 Scientific Implementation Merit and the Feasibility of the Proposed Investigation

Each proposed investigation will be evaluated for its scientific implementation merit, including feasibility, resiliency, and the probability of success as expressed in terms of specific major and minor strengths and weaknesses. Scientific implementation merit and feasibility will be evaluated by assessing the degree to which the investigation will address the proposed scientific goals and objectives, the degree to which the proposed instrument(s) can be built using the proposed technologies, the degree to which the proposed instrument(s) can provide the necessary data, and the degree to which the mission will support the accomplishment of acquisition of the

required data. Areas requiring critical technology development of the instrument for flight readiness will be identified and the plan for completing technology development will be assessed. Considerations in the evaluation of the calibration/validation, data analysis, 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, an assessment for adequacy of resources for physical interpretation of data and reporting scientific results in refereed journals, and the proposed plan for the timely release of the data to the public domain. Any SEOs (such as an extended mission, a guest investigator program, or an archival data analysis program) will be evaluated as part of this criterion; SEOs will be evaluated for the selection of appropriate activities to enlarge the science impact of the mission, the potential of the selected activities to enlarge the science impact of the mission, and the appropriate costing of the selected activities. Impact of the SEO evaluation on the overall score of the *Scientific Implementation Merit and Feasibility* criterion will be provided to NASA by the peer review panel. Should a new technology that represents an untested advance in the state of the art be proposed for use, an assessment will be made of the likelihood of its success. For SMEX investigations, resiliency will be evaluated by assessing the approach to descoping the Baseline Mission to the Minimum Mission in the event that development problems force reductions in scope. The probability of success will be evaluated by assessing science team roles, experience, expertise, and the organizational structure of the science team and the technical risk associated with the overall mission design and/or instrument set. The role of <u>each</u> Co-I will be evaluated for necessary contributions to the proposed investigation; the inclusion of Co-Is who do not have a well-defined and necessary role will be considered a weakness of the proposal. This evaluation will result in narrative text, as well as an appropriate adjectival rating.

8.2.4 Technical, Management, and Cost Feasibility, including Cost Risk, of the Proposed Investigation

Each proposed investigation will be evaluated for its technical, management, and cost feasibility, including cost risk, as expressed in terms of specific major and minor strengths and weaknesses. The technical and management approaches will be evaluated to assess the likelihood that the investigation can be implemented as proposed. This includes an assessment of risk of completing the investigation within the proposed cost. The evaluation will consider implementation factors such as the overall mission design (i.e., “mission architecture”); spacecraft design and design margins; communication and navigation/tracking; 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. For SMEX space flight investigations, this will also include an assessment of the likelihood of launching by the proposed launch date. Since it is recognized that teaming arrangements for implementing the mission may not be complete before the proposal closing date, proposers will not be penalized if the proposal indicates only candidate (but credible) implementation approaches for the spacecraft, launch vehicle, communications, and ground systems that should reasonably allow successful implementation of the mission. Mission resiliency (the flexibility to recover from

problems) will also be evaluated. For SMEX missions, this will include an assessment of the approach to descoping the Baseline Mission to the Minimum Mission in the event that development problems force reductions in scope. Investigations proposing new technology, i.e., technologies having a Technology Readiness Level (TRL) less than 6 (see *TRL Definitions* in the EPL), will be penalized for risk if adequate backup plans to ensure success of the mission are not described**.**

The methods and rationale used to develop the estimated cost, and the discussion of cost risks, will be assessed. Mission proposals will be evaluated for the adequacy of the cost reserves; proposals with inadequate cost reserves, and those that do not demonstrate a thorough understanding of the cost risks, will be penalized. The single biggest item that reduces cost risk is a complete and detailed basis of estimate, including complete cost model input data, vendor quotes, comparisons to similar analogous missions, etc.

The risk management approach the project team intends to use will be assessed, as will any risk mitigation plans for new technologies, any long-lead items, and the adequacy and availability of any required manufacturing, test, or other facilities.

The role, qualifications, and experience of the PI will be assessed, as will the commitment, spaceflight experience, and past performance of the PI and his/her implementing institution, against the needs of the investigation.

The role, qualifications, and experience of the PM will be assessed, as will the commitment and past performance of the PM and his/her implementing institution, against the needs of the investigation.

The plans for managing the risk of contributed critical goods and services will be assessed including the commitment of every partner as documented in letters of commitment and the adequacy of contingency plans for coping with the failure of a proposed cooperative arrangement.

Since partner MO investigations fly on non-SMD missions, factors involving spacecraft and launch vehicle capabilities will be considered in the evaluation only as appropriate. This evaluation will result in narrative text, as well as an appropriate adjectival rating.

8.2.5 Overall Merit of E/PO and Student Collaboration

The plan for “core” E/PO will be assessed for compliance with the requirements indicated in Appendix B, section H. These are a required PI statement of understanding and commitment to the E/PO program and the E/PO program overview. Comments on the strengths and weaknesses of the planned program will be provided to assist selected proposers in development of detailed Phase A E/PO plans.

Student Collaboration (SC) elements are encouraged. SC elements will be evaluated for overall merit. Overall merit of an SC is a combination of 1) the science/engineering merit of the proposed SC investigation; 2) implementation merit of the SC based on technical, management, and cost feasibility of the SC, including cost risk, as expressed in terms of specific major and

minor strengths and weaknesses; and 3) and educational merit of the SC. These three factors are of equal value. The SC must be non-impact to the rest of the mission, not add risk to the success of the primary mission, and be shown as clearly separable from the primary mission as discussed in Section 4.8.2. In order to achieve the SC objectives, inherently higher cost risk, schedule risk, or technical risk of the SC will be tolerated if and only if the SC is shown to be clearly separable from the primary mission.

To address science/engineering alignment the proposer must discuss the goals and objectives of the proposed SC, including the value of the SC to one or more of NASA's science/engineering/education goals and objectives, including workforce development, and the observations and/or data required to meet the objectives.

To address SC implementation merit the proposer must describe the SC unique instrumentation and/or data analysis. Each necessary individual of the SC team and their roles and responsibilities must be identified. The capabilities and experience of all members of the proposed SC team must be described. In addition, if an instrument is proposed, the description must identify the SC 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 SC payload observing profile and the SC data reduction and analysis plan must also be discussed, including the method and format of the data reduction, data validation, and preliminary analysis.

To address the SC educational merit the proposer must identify the educational objectives of the SC, their relationship to NASA's education outcomes defined in the *NASA Education Strategic Coordination Framework*, and how achievement of the objectives will be evaluated. The SC educational merit will be evaluated in four education merit areas: 1) quality, scope, realism and appropriateness, 2) continuity, 3) evaluation, and 4) diversity. These areas are discussed in detail in the *Explanatory Guide to the NASA Science Mission Directorate Educational Merit Evaluation Factors for Student Collaborations* in the EPL.

8.3 Selection Factors

As described in Section 8.1, the results of the proposal evaluations based on the criteria above and categorizations will be considered in the selection process. In addition, the proposed cost to NASA SMD will also be considered in the final selections.

The Selection Official may take into account a variety of programmatic factors in deciding whether or not to fund any proposals for Phase A study, including, but not limited to, available funding and maintaining a programmatic and scientific balance across the Explorer Program, heliophysics, astrophysics, and SMD. Although SMD develops and evaluates its program strategy in close consultation with the scientific community, the SMD 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. In any event, this exercise of discretion by the Selection Official will be consistent with the categorization of the proposals.

The overriding consideration for the final selection of proposals submitted in response to this AO will be to maximize scientific return and minimize implementation risk 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 an investigation at the cost ceiling for SMEX investigations, one or more investigations significantly below the cost ceiling that would allow a more rapid release of the next Explorer AO, or a combination of investigations of various costs including any MO investigations.

8.4 Implementation Activities

8.4.1 Notification of Selection

Following Stage 1 selection, the PIs of the selected investigations will be notified immediately by telephone, followed by formal written notification. The formal notification may include special instructions for the concept study. A Project Initiation Conference will be held as soon as possible after selection to clarify requirements and responsibilities of all parties having roles in each selected SMEX or MO mission; this meeting will include launch service personnel. Proposers of investigations that were not selected will be notified in writing and offered a debriefing as described in Section 8.5.

8.4.2 Award Administration and Funding

It is anticipated that contracts or other funding mechanisms will be awarded for Phase A concept studies for 6-8 SMEX investigations selected under this AO. One or more MOs may also be selected for Phase A concept studies or for flight. Each contract resulting from this selection will contain a priced option for a bridge phase, to be exercised upon investigations downselected to proceed into Phases B/C/D. The bridge phase is intended to cover a four-month period of Phase B effort to provide program continuity while the Phase B/C/D/E/F negotiations are completed. Upon completion of these negotiations, the Phase A contract will be modified to include Phases B/C/D/E/F for the downselected investigations.

It is anticipated that NASA will provide up to $750K to each SMEX investigation and between $150K and $300K for each MO investigation, depending on the scope and cost of the MO, to perform a Phase A concept study to be initiated as soon as possible after notification. If the Phase A contract plus the priced Bridge Phase option exceeds $650K, the contractor will have to certify the proposed costs for the Phase A contract, in accordance with FAR 15.406-2.

8.4.3 Phase A Concept Study

The concept studies are intended to provide NASA with more definitive information regarding the cost, risk, and feasibility of the investigations, as well as a detailed plan for the conduct of an appropriate education and outreach program before final selection for implementation. The product of the concept studies will be reports to be delivered by each selected investigation team four months after the Project Initiation Conference. The content and format of the study reports are specified in the *Guidelines and Criteria for the Phase A Concept Study* document in the EPL (Appendix C). The PI will provide in the Concept Study Report a proposed set of Level 1 requirements, including the criteria for full mission success satisfying the Baseline Investigation, and the criteria for minimum mission success satisfying the Minimum Investigation. The NASA review of the completed Concept Study Report will include all mission facets including E/PO.

Risk reduction that has been accomplished during Phase A will be closely reviewed. NASA may request presentations and/or site visits to review the final concept study results with the investigators.

8.4.4 Downselection of Investigations

The downselection will be made by the Associate Administrator for SMD based upon NASA review of the Phase A concept study results and programmatic considerations. The criteria for evaluating the concept study are as follows:

- Scientific merit of the proposed investigation
- Scientific implementation merit of the proposed investigation
- Technical, management, and cost feasibility, including cost risk, of the proposed investigation
- Quality of plans for E/PO, including SC (if proposed)

The criteria for downselection are described in the *Guidelines and Criteria for the Phase A Concept Study* document in the EPL. Any changes to science and the science implementation scheme contained in the Phase A Concept Study Report will be carefully evaluated. Assuming no changes to the first two criteria, the emphasis for downselection will be on the latter three.

The Phase A Concept Study Report will include detailed information on the relevant experience and past performance of the major partner organizations over the last 5 years. NASA will also use information from other sources, such as the NASA Past Performance Database, to evaluate the likelihood that technical, schedule, and cost requirements will be met.

As a result of evaluation of the concept studies, NASA expects to downselect up to three SMEX investigations to proceed by exercising their bridge phase options. Any selected MO may also be authorized to proceed. Investigations may also be downselected for a funded Extended Phase A so they can retire one or more risks before being allowed to proceed to Phase B. There is no guarantee that the investigation will be approved to enter phase B, even if all risks have been retired during the extended Phase A. In no case, however, is NASA required to exercise any option. NASA will not exercise the contract option nor continue funding those investigations not selected to proceed.

Proposers should note that the definition phase for any investigation chosen as a second or third SMEX mission (launch by 2013 or September 30, 2015) will proceed in Phase B or an extended Phase A at a lower funding level for a period of time, to conform to the available Explorer Program budget profile.

A fourth mission may be designated as an unfunded backup until all selected missions pass or fail their Confirmation Reviews to enter Phase C, in case one of them is unable to meet its technical, cost, or schedule commitments, and with no guarantee of being approved for continuing into subsequent mission phases.

Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of External Relations, Science Division, will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail a letter of notification by NASA with a subsequent exchange of letters between NASA and the sponsoring governmental agency or a formal Agency-to-Agency MOU.

The contract or other funding mechanism for further formulation and implementation will conform to all applicable Federal and NASA procurement requirements. A draft model contract for Phase B/C/D/E formulation and implementation is available in the EPL (see Appendix C).

8.4.5 Confirmation of Investigations

At the end of Phase B, NASA will conduct an independent review of the investigation's readiness to proceed before being authorized to spend more than 25 percent of the total NASA commitment for Phases A/B/C/D, excluding launch services costs. Results of this Confirmation Review and a decision to proceed (or not) will be rendered within 30 days of the review. This decision will be based upon review of all aspects of the Phase B results (including education and outreach), and evidence of satisfactory technical, cost, and schedule performance including demonstration of the required minimum unencumbered cost reserve. In addition, for any MO, a commitment from the organization sponsoring the full mission to enter into an appropriate agreement with NASA is required. Once a mission is confirmed, no rephasing of Phase E costs to Phase C/D will be permitted.

8.5 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). Written debriefing materials will be provided at the time of the oral debriefing. Such debriefings may be in person at NASA Headquarters or by telephone if the investigation team prefers. In the former case, please note that all expenses and arrangements for attending a debriefing are the responsibility of the attendee. Travel and associated costs of attendance are not allowable as a direct cost under another Federal Government award, i.e., contract, grant, or cooperative agreement. Government employees may attend and be authorized travel and associated costs as a matter of official business.

8.6 Agency Procurement Ombudsman

The Agency Procurement Ombudsman, designated in NPD 5101.32, will take action to resolve concerns, disagreements, and recommendations submitted by interested parties that cannot be resolved at the Center level, or those having Agency wide implications, refer Center-specific issues to the appropriate Center Procurement Ombudsman for action, and periodically communicate with Center Procurement Ombudsmen on common Agency wide issues and refer those issues to the appropriate office for action.

8.7 Protests

Only prospective offerors seeking contract awards under this AO have the right to file a protest, either at the Government Accountability Office (GAO) or with the Agency, as defined in FAR 33.101. The provisions at FAR 52.233-2 ("Service of Protest") and NFS 1852.233-70 ("Protests to NASA") are incorporated into this AO. Under both of these provisions, the designated official for receipt of protests to the Agency and copies of protests filed with the GAO is:

Assistant Administrator for Procurement
Office of Procurement
NASA Headquarters
Washington, DC 20546
USA

9.0 CONCLUSION

The Explorer Program continues to represent an extraordinarily productive program that enables NASA to accomplish important space science exploration, as well as to generate opportunities to enhance education and to engage the public in the excitement of science discoveries. NASA invites both the U.S. and international space science communities to participate in proposals for SMEX and MO investigations to be carried out as a result of this Announcement.

Richard R. Fisher
Director
Heliophysics Division

Jon A. Morse
Director
Astrophysics Division

S. Alan Stern
Associate Administrator
for Science Mission Directorate

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 Selection 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.

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 4.7 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

Submission of cost or pricing data, as defined in FAR 15.401, is required if the combined Phase A and Bridge Phase costs exceed $650,000. Cost or pricing data will also be required for proposals for subsequent mission phases. 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 Selection 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 NASA is subject to statutory goals to allocate a fair portion of its contract dollars to SDB concerns, HBCUs, and OMIs, as these entities are defined in 52.219-8 and 52.226-2 of the FAR. Offerors are encouraged to assist NASA in achieving these goals by using best efforts to involve these entities as subcontractors to the fullest extent consistent with efficient performance of their investigations.

B. Offerors are advised that, by law, NASA prime contracts resulting from this solicitation which offer subcontracting possibilities, exceed $500,000, and are with organizations other than small business concerns, the clause at FAR 52.219-9 shall apply. Accordingly, offerors awarded contracts for Phase A concept studies that exceed $500,000 are required to submit small business subcontracting plans consistent with the FAR, covering the study phase only, unless they adequately demonstrate that subcontracting opportunities

are not reasonably available in the performance of these concept studies. Failure to do so will make the offeror ineligible for award. These plans should be submitted for negotiation after selection in conjunction with contract execution.

C. As part of the downselection of investigations, offerors, other than small business concerns, are required to submit small business subcontracting plans, covering implementation and operation phases B/C/D/E/F, at the time the Phase A Concept Study Reports are delivered. Failure to submit a subcontracting plan will make the offeror ineligible for award. As part of the downselect decision, these subcontracting plans will be evaluated on the participation goals and quality and level of work performed by small business concerns overall, as well as that performed by the various categories of small business concerns listed in FAR 52.219-9, except for SDBs. Offerors shall separately identify and will be evaluated on participation targets of SDBs in North American Industry Classification System (NAICS) codes determined by the Department of commerce to be underrepresented industry sectors.

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 that dictate termination of evaluation.

APPENDIX B

GUIDELINES FOR PROPOSAL PREPARATION

INTRODUCTION

The following guidelines apply to the preparation of proposals in response to this SMEX and MO 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 proposal material by facsimile (fax), electronic media, videotape, or floppy disk is not acceptable except as specifically requested. No proposal may reference a World Wide Web site for any data or material needed for adequate review of the proposal.

The proposal must consist of only one volume, with readily identified sections corresponding to Sections A through H given below. In order to allow for recycling of proposals after the review process, all proposals and copies must be submitted on plain white paper only (e.g., no cardboard stock or plastic covers, no colored paper, etc.). Proposers are requested not to use three-ring binders. Photographs and color figures are permitted if printed on recyclable white paper only. The original signed copy must be bound in a manner that makes it easy to disassemble for reproduction. Except for the original, two-sided copies are preferred. Every side upon which printing appears will be counted against the page limits.

Proposals must contain no more pages than given in the table below, with exclusions to the page count as noted below, including no more than four fold out pages (28 x 43 cm; i.e., 11 x 17 inches). A fold out page counts as one page. All pages other than fold out pages shall be 8.5 x 11 inches or A4 European standard.

Single- or double-column format is acceptable. In complying with the page limit, no page may contain more than 55 lines of text and the type font must not be smaller than 12-point (i.e., less than or equal to 15 characters per inch). Figure captions must not be smaller than 12 point. Within figures and tables the font must not be smaller than 10 point.

The following table provides restrictions and guidance on page count within the proposal:

Section	Page Limits
Graphic cover page (optional)	Single page, does not count against page limit
A. Cover Page and Proposal Summary	Printout of electronic submission
B. Fact Sheet	2
C. Table of Contents	No page limit
D. Science Investigation including optional SEO	25
E. Mission Implementation, F. Management, Schedule, and G. Cost and Cost Estimating Methodology	25
Cost tables B3 or B4, B5, and B8; Optional: Master Equipment List (MEL); WBS; WBS Dictionary; WBS Cost Table; and Basis of Estimate Details	No page limit
H. Plan for Education and Public Outreach and Small Disadvantaged Businesses (SC optional)	2 + 5 for SC
I. Appendices: (no others permitted) 1. Letter(s) of Commitment 2. Statement(s) of Work (SOW) 3. Resumes 4. Summary of Proposed Program Cooperative Contributions 5. Draft International Participation Plan - Discussion on Compliance with U.S. Export Laws and Regulations 6. Draft Outline of Technical Responsibilities for International Participation 7. Orbital Debris Generation Acknowledgement 8. Demonstration of Minimum Space Flight Experience for the PI 9. Compliance with Procurement Regulations by NASA PI Proposals 10. Compliance Checklist 11. Heritage 12. Acronyms List 13. Reference List (optional)	No page limit, but small size encouraged

A. COVER PAGE AND PROPOSAL SUMMARY

A Cover Page and Proposal Summary must be a part of the proposal, but will not be counted against the page limit. It must be signed by an official by title of the investigator's organization who is authorized to commit the organization. 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 D of this AO; therefore, certifications do not need to be submitted separately.

The form for the Cover Page and Proposal Summary is found at http://nspires.nasaprs.com/; it must be completed and submitted online. The full names of the PI 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, the PI Mission Cost, and a 200-word Summary. Categories of participants (e.g., collaborator, lead representative) must match the choices available in the electronic submittal system. Note that every person whose name is entered on this from must be registered in its database. Each person must do this for himself/herself--the PI cannot do this for his or her Co-Is. Therefore, proposers and their team members are strongly advised to visit this Web site well in advance to ensure that they are properly registered.

The cover page has four blocks for two types of cost so each can be given in FY 2008 dollars and real year dollars: PI Mission Cost, that is the cost paid by SMD which is limited to $105M (FY 2008); and Total Mission Cost, which is the PI Mission Cost plus any contributions. The short title requested in this form is the mission's acronym. The non-U.S. participation block requests a statement of contributions to development or operations (but not science) including the non-U.S. partner, the non-U.S. funding agency, and the approximate value of the non-U.S. contributions.

A hard copy version of this Cover must be printed in time to acquire signatures and include with the original hard copy of the proposal for delivery according to the schedule provided in Section 1.3 in this AO. Proposers are advised that they must not reformat this Cover after it is printed, as important NASA-required documentation may be lost. Proposers who experience difficulty in using this site may contact the Help Desk at nspires-help@nasaprs.com or (202) 479-9376 Monday through Friday, 8:00 A.M. – 6:00 P.M. Eastern time. Frequently Asked Questions (FAQs) may be accessed through the Proposal Online Help site at http://nspires.nasaprs.com/external/help.do. Please note that submission of the electronic Cover does not satisfy the deadline for proposal submission.

It is NASA's intent to enter the Summaries of all selected investigations for its various programs into a publicly accessible database. Therefore, the Summary should not contain any proprietary or confidential information that the submitter wishes to protect from public disclosure.

It is permitted but optional to submit a graphic cover page (color or otherwise). It may be placed in front of the hard copy of the electronically submitted cover page and proposal summary. It will not count against the page limit so long as it does not contain any technical information not found within the body of the proposal.

B. 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 must include the following: science objectives (including the importance of the science to the NASA science research

programs), mission overview (including mission objectives and major mission characteristics), science payload, key spacecraft characteristics, anticipated launch vehicle, mission management (including teaming arrangement as known, PI and PM names), schedule, and cost estimate. 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 double-sided single sheet).

C. TABLE OF CONTENTS

The proposal shall contain a table of contents that parallels the outlines provided below in Sections D through I.

D. SCIENCE INVESTIGATION

1. Overview. The science section must describe the scientific objectives of the proposed investigation, including the value of the investigation to one or more of NASA's science goals and objectives.

2. Scientific Goals and Objectives. This section must discuss the goals and objectives of the investigation, their value to NASA's science objectives, and their relationships to past, current, and future investigations and missions. It should describe the history and basis for the proposal. This section must discuss the need for such an investigation. This section must directly address the evaluation criteria for scientific merit described in the AO.

3. Science Requirements. This section must describe the observations and/or data required to meet the scientific objectives. The scientific requirements for the mission must be explicitly described and these must be linked to the scientific objectives of the mission. The requirements that these objectives and observations impose on the mission design elements must be discussed. The required "science objectives-to-measurements-to-mission traceability" may be provided either in narrative or tabular form.

   The measurements required in the course of the mission, the data that must be returned, and the approach that must be taken in analyzing the data to achieve the scientific objectives of the investigation must be discussed. This description must identify the investigation that must be performed, the quality of the data that must be returned (e.g., resolution, coverage, pointing accuracy, measurement precision, etc.), and the quantity of data that must be returned (bits, images, etc.). The relationship between the data products that must be generated and the scientific objectives must be explicitly described, as well as the expected results.

   Examples of a Science Traceability Matrix and a Mission Traceability Matrix are given in Tables B1 and B2 along with examples for elements in such matrixes.

4. Science Data and Other Scientific Products. A discussion of the scientific products (e.g. flight data, ancillary or calibration data, theoretical calculations, higher order analytical or

data products, sample returns, witness samples, laboratory data, etc.) and how the science products and data obtained will be used to fulfill the scientific requirements must be provided. A discussion of how the science data will be obtained, including a plan for delivery of the products, and the individuals responsible for the data delivery, must also be provided. It is assumed that the above information will constitute the Baseline Mission.

5. Minimum Science Mission. This section must identify a minimum acceptable data and scientific return for the mission (the Minimum Mission), below which the mission would not be worth pursuing. The value of the Minimum Mission must be discussed. A description of the descope options available, their phasing, their effect on meeting the scientific objectives of the mission, and their value during development (e.g., savings in cost, schedule, or risk), as the mission is descoped from the Baseline to the Minimum Mission must be discussed. In developing the Minimum Mission, the proposer must consider all aspects of the mission (e.g., launch vehicle, instrument, spacecraft, ground system) and not focus entirely on possible instrument descopes or mission length reductions. Proposals must include only one Baseline Mission and one Minimum Mission. In NPR 7120.5D, the Minimum Mission is defined as the "Threshold Science Requirements".

6. Science Implementation.

   a. Instrumentation. This section must describe the instrumentation and the rationale used for its selection. It must 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 proposed science investigation goals and objectives, must be discussed. The flow-down from science investigation goals to measurement objectives and instrument performance must be stated clearly and supported by quantitative analysis where possible.

      A preliminary description of each instrument design with a block diagram showing the instrument systems and their interfaces must be included, along with a description of the estimated performance of the instrument. Performance characteristics must be related to the measurement and investigation objectives as stated in the proposal. 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 Concept. The science payload observing profile must be discussed, including all mission-relevant parameters, such as orbit, pointing requirements, operational time lines (including observing periods, data transmission periods and techniques, and time-critical events), etc. The manner in which the proposed 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 plan must be discussed, including the method and format of the 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 and the individual team members responsible for the data products. The plan must include a schedule for the submission of raw and reduced data to the appropriate NASA data archive in the proper formats, media, etc. Delivery of the data to the data archive must take place in the shortest time possible.

d. Science Team. This section must identify each necessary individual of the investigation science team and their roles and responsibilities. The capabilities and experience of all members of the proposed science team must be described. Resumes or curriculum vitae of team members must be included as attachments to the proposal (see Section I.3, below). The role of each Co-I must be explicitly defined and justified, and the funding source (NASA or contributed) for the PI and each Co-I noted. If a Co-I's services are contributed at no cost to the investigation, a letter of commitment is required from that Co-Is institution (see Section I.1). Other nonfunded members of the proposal team may be included in the proposal as collaborators.

7. Plan for Science Enhancement Options. SMD policy encourages the addition of extended missions, guest investigator programs, general observer programs, participating scientist programs, interdisciplinary scientist programs, or archival data analysis programs. The proposal must define and describe any proposed SEO activities, where appropriate, to broaden the scientific impact of missions. These programs are usually initiated no earlier than Phase E. SMD will independently solicit and administer these programs using competitive peer review (Section 4.3.2).

E. 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, 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 (e.g., 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.

In areas of mission implementation where the required depth of information is not available, for whatever reason, at this stage of mission design, the proposal must (i) describe the current design concept, (ii) justify that the development of that aspect of the design is not required at this stage and that it is acceptable to develop details later, and (iii) explain why the lack of information at this stage should not translate into a risk to the proposer's ability to implement the mission as proposed. The schedule and process for developing the required depth of information must be explicitly included among the plans for future activity. In the case where

a mission is proposed at or near the cost cap, but depth of technical detail is deferred, the proposal must justify the adequacy of the proposed cost reserves given that the proposed cost is not allowed during Phase A to increase beyond the cost cap.

If the proposed spacecraft bus is in the Rapid Spacecraft Development Office catalog, explain how any changes to the technical specifications given in the catalog are going to be achieved and how those changes affect other subsystems.

As part of this section, the development approach which will assure mission success must be described. The following items must be included in the discussion:

- Heritage and maturity of mission elements (instruments, spacecraft, ground systems, and mission design, etc.);
- Approach to use or nonuse of redundancy and other reliability measures (requirements for burn-in of parts, total operating time required without failure prior to flight, etc.);
- Assembly, integration, and test flows and integration and test approach;
- Environmental test philosophy (test flow and sequence, test margins, and test durations);
- Product assurance activities;
- Systems engineering plan and philosophy, and trade studies to be conducted;
- Potential risks to the proposed investigation and plans for mitigating those risks;
- Technology development plans and back-up plans, if technologies do not meet development needs (new technology may be penalized for risk if adequate back-up plans are not described to ensure success of the investigation);
- Identification of instrument to spacecraft interfaces, including integration and test approach;
- Subsystem descriptions including telecommunications, thermal, power, propulsion, attitude determination and control, command and data handling, flight software (including fault protection and safing), and ground software; and
- At a high level, discussion of operations team training, availability of spacecraft experts for operations, operations center development, and planned ground station network.

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.

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 must be provided (in tables) to the extent known at the time the proposal is due and as applicable to the proposed mission configuration proposed for all SMEX investigations and as applicable to MOs.

1. General Information
   Launch date (including launch date flexibility), mission duration, orbit type (Earth orbit, heliocentric, etc.), and orbit information (semimajor axis, eccentricity, inclination, node

time of day, argument of perigee, altitude), ground station(s) usage (e.g., location(s), transmitting and receiving communication parameters).

2. Downlink Information
   Data volume (Mbytes/day), bit error rate, onboard storage (Mbytes), transmit frequency, power available for communications (Watts), downlink data rate, effective isotropic radiated power (dBW). transmitting antenna type and gain (dBi), modulation and coding [e.g., Binary Phase Shift Keying (BPSK), Consultative Committee for Space Data Systems (CCSDS), Reed-Solomon], number of data dumps per day, spacecraft data destination (e.g., mission operations center), science data destination (e.g., science operations center), and maximum time lag between data dump and data arrival at destination, if relevant to science needs.

3. Uplink Information
   Number of uplinks per day, number of bytes per uplink, bit error rate, receive frequency, uplink data rate, receiving antenna type and gain (dBi), modulation and coding (e.g., BPSK, CCSDS, Reed-Solomon), 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., spacecraft separation, orbit insertion, etc.), <u>and spacecraft telemetry is required for mission critical events</u> 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
   For a satellite (instrument package and spacecraft), provide estimates for mass, power, and reserves at the subsystem level (including propellant), and margins at the system level. For instrument package requirements on the spacecraft, provide pointing, stability, attitude, and maneuvering requirements necessary for science operations (include design margins, when known).

Definitions:

<u>Contingency</u> (or *<u>reserve</u>*) 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.
<u>Margin</u> 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 an 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 payload the full capability of the vehicle, if needed. The ELV capability is 200 kg. The mass reserve is 15/100 = 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 instrument is expected to use 50 Watts, including 25% contingency. It is allotted 75 Watts by the satellite provider. The reserve is 10 Watts and the margin is 25 Watts, or 25/50 = 50%.

6. Attitude and Control Requirements
   - Attitude control requirements for the spacecraft pointing control, pointing knowledge (at the instrument interface), pointing stability or jitter (each axis, 3-sigma);
   - Attitude control requirements for bias, drift, stability or jitter, rate for scanning (each axis);
   - Spacecraft attitude knowledge requirements at the instrument interface for bias, drift, jitter, rate for scanning (each axis);
   - Agility (maneuvers, scanning, etc.);
   - Deployments (solar panel, antennas, etc.);
   - Articulation (1, 2 -axis solar arrays, antennas, gimbals, etc.);
   - On-orbit calibration (alignment, line-of-sight, thermal deformation); and
   - Attitude knowledge processing (real-time versus postprocessing, spaceborne versus ground).

7. Instrument Characteristics
   For each science instrument proposed provide the following information:
   - Mass (include breakouts of electronics and optics 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 instrument-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 MOs, provide the

information below that is related to the proposed investigation's requirements on, and interfaces with, the sponsor's instrument/spacecraft):

- Spacecraft Parameters:
  - Figure of the complete spacecraft/instrument system, on the launch vehicle and in-flight, with major components labeled and approximate overall dimensions;
  - Block diagram of the spacecraft subsystems and their components; and
  - Attitude and control subsystem sensors and actuators information (number, type, redundancy, 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.
- 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;
  - Antenna Tx and Rx patterns (if available); and
  - For Rx and Tx modes simultaneously: Mode timeline, data rate(s), 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 and End of Life;
  - Worst case Sun incidence angle to solar panels during science mission;
  - Battery type and storage capacity;
  - Worst case battery Depth of Discharge; and
  - Spacecraft bus voltage.

9. Technology Development and New Technology

For the SMEX Mission proposals, a specific portion of the Mission Implementation section 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 TRL for each proposed new development and/or advanced development at the time the proposal is submitted (Note: see TRL definitions in the EPL);
- Description of the proposed plan for bringing each of the identified items to a minimum of TRL 6, defined as “system/subsystem model or prototype demonstration in a relevant environment, space, or ground” by Confirmation Review at the end of Phase B (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 (see also Section 8.2.4), a description of the cost, schedule, and performance liens they will impose on the baseline design and the decision milestones for their implementation.

10. Missions of Opportunity Information

For MO, provide the information above that is related to the proposed investigation's requirements on and interfaces with the sponsor's instrument/spacecraft, as appropriate.

Partner MO proposals must also include:

- An overview of the total mission;
- If and how the proposed investigation relates to the spacecraft sponsor's overall mission objectives; and
- An overview of how the operations plan for the proposed investigation fits within the mission of the sponsoring organization.

New science mission extension MO proposers must include an overview of current operations for the existing spacecraft or space asset as well as all appropriate information on the proposed changes to operations and the plan for transition of operations.

For Small Complete Missions, proposal requirements are the same as for SMEX missions.

F. MANAGEMENT AND SCHEDULE

This section must summarize the investigator's proposed management approach. The management organization (including an organization chart) and decision-making process must be described, and the teaming arrangement (as known) must be discussed. The responsibilities of the PI, the team members, including contributors, and institutional commitments must be discussed. Unique capabilities that each team member organization brings to the team, as well as previous experience (including cost and schedule performance) with similar systems and equipment, must be addressed. The specific roles and responsibilities of the PI and the PM must be described. Risk management and risk mitigation plans must be described. This discussion must include the top risks considered

significant by the PI and the PM, descoping strategies, if relevant, and management strategies for control, allocation and release of technical, cost and schedule reserves and margins. When contracts are required, the acquisition strategy including any incentive strategy must be described.

Partner MO proposals should specifically address how the investigation team will interrelate with the sponsor of the parent mission, organizationally and managerially. Partner MO 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's organizational interfaces and plans for reporting to NASA.

A project schedule to meet the proposed launch date and covering all phases of the investigation must be proposed. The schedule must include, as a minimum, proposed major project review dates, instrument development, spacecraft development (if applicable); instrument-to-spacecraft/host integration and test, launch vehicle integration and launch, and Mission Operations and Data Analysis (MO&DA). Schedule critical path and funded schedule reserve must be clearly identified. A MO schedule shall also include the major milestones of the mission sponsor/host and show how the investigation fits in the development plan for the sponsor's mission.

In areas of management and schedule where the required depth of information is not available at this stage, for whatever reason, the proposal must (i) describe the current management approach and schedule, (ii) justify that the development of that aspect of the project is not required at this stage and that it is acceptable to develop details later, and (iii) explain why the lack of information at this stage should not translate into a risk to the proposer's ability to implement the mission as proposed. The schedule and process for developing the required depth of information must be explicitly included among the plans for future activity. In the case where a mission is proposed at or near the cost cap, but depth of detail is deferred, the proposal must justify the adequacy of the proposed cost reserves given that the proposed cost is not allowed during Phase A (or at any later time) to increase beyond the cost cap.

G. 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, mission unique or special launch services, development of the ground data system, fee, and contributions. These costs shall be consistent with the program requirements described in Section 3 and Section 4 or 5, as applicable, of the AO.

In particular, where NASA-provided services are used, the proposed cost must include all costs that will be paid out of the resulting award including direct civil service labor, travel, and other direct charges (including procurements and contractor labor). Costs which will not be paid out of the resulting award, but are paid from a separate NASA budget (e.g., CM&O) should not be included in the proposal budget.

The amount required in each fiscal year must be identified by providing the data in Table B3 for SMEX investigations and Table B4 for MO, which will not be counted against the page limit. The top portion of Tables B3 and B4 requests cost data relative to the NASA SMD Cost. The lower portion addresses contributions. The rows in Tables B3 and B4 may be modified as appropriate for the proposal. The cost elements in Tables B3 and B4 are defined in Appendix F. Provide the data requested in Table B5, which will not be counted against the page limit, for the NASA SMD Cost by mission phase. The columns in Tables B3, B4, and B5 must be labeled with the appropriate fiscal years. Table B6 gives the NASA inflation index to be used to calculate real year dollars.

Proposers are further required to complete Table B8. Data must be provided in Table B8 for each participating organization including the PI organization and each partner/subcontractor/subawardee that will receive at least 5% of the total proposed cost. The data required in the table for each participating organization is: (i) number of Full Time Equivalents (FTEs) or Work Year Equivalents (WYEs) broken into (a) NASA civil servants, (b) other civil servants, (c) JPL employees, and (d) other contractors; and (ii) effective direct costs for each participating organization. Direct costs are the proposed costs not including any overhead or indirect costs; for NASA Centers this is costs not including CM&O and for corporations this is costs not including G&A and other overheads or indirect costs. All entries should be cumulative over the proposed baseline mission life, and costs should be in FY 2008 dollars.

Although not a requirement, the proposers are highly encouraged to provide the following items, which will not be counted against the page limit, to enable the validation of their costs.

- MEL
- WBS
- WBS Dictionary
- WBS Cost Table
- Basis of Estimate Details

A fully developed MEL or WBS is not expected at this stage. However, since a preliminary top-level version of them will probably be used to generate the budget in the proposal, their inclusion in the proposal would be of value to the reviewers in the same way it was to the proposers. The rows in the WBS Cost Table would be the WBS elements whereas the columns would be the real year costs for each fiscal year. As in Tables B3 and B4, the last two columns in the WBS Cost Table would be the Total in real year dollars and the Total in FY 2008 dollars. Basis of estimate details include complete cost model input data, vendor quotes, and comparisons to analogous missions.

H. PLAN FOR EDUCATION AND PUBLIC OUTREACH AND SMALL BUSINESSES PARTICIPATION

The proposer must provide a statement that she/he understands NASA SMD requirements for E/PO and is committed to carrying out an E/PO program that meets the goals described in Section 4.8. The proposer must also provide a brief overview of the planned E/PO activities and their relationship to the proposed mission. This overview must include a brief discussion of any unique characteristics of the mission which might provide unusual opportunities for E/PO. 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 downselection process.

The proposer must declare any intention to include any SC as defined in Section 4.8.2. The SC must fully describe its scientific/engineering merit, technical merit, and educational merit as defined in Section 8.2.5. The SC must be dependent upon the flight of the baseline mission, including provision of flight elements and/or access to science/engineering data generated by the baseline mission. SC elements involving only analysis of archival data are not allowed. The proposal must discuss how the SC can be incorporated into the baseline mission on a non-impact basis. A separate 5 page allocation is allowed to discuss the SC, including its approach and implementation.

The proposal must demonstrate an understanding of NASA requirements for the participation of small business concerns, including SDBs, and minority institutions and provide its approach to complying with these requirements. See Appendix A, Section XIII for detailed instructions.

I. APPENDICES

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

1. Letters of Commitment.

   Letters of commitment must be provided from all organizations (i) offering critical goods and/or services (including Co-I services) on a no-exchange-of-funds basis, (ii) non-U.S. organizations providing hardware or software to the investigation and their funding agencies, and (iii) the major or critical participants in the proposal. Critical participants are those participants who are assigned to tasks considered by the PI to be critical to the success of the mission, including those who provide unique required services. All other participants are non-critical. Requirements for letters of commitment may be found in Section 4.5.4 and Section 4.7.3.

2. Statement of Work (SOW) and Funding Information.

For investigations managed from non-Government institutions, provide a SOW. For investigations managed from Government institutions, provide a SOW as if the institution were non-Government. 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 EPL. The SOW must include general tasks statements for Phases B/C/D and for Phases E/F. All SOWs must include Scope of Work and Government Responsibilities (as applicable). SOWs need not be more than a page or two in length. If more than one contractual arrangement or other funding mechanism between NASA and the proposing team is required for Phase A or the Bridge Phase, information must be provided which identifies how funds are to be allocated among the organizations.

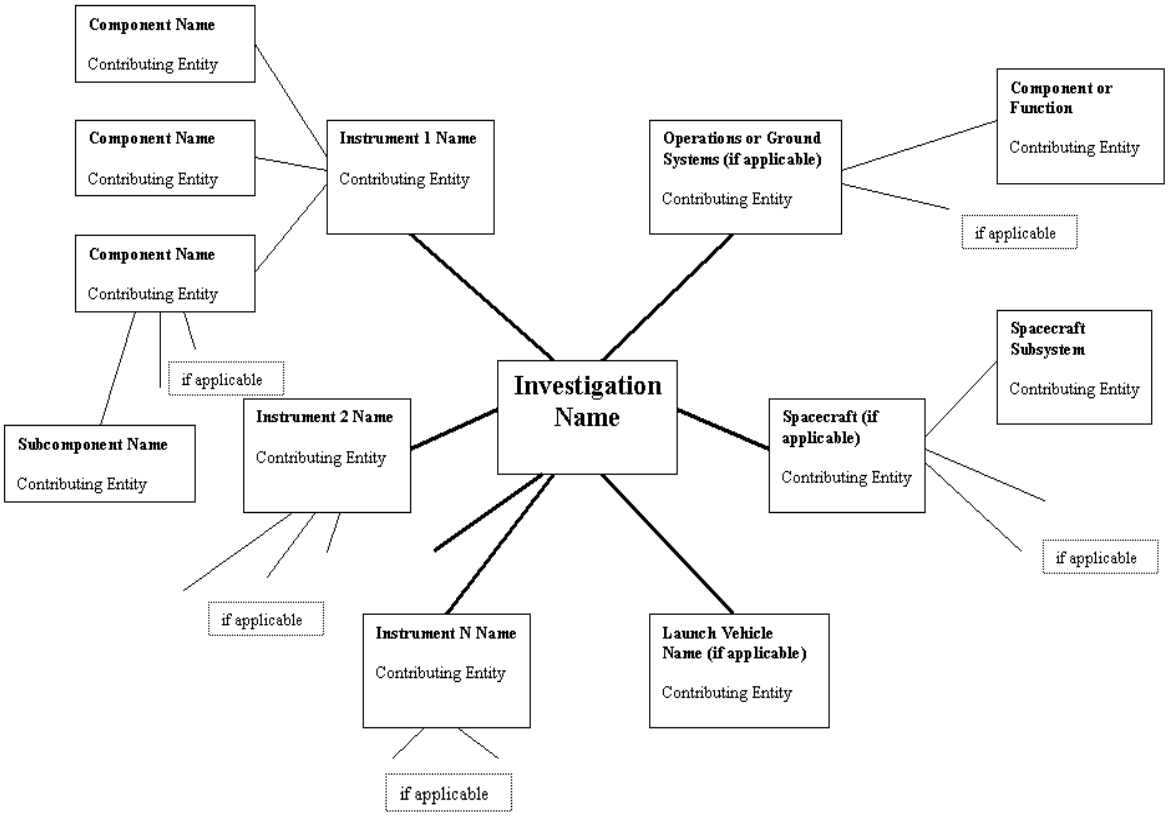
3. Resumes.

Provide resumes or curriculum vitae for the PI and all Co-Is identified in the science section and for any key project personnel. The resume must clearly show experience related to the job the individual will perform on the proposed investigation. If the PI or PM have project management experience, it must be included in their resume. Resumes or curriculum vitae should be no longer than three pages for the PI and one page for each additional participant. Resumes should be organized alphabetically after that of the PI.

4. Summary of Proposed Program Cooperative Contributions.

The following requirement for additional information does not apply to Missions of Opportunity proposed in response to this AO unless there are cooperative contributions to the MO investigation (the host mission is not considered a contribution to the MO investigation). As provided in Section 8.2.4 of the AO, each proposal will be evaluated for feasibility of the proposed approach for implementation, including cost risk (see also Section 5.3). Per these provisions, proposals that include cooperative contributions, whether U.S. or non-U.S., may be attributed risk if (1) the approach does not have clear and simple technical and management interfaces, (2) the proposal does not provide evidence that the contribution is within the scientific and technical capability of the contributing partner, and/or (3) the proposal does not include a firm commitment for each contribution. Cooperative contributions are defined to be those that are to be provided to the proposed investigation from a domestic or international partner on a no-exchange-of-funds basis. In order to aid NASA in conducting an equitable assessment of risks from cooperative contributions, each proposer must provide, in addition to the commitment letter from funding sponsors of all cooperative contributions, two additional items:

Sample "Exploded Diagram"



a. <u>An "exploded diagram" of the mission (see example figure) that provides a clear visual representation of cooperative contributions incorporated in the proposed implementation approach</u>. All cooperative contributions, including those that will require an international agreement, or interagency memorandum of agreement, must be shown in this diagram. Each contribution shown must display a unique name for the contribution as well as the identity of the contributing entity. However, the following should not be shown:
   i. If there are no cooperative contributions of spacecraft, launch vehicle or services, or ground operations or facilities, these boxes need not be shown on the diagram at all.
   ii. Scientific collaborations such as joint data analysis that do not involve contribution of flight hardware or other critical items should not be shown.
   iii. Foreign or domestic goods and services obtained by contract using NASA funds are not cooperative contributions and are also not to be shown.

b. <u>A supporting table with more information that elaborates each cooperative contribution shown in the exploded diagram.</u> The table must include, for each contribution, the following information:
   i. Unique name identifying the contribution (matching the name on the exploded diagram);
   ii. The identity of the providing entity, whether foreign or domestic;

iii. The roles and responsibilities of the providing entity;
iv. For non-U.S. contributions, the identification of the funding sponsor if different from the entity identified in item (ii) above;
v. The approximate value of the contribution, in U.S. dollars (i.e., what would be the cost to NASA to replace the contribution if it were not provided as planned); and
vi. Cross reference to letters of commitment.

5. 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 in detail the proposed international participation and is to include, but not be limited to, the following items: (i) complexity and risk, (ii) management of international contributions (including flowchart showing flow of hardware, information, and management authority), (iii) risk mitigation should contributions not materialize, and (iv) 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.pmddtc.state.gov/ and http://www.bis.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 subject to the provisions of the International Traffic in Arms Regulations, 22 CFR 120-130, *et seq*.

Foreign nationals requiring access to NASA facilities and information systems will be required to comply with Homeland Security Presidential Directive HSPD-12 (see http://hspd12.nasa.gov/) where applicable. The discussion should include the impact, if any, on the investigation and the proposed international participation of compliance with HSPD-12. If no impact is anticipated, this should be explicitly stated.

6. Draft Outline of Assignment of Technical Responsibilities between U.S. and International Partners.

These outlines will be used by NASA at selection as the starting point for formalizing the agency-to-agency agreements that will be required if the investigation is implemented. There is a *Letter of Agreement (LOA) Template* in the EPL.

7. Orbital Debris Generation Acknowledgement.

NASA policy requires all objects launched into space to have a formal Orbital Debris assessment done to limit the amount of orbital debris generated. Orbital Debris is defined as any object placed in space by humans that remains in orbit and no longer serves any useful function or purpose. Objects range from spacecraft to spent launch vehicle stages to instruments and also include materials, trash, refuse, fragments, or other objects which are overtly or inadvertently cast off or generated. This policy applies to SMEX missions and MOs.

All missions shall conduct orbital debris assessments prior to PDR to ensure compliance with the requirements in NASA-STD-8719.14, *NASA Process for Limiting Orbital Debris*. Complete missions, including SMEX missions and small complete mission MOs, will be required to submit an assessment following Appendix A.1 of NASA-STD-8719.14. MOs which are not complete missions, including partner MOs, will be required to submit an assessment following Appendix A.3 of NASA-STD-8719.14.

This appendix to the proposal must briefly discuss what actions are necessary to meet orbital debris requirements including any design changes or any spacecraft disposal at mission termination. If there are any actions required, the appendix must briefly demonstrate that the proposed mission contains sufficient resources (mass, budget, fuel, etc.) to accommodate the anticipated actions necessary to meet orbital debris requirements.

NPR 8715.6, *NASA Procedural Requirements for Limiting Orbital Debri*s, and NASA-STD-8719.14, *NASA Process for Limiting Orbital Debris*, are available in the EPL.

8. Demonstration of Minimum Space Flight Experience for the PI

For SMEX PIs only. Not required for MO PIs. It is expected that this information should take no more than 2 pages.

Table B7 must be completed to demonstrate that the proposal PI meets the requirements for space flight experience that are described in Section 4.5.1. Specific project(s) must be identified. The roles, responsibilities, and authorities of the proposal PI on those project(s) must be described. Experience in all four areas – leadership, planning, implementation, approval – as described in Appendix H, must be demonstrated by completing all sections of Table B7.

Although only a single space flight experience is required to qualify the proposal PI to be a SMEX mission PI, Table B7 may be duplicated as many times as necessary to demonstrate that the proposed mission PI has relevant experience in all four of the job areas described in Appendix H.

9. Compliance with Procurement Regulations by NASA PI Proposals.

The following instructions clarify the requirements for compliance with regulations governing proposals submitted by NASA PIs (NASA FAR Supplement 1872.308).

(a) NASA solicits, accepts, and evaluates proposals submitted by NASA Centers in response to an AO. A NASA investigator may team with one or more non-Government co-investigators. A NASA investigator may also need to acquire supplies, including instruments and other hardware, and non-research services in support of the proposed investigation. If a proposal submitted by a NASA Center is selected, assembly of the project team and acquisition of hardware and support services must be accomplished through the award of new Government contracts, unless existing Government contracts are available. The award of new Government contracts must comply with procurement laws and regulations.

(b) In addition to complying with proposal preparation instructions contained in the AO, proposals submitted by NASA Centers should address the following matters.

(1) Non-Government co-investigators.
The proposal should describe the competitive process that was used for selecting proposed research team members. While a formal solicitation is not required, the process should include the following competitive aspects: submissions from and/or discussions with potential sources and criteria used for selecting research team members who serve well-defined and necessary roles.

(2) Supplies, including instruments and other hardware, and non-research services.

(i) The proposal should indicate that the supplies or services are available under an existing Government contract;

(ii) The proposal should state that the supplies or services will be acquired under a full and open competition;

(iii) The proposal should describe the open process (e.g., Teaming Opportunity or Partnership Opportunity Document) that was used for selecting proposed suppliers and/or service providers. While a formal solicitation is not required, the process must 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 used for selecting sources. The proposal must address how the selection of the proposed suppliers and/or service providers followed the objective criteria and is reasonable from both a technical and cost standpoint; or

(iv) If the selected provider of supplies or services is deemed to be the only responsible source available, then the proposal must explain the basis of a justification for acquiring the supplies and/or services noncompetitively (see FAR Subpart 6.302-1).

(3) The proposal should also include a representation that the NASA investigator, co-investigator, and suppliers of instruments and other hardware, and non-research services have examined their financial interests and have determined that no personal conflicts of interest exist.

(c) A selection decision approving the non-Government team members as selected co-investigators satisfies legal and regulatory requirements without further competition or

justification (see NFS 1872.702).

(d) For the acquisition of supplies, including hardware, and support services by non-Government co-investigators, see NFS 1872.502(a)(4).

10. Completed Compliance Checklist.

Each proposal must include a completed copy of the Compliance Checklist in Appendix E, with the page numbers for each item clearly identified. Please note that any missing items on this checklist may result in the return of the proposal without review.

11. Heritage.

Describe heritage for each instrument, each spacecraft subsystem, each ground system, and each major module of flight or ground software. The description should address:

- The design basis:
  - Describe the closest heritage system, including recent application(s), dates of use, developer institution, and cost.
  - Is the developer (institution) on the proposing team?
  - Will the individuals who participated in the heritage basis be available to the proposing team?
  - State whether spaceflight-proven, ground or aircraft application, or other status.
  - Indicate the highest assembly level at which full heritage is claimed.
- Difference between the basis and the proposed design:
  - Describe differences in the environment and/or application.
  - Why is the design modification required?
  - Specify exactly what will be modified.
  - Characterize the difference in relevant terms: mass reduction, reduced power draw, cost saved, etc.
- Development challenges:
  - Describe any circumstances that might adversely impact the proposer's ability to achieve the planned design heritage or to deliver the new technology item.
  - Describe the steps planned to ensure that claimed design heritage is captured.
  - Describe remedial action plan should the expected design prove undeliverable within resources.

Provide substantiation of all heritage claims including descriptions of changes required to accommodate project-unique applications and needs. Where enhancements to heritage elements are proposed or heritage is from a different application, sufficient descriptions should be provided to independently assess the current level of maturity. Generally, systems with significant levels of claimed heritage are expected to provide sufficient mass details to allow independent validation. For systems with minimal or partial heritage, provide sufficient explanation to validate readiness of: a) proposed enhancements/modifications, and b) the maturation plan. The maturation plan should include: a) decision criteria for determining if technology efforts should be ended, and b) backup options. This description of heritage will be used by the evaluation team to

assign levels of heritage for the applicable seven areas in the following table. The evaluation team will use a scale with at least three levels (full, partial, or none) as illustrated in the table below.

	Full heritage	**Partial heritage**	**No heritage**
Design	Identical	Minimal modifications	Major modifications
Manufacture	Identical	Limited update of parts and processes necessary	Many updates of parts or processes necessary
Software	Identical	Identical functionality with limited update of software modules (<50%)	Major modifications (>=50%)
Provider	Identical provider and development team	Different however with substantial involvement of original team	Different and minimal or no involvement of original team
Use	Identical	Same interfaces and similar use within a novel overall context	Significantly different from original
Operating Environment	Identical	Within margins of original	Significantly different from original
Referenced Mission	In operation	Built and successfully ground tested	Not yet successfully ground tested

12. List of Abbreviations and Acronyms.

13. List of References.

In addition to the above items, a References List may be provided that identifies reference documents and materials that were fundamentally important in generating the proposal. Proposers are allowed to include a Uniform Resource Locator (URL) for those documents available through the Internet. Note that the proposal must be self-contained: any information intended as part of the proposal must be included in the proposal. If documents and materials themselves are submitted as a part of the proposal, they must be included within the prescribed page count.

TABLE B1
SCIENCE TRACEABILITY MATRIX

Science Objectives	**Scientific Measurement Requirements**	**Instrument Functional Requirements**	**Mission Functional Requirements (Top-Level)**

TABLE B2
MISSION TRACEABILITY MATRIX

Mission Requirement	**Spacecraft Requirement**	**Ground System Requirement**	**Operations Requirement**

Kinds of information to be addressed in the matrixes B1 and B2 (not all inclusive):

<u>Requirements on Mission</u>
Orbit information (type, altitude, inclination)
Launch vehicle and any upper stages
Launch date and launch date flexibility
Mission duration
Number of satellites

<u>Requirements on Spacecraft Host</u>
Control method (3-axis stabilized, spinner, gravity-gradient)
Pointing control, knowledge, and jitter
Slew Rates
Data storage
Special thermal requirements
Power required by instruments
Radiation environment

<u>Requirements on Communications and Ground Data System</u>
Data Volume (Mbytes per day)
Number of data dumps per day
Real time requirements

<u>Requirements on Mission Operations</u>
Maneuvering, including constraints on maneuvering

TABLE B3
TOTAL MISSION COST FUNDING PROFILE TEMPLATE
FOR SMEX INVESTIGATIONS
(FY costs[1] in Real Year Dollars, Totals in Real Year and 2008 Dollars)

Cost Element	FY1	FY2	FY3	FY4	FY5	...	FYn	Total (Real Yr.)	Total (FY 2008)
Phase A									
Phase B									
Reserves									
Phase C/D PM/MA/SE[2]									
Instruments*									
Instrument IAT[3]									
Spacecraft Bus									
Spacecraft IAT[3]									
Other H/W Elements*									
Launch + 30 Days Ops									
Science Team									
Pre-Launch GDS/MOS[4]									
E/PO[5]									
DSN[6]									
Other*									
Instrument Reserves									
Spacecraft Reserves									
Other Reserves									
Phase E PM[2]									
Science Team									
MO&DA[7]									
DSN[6]/Tracking									
E/PO[5]									
Other*									
Reserves									
Phase F									
PI Mission Cost	$	$	$	$	$	$	$	$	$
4-Month Bridge Phase[9]									
Contributions									
For Each Element Above*									
Total Contributions	$	$	$	$	$	$	$	$	$
Total Mission Cost	$	$	$	$	$	$	$	$	$
SEO Activities[8] (specify)									
Total Enhanced Mission Cost	$	$	$	$	$	$	$	$	$

Notes for Table B3

Rows should be modified to suit the proposal

* Specify each one in separate row
1 Costs must include all costs including any fee
2 PM/MA/SE - Project Management/Mission Analysis/Systems Engineering
3 IAT - Integration, Assembly and Test
4 GDS/MOS - Ground Data System/Mission Operations Services
5 E/PO - Education /Public Outreach [If Student Collaboration (SC) is included, please split E/PO into two lines – one for E/PO ("core") and one for SC.]
6 DSN - Deep Space Network
7 MO&DA - Mission Operations and Data Analysis
8 Optional. See Section 4.3.2
9 Also include within Phase B and within PI Mission Cost

TABLE B4
NASA COST FUNDING PROFILE TEMPLATE
FOR MISSIONS OF OPPORTUNITY
(FY costs[1] in Real Year Dollars, Totals in Real Year and 2008 Dollars)

Cost Element	FY1	FY2	FY3	FY4	FY5	...	FYn	Total (Real Yr.)	Total (FY 2008)
Phase A									
Phase B									
Reserves									
Phase C/D PM/MA/SE[2]									
Instruments*									
Instrument IAT[3]									
Science Team									
Pre-Launch GDS/MOS[4]									
E/PO[5]									
Other*									
Instrument Reserves									
Other Reserves									
Phase E PM[2]									
Science Team									
MO&DA[6]									
DSN[7]/Tracking									
E/PO[5]									
Other*									
Reserves									
Phase F									
PI Mission Cost	$	$	$	$	$	$	$	$	$
4-Month Bridge Phase[8]									
Contributions									
For Each Element Above*									
Total Contributions									
Total Mission Cost	$	$	$	$	$	$	$	$	$
SEO Activities[9] (specify)									
Total Enhanced Mission Cost	$	$	$	$	$	$	$	$	$

Notes for Table B4

Rows should be modified to suit the proposal

* Specify each one in separate row
1 Costs must include all costs including any fee
2 PM/MA/SE - Project Management/Mission Analysis/Systems Engineering
3 IAT - Integration, Assembly and Test
4 GDS/MOS - Ground Data System/Mission Operations Services
5 E/PO - Education /Public Outreach (if Student Collaboration (SC) is included, please split E/PO into two lines – one for E/PO("core") and one for SC.)
6 MO&DA - Mission Operations and Data Analysis
7 DSN - Deep Space Network
8 Also include within Phase B and within PI Mission Cost
9 Optional. See Section 4.3.2

TABLE B5
MISSION PHASE SUMMARY FOR COST
(FY costs[1] in Real Year Dollars, Totals in Real Year and 2008 Dollars)

Mission Phase	FY1	FY2	FY3	FY4	FY5	...	FYn	Total (Real Yr.)	Total (FY 2008)
Phase A/B									
Phase C/D									
Phase E									
Phase F									
PI Mission Cost	$	$	$	$	$	$	$	$	$
Contributions									
Total Mission Cost									
SEO Activities									
Total Enhanced Mission Cost									

1 Costs must include all costs including any fee

TABLE B6
NASA NEW START INFLATION INDEX

Fiscal Year	2008	2009	2010	2011	2012	2013	2014	2015
Inflation Rate	0.0%	2.7%	2.7%	2.9%	3.0%	2.8%	2.7%	2.7%
Cumulative Inflation Index	1.0	1.027	1.055	1.085	1.117	1.149	1.181	1.212

Use an inflation rate of 2.7% for years beyond 2015.

TABLE B7
PRINCIPAL INVESTIGATOR SPACE FLIGHT EXPERIENCE

Name of PI	
PI Institution	
Space Project	
Project launch date or planned launch date	
Space or near-space environment (e.g., orbital, deep space, etc.)	
Title of position held	
If different title, position with the same roles and responsibilities	
Dates position held	
Role, responsibilities, authority (Leadership)	
Role, responsibilities, authority (Planning)	
Role, responsibilities, authority (Implementation)	
Role, responsibilities, authority (Approval)	

TABLE B8
FULL TIME EQUIVALENTS, WORK YEAR EQUIVALENTS,
AND EFFECTIVE DIRECT COSTS

Organization	NASA Civil Servant FTEs	Other Civil Servant FTEs	JPL Employee WYEs	Other Contractor WYEs	Effective Direct Costs (FY 2008)
PI organization					
other organizations					

Specify each organization in Table B8 in a separate row. All entries should be cumulative over the proposed baseline mission life, and costs should be in FY 2008 dollars.

APPENDIX C

CONTENTS OF THE EXPLORER PROGRAM LIBRARY

The EPL includes documents available electronically via the Internet. Proposers must access the documents electronically. In the event of an apparent conflict between a document contained in the EPL and the AO, the AO shall take precedence. Please note that not all documents are available via the EPL, but access information is provided.

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

The EPL is accessible at the World Wide Web address http://explorers.larc.nasa.gov/smexlib.html.

All NASA documents can be accessed through the NASA Online Directives Information System (NODIS). The URL is: http://nodis.hq.nasa.gov/.

1. NASA Strategy and Requirements

2006 NASA Strategic Plan
This document describes the strategy and goals for achieving the national vision for space exploration.

NPR 7120.5D – Space Flight Program and Project Management Requirements (March 6, 2007)
This document provides a reference for typical activities, milestones, and products in the development and execution of NASA missions.

NPR 7123.1A – Systems Engineering Processes and Requirements (March 26, 2007)
This document articulates and establishes the requirements on the implementing organization for performing, supporting, and evaluating systems engineering.

NPR 7150.2 – Software Engineering Requirements (September 27, 2004)
This document provides the minimal set of requirements established by the Agency for software acquisition, development, maintenance, operations, and management.

NPR-8000.4 – Risk Management Procedural Requirements (April 25, 2002)
This document provides the requirements and information for applying risk management to programs and projects.

NPR 8705.4 – Risk Classification for NASA Payloads (June 14, 2004)
This document establishes baseline criteria that enables a user to define the risk classification level for NASA payloads on human- or nonhuman-rated launch systems or carrier vehicles and the design and test philosophy and the common assurance practices applicable to each level.

NPD 2200.1 – Management of NASA Scientific and Technical Information (STI) (March 28, 2003)

This document provides the requirements for the management of NASA STI.

NASA-STD-8739.8 – Software Assurance Standard (July 28, 2004)

This document provides a standard for assessing software systems for their contribution to safety and quality. It describes the processes and procedures for analyzing and applying appropriate assurance techniques and methods to software.

NASA Education Strategic Coordination Framework: A Portfolio Approach (February 2006)

This document serves as the education strategic coordination framework for an Agency portfolio approach to education. It aligns NASA's total education portfolio with the Agency's Strategic Plan, provides a coordination structure, and creates an Agency-wide strategic planning, implementation, and evaluation framework for the Agency's investments in education.

2. Science Mission Directorate Strategies and Policies

Science Plan for NASA's Science Mission Directorate 2007- 2016
(January 2007)

This document describes the goals and objectives of NASA's SMD, and of the major ideas described in the context of the overall NASA Strategic Plan.

Explanatory Guide to the NASA Science Mission Directorate Education and Public Outreach Evaluation Factors (December 2006)

Provides a descriptions and elaborates on each of the SMD E/PO evaluation factors. Provides answers to frequently asked questions.

Explanatory Guide to the NASA Science Mission Directorate Educational Merit Evaluation Factors for Student Collaboration Elements (July 2007)

Provides a descriptions and elaborates on each of the SMD SC educational merit evaluation factors. Provides answers to frequently asked questions.

3. Space Science Roadmaps

The science research programs of the NASA SMD, through the Space Science Advisory Committee and its subcommittees, have developed Roadmaps. These planning documents prioritize the space science goals for NASA for the years 2007-2035. The following Roadmaps apply to the Explorer Program:

Heliophysics Roadmap for Science and Technology 2005-2035, The New Science of the Sun-Solar System Connection (2006)

The Heliophysics Division of the SMD through its Advisory Subcommittee has developed a roadmap. This document prioritizes the heliophysics science goals for NASA for the year 2005-2035.

Community Roadmap: Astrophysics (2006)

The Astrophysics Division of the SMD through its Advisory Subcommittee has developed a roadmap. This document prioritizes the astrophysics science goals for NASA for the year 2005-2035.

4. Space Science Supporting Documents

Dark Energy Task Force Report (2006***)***

Report of the NASA-National Science Foundation (NSF)-Department of Energy (DOE) Dark Energy Task Force, which was asked to advise the agencies on the optimum near- and intermediate-term programs to investigate dark energy and, in cooperation with agency efforts, to advance the justification, specification and optimization of a ground-based Large Survey Telescope (LST) and a space-based Joint Dark Energy Mission (JDEM).

Task Force on the Cosmic Microwave Background Report (2005)

This report of the NASA-NSF-DOE Task Force on Cosmic Microwave Background (CMB) presents a roadmap for leading CMB research to its logical next step, using precision polarization measurements to learn about ultra-high-energy physics and the Big Bang itself.

Connecting Quarks with the Cosmos: Eleven Science Questions for the New Century (2002).

National Research Council report of the Committee on the Physics of the Universe. A study undertaken by the Board on Physics and Astronomy assessing the science opportunities at the intersection of physics and astronomy.

Gravitational Physics: Exploring the Structure of Space and Time (1999)

National Research Council report of the Committee on Gravitational Physics. A research briefing by the Board on Physics and Astronomy to reassess the opportunities for scientific advances in gravitational physics.

Astronomy and Astrophysics in the New Millennium (2001)

National Research Council report of the decennial Astronomy and Astrophysics Survey Committee. A study undertaken by the Space Studies Board and the Board on Physics and Astronomy of both ground and space based astronomy recommends priorities for new initiatives in the decade 2000 to 2010.

Opportunities in Cosmic-Ray Physics and Astrophysics (1995)

National Research Council report of the Committee on Cosmic-ray Physics. A review was undertaken by the Board on Physics and Astronomy to review the field that addresses both experimental and theoretical aspects of the origin of cosmic radiation from outside the heliosphere.

The Sun to the Earth--and Beyond: A Decadal Research Strategy in Solar and Space Physics (2002)

National Research Council report of the Solar and Space Physics Survey Committee. A study undertaken by the Space Studies Board and the Board on Physics and Astronomy of both solar and space physics recommends priorities for new initiatives in the decade 2003 to 2013.

Recommended Priorities for NASA's Gamma-Ray Astronomy Program 1999-2013 (June 1999)

Report of the Gamma Ray Astronomy Program Working Group.

15-Year Plan for X-Ray Astronomy (June 1999)

Report of the X-Ray Astronomy Program Working Group.

The Emergence of the Modern Universe: Tracing the Cosmic Web (November 1999)

Report of the Ultraviolet-Optical Astronomy Program Working Group.

HELEX: Heliophysical Explorers: Solar Orbiter and Sentinels

This is the pre-publication version of the Joint Science and Technology Definition Team Report.

5. <u>SMEX Guidelines and Requirements Documents</u>

Approval of the Reclassification of Small Explorer (SMEX) Mission (July 10, 2007)

Letter from the Associate Administrator for SMD to the Director of GSFC approving the reclassification of SMEX missions as tailored Class D.

SMEX Expendable Launch Vehicle Services Information Summary

This document provides information and points of contact on available expendable launch vehicles.

NASA's Mission Operations and Communications Services

This document provides information and points of contact on the functions and costs of NASA-provided ground data systems, mission operations capabilities, and the access to NASA's space communications networks.

SMD Mission Extension Paradigm

This document describes the guidelines used by SMD Senior Reviews when reviewing extended mission proposals.

SMEX Guidelines for Concept Study Preparation

This document describes the requirement for preparation of the Phase A Concept Study Report.

SMEX – Sample Terms and Conditions for the Phase A (Concept Study) Contract

This document describes the requirements for a Phase A Concept Study Contract.

Draft Model Contract

This is a draft model contract for the Phase B/C/D/E contract for further formulation and implementation of missions downselect for proceeding beyond Phase A.

GPR 7120.3B – Management of Principal Investigator Mode Missions (December 15, 2004)

This document describes the roles and responsibilities of the PI, the program office (including the Mission Manager), the implementing organization, and NASA HQ with respect to the overall management of PI-mode missions at the GSFC.

GPR 7120.4A – Risk Management (June 14, 2005)

This document provides procedures for applying risk management to GSFC projects.

GPR 8700.4F – Integrated Independent Reviews (June 2, 2005)

This document establishes the process for planning, conducting, and reporting Integrated Independent Reviews for GSFC products.

GPR 8700.6A – Engineering Peer Reviews (January 26, 2005)

This document defines the process for Engineering Peer Reviews of applicable GSFC products.

410-PLAN-0036 – Small Explorer (SMEX) Program, Low Priority, High Risk Payload (Class D), Mission Assurance Requirements

This document describes the responsibilities of the PI with regard to Safety, Reliability, and Quality Assurance.

410-PLAN-0068A – System Safety Implementation Plan For The Goddard Space Flight Center Explorers Program Office (May 10, 2005)

This document describes the safety approach that will be followed during the design, development, fabrication, assembly, and test phases of mission hardware from conception through launch.

410-PLAN-0095 – SMEX General Project Plan

GSFC-STD-1000C.2 – Rules for the Design, Development, Verification, and Operation of Flight Systems (December 12, 2006)

This document provides a high-level subset of all the design rules required for safety and mission success for all space flight products.

GSFC-STD-7000 – General Environmental Verification Standard (GEVS) (April 2005)

This document provides requirements and guidelines for environmental verification programs for GSFC payloads, subsystems and components and describes methods for implementing those requirements.

6. General Guideline and Requirements Documents

Example Project Level Requirements
Example of such requirements for the Interstellar Boundary Explorer (IBEX).

Example Mission Definition and Requirements Agreement
Example of such an agreement for IBEX.

ANSI/EIA-748-A Earned Value Management Systems
These guidelines incorporate best business practices for the implementation of an Earned Value Management System.

Letter of Agreement (LOA) Template
Example of such an agreement for IBEX.

7. Explorer Program Background

Predicting Mission Success in Small Satellite Missions (October 1999)
Paper providing an overview of the process by which proposals submitted in response to Announcements of Opportunity are evaluated. It was presented at the 50th International Astronautical Congress, Amsterdam, The Netherlands, IAF-99-IAA.

Lessons Learned from Technical, Management, and Cost Review of Proposals (February 21, 2006)
A Summary of 10 Years Experience in Reviewing Competitively Selected Proposals for New Science Missions.

8. Education and Public Outreach

SMD Education and Public Outreach Annual Reports
Describes the breadth of SMD Education and Public Outreach (E/PO) programs and accomplishments in space science.
(URL: http://ossim.hq.nasa.gov/ossepo/index.html)

SMD Education and Public Outreach Newsletters
Describes SMD space science E/PO newsworthy activities.
(URL: http://science.hq.nasa.gov/research/newsletters.htm)

9. Procurement-related Information

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/fmmintro.htm)

NPR 5800.1E -- Grant and Cooperative Agreement Handbook (May 7, 2002)
(URL: http://ec.msfc.nasa.gov/hq/grcover.htm)

Federal Accounting Standards Advisory Board (FASAB)
(URL: http://www.fasab.gov/)

10. Orbital Debris

NPR 8715.6 – Procedural Requirements for Limiting Orbital Debris (August 17, 2007)
(URL: http://nodis.hq.nasa.gov/displayDir.cfm?t=NPR&c=8715&s=6)

NASA-STD-8719.14 – NASA Process for Limiting Orbital Debris (August 28, 2007)
(URL: http://www.hq.nasa.gov/office/codeq/doctree/871914.pdf)

Orbital Debris Modeling
(URL: http://www.orbitaldebris.jsc.nasa.gov/model/modeling.html)

Orbital Debris Reentry
(URL: http://www.orbitaldebris.jsc.nasa.gov/reentry/reentry.html)

11. Other

NASA Science Mission Directorate
(URL: http://science.hq.nasa.gov/)

SMEX Acquisition Additional Information Page
(URL: http://explorers.larc.nasa.gov/smexacq.html)

SMEX NOI and Proposal Cover Sheet Submission Online Site
(URL: http://nspires.nasaprs.com)

NASA Lessons Learned Database
(URL: http://www.nasa.gov/offices/oce/llis/home/index.html)

NASA Online Directives Information System (NODIS) Library
(URL: http://nodis.hq.nasa.gov/)

Technology Readiness Level (TRL) Definitions
(URL: http://www.hq.nasa.gov/office/codeq/trl/trl.pdf)

NASA Export Control Program
(URL: http://www.hq.nasa.gov/office/oer/nasaecp/)

Directorate of Defense Trade Controls, U .S. Department of State
Includes links to the International Traffic in Arms Regulations (ITAR).
(URL: http://www.pmddtc.state.gov/)

Bureau of Industry and Security, U. S. Department of Commerce
Includes links to the Export Administration Regulations (EAR).
(URL: http://www.bis.doc.gov/)

NPD 8610.7C – Launch Services Risk Mitigation Policy for NASA-Owned Or NASA-Sponsored Payloads (April 5, 2005)
(URL: http://nodis.hq.nasa.gov/displayDir.cfm?t=NPD&c=8610&s=7C)

Principal-Investigator-Led Missions in the Space Sciences (2006)
(URL: http://www.nap.edu/catalog.php?record_id=11530)

Treasury Department Official Exchange Rate
(URL: http://fms.treas.gov/intn.html)

New Millennium Program: Infusion of NMP-validated Technologies into Subsequent Science Missions
(URL: http://nmp.nasa.gov/TECHNOLOGY/infusion.html)

APPENDIX D

CERTIFICATIONS

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.

Assurance of Compliance with the National Aeronautics and Space Administration Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

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The *(Institution or 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 1972 (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 GIVES 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 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 it retains ownership or possession of the property. In all other cases, 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, contract, 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 recognizes 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.

Certification Regarding Debarment, Suspension, and Other Responsibility Matters
Primary Covered Transactions

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.

Certification Regarding Lobbying

As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant 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;

(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, 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 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 E
COMPLIANCE CHECKLIST

Administrative	
1. Proposal arrived on time	§7.3.3
2. Proposal included copy of electronic cover page and summary	§7.2.2
3. Original authorizing official signature included	§7.2.3
4. Correct number of copies	§7.3.1
5. Meets page limits	Appendix B
6. Includes CD with every copy	§7.3.1
7. Meets general guidelines (one volume original easy to disassemble, no more than 4 fold out pages, maximum 55 lines text/page, maximum 15 characters/inch --approximately 12 pt font)	Appendix B
8. Required appendices included	Appendix B
9. No additional appendices included	Appendix B
10. Budgets are submitted in required formats	Appendix B
Scientific	
11. Addresses solicited science research programs	§1.1
12. Requirements traceable from science to instruments to mission	Appendix B
13. Appropriate data archiving plan	§4.3.1
14. For full Explorer only (not MO), defines both a baseline mission and a minimum science mission	§5.6
15. Allocation of sufficient resources for data analysis has been demonstrated	§4.3.1
16. PI meets space flight experience requirements (full Explorer only)	§4.5.1
Technical	
17. Proposed complete investigation (Phases A-F) for full Explorer, or allowed type of Mission of Opportunity	§1.1, §6.2, §6.3, §6.4
18. Includes E/PO outline and commitment	Appendix B
19. Includes technology and SDB commitment	Appendix B
20. Team led by a single PI	§4.5.1
21. Proposed budget within cost cap	§5.4.2, §6.5
22. Contributions within contribution limit	§5.4.3
23. Phase A costs within cost limit	§5.5
24. Co-investigator costs in budget	§4.5.3
25. Launch date (for Explorer) or commitment date (for MO) prior to cutoff	§5.4.1, §6.2, §6.3
26. Domestic letters of commitment for non-funded (contributed) Co-Is	§4.5.4
27. Domestic letters of commitment from all organizations contributing critical goods and services, from all major or critical participants, and from any required funding organizations	§4.6.2, Appendix B
28. Table describing non-U.S. participation	§4.7.6
29. Foreign letters of commitment from participating institution	§4.7.3
30. Foreign letters of commitment from funding agencies including binding law statement	§4.7.3, §4.7.5

APPENDIX F

PROJECT COST ELEMENT DEFINITIONS

This is a short dictionary of definitions for the cost elements shown in the tables and discussed in the body of this AO.

Reserves
In that NASA maintains no reserves for missions, reserves must include those project funds that are not allocated specifically to estimated resources, but are held against contingencies or underestimation of resources to mitigate the investigation risk. Reserves must be reported according to the proposed reserve management strategy. For example, if the reserve is divided into funds to be preallocated to the flight system and instrument payload, with another portion held at the project level, specific dollar amounts to fund each must be identified.

Project Management/Mission Analysis/Systems Engineering
Project management costs include all efforts associated with project level planning and directing of prime and subcontractor efforts and interactions, as well as project-level functions such as quality control and product assurance. Mission Analysis includes preflight trajectory analysis and ephemeris development. Systems engineering is the project-level engineering required to ensure that all satellite subsystems and payloads function properly to achieve system goals and requirements. This cost element also includes the data/report generation activities required to produce internal and deliverable documentation.

Instruments
Instrument costs include costs incurred to design, develop, and fabricate the individual scientific instruments or instrument systems through delivery of the instruments to the spacecraft for integration. Costs for instrument integration, assembly, and test are to be shown separately from instrument development. Costs incurred for integration of the instruments to the spacecraft are included in the Spacecraft Integration, Assembly and Test cost element (see below).

Spacecraft Bus
Spacecraft bus costs include costs incurred to design, develop, and fabricate (or procure) the spacecraft subsystems. Costs for integration and assembly are not included in this element. Component level test and burn-in is included in this cost element. System tests are included in Spacecraft IAT (see below).

Spacecraft Integration, Assembly, and Test (IAT)
Spacecraft integration, assembly and test is the process of integrating all spacecraft subsystems and payloads into a fully tested, operational satellite system. The total cost of IAT for a satellite includes research/requirements specification, design and scheduling analysis of IAT procedures, ground support equipment, systems test and evaluation, and test data analyses. Typical satellite system tests include thermal vacuum, thermal cycle, electrical and mechanical functional, acoustic, vibration, electromagnetic compatibility/interference, and pyroshock.

Launch Checkout and Orbital Operations
Launch checkout and orbital operations support costs are those involving prelaunch planning, launch site support, launch-vehicle integration (spacecraft portion), and the first 30 days of flight operations.

Prelaunch Science Team Support
Includes all Phase B/C/D (prelaunch) support costs for the science team. (See MO&DA below for post-launch component.)

Prelaunch GDS/Mission Operations Services (MOS) Development
Includes costs associated with development and acquisition of the ground infrastructure used to transport and deliver the telemetry and other data to/from the Mission Operations Center and the Science Operations Center. (For more information, refer to *NASA's Mission Operations and Communications Services* document in the EPL.) Includes development of science data processing and analysis capability. Also includes prelaunch training of the command team, development and execution of operations simulations, sequence development, and flight control software. This element includes any mission-unique tracking network development costs.

Education and Public Outreach
Includes all costs associated with developing and implementing the proposed project's programs for education and public outreach.

Tracking Services including DSN
This line item includes all costs associated with this service for the specific proposed mission profile. (Refer to *NASA' s Mission Operations and Communications Services* document, in the EPL.)

Mission Operations and Data Analysis (MO&DA)
This cost element refers only to Phase E (postlaunch) and has two major components: Mission Operations and Data Analysis. Mission operations comprises all activities required to plan and execute the science objectives, including spacecraft and instrument navigation, control, pointing, health monitoring, and calibration. Data analysis activities include collecting, processing, distributing and archiving the scientific data. MO&DA costs include postlaunch all costs for people, procedures, services, hardware and software to carry out these activities. It includes post-launch science team support costs. It does <u>not</u> include costs of any SEO activities.

SEO Activities
Options for enlarging the science impact beyond the baseline mission, such as extended missions, guest investigator programs, general observer programs, or archival data analysis programs are termed SEO activities. These costs do not count against the mission funding cap.
Project-Unique Facilities
If the proposed project requires construction or lease of any ground facilities, include here only the portion of costs to be borne by the proposed project, with description of the nature and extent of any cost-sharing arrangements assumed.

Launch Services
Launch vehicles and services are either procured and provided by NASA to launch spacecraft under fixed price contracts, or provided by the proposer. The launch service price includes procurement of the ELV, spacecraft-to-launch vehicle integration, placement of spacecraft into designated orbit, analysis, postflight mission data evaluation, oversight of the launch service and coordination of mission-specific integration activities. (For more information, refer to the *SMEX Expendable Launch Vehicle Opportunities* document in the EPL.)

NASA Center Costs (all categories)
Additional costs borne by the project for NASA Center participation. For example, there may be additional project management/systems engineering costs, above those incurred by the spacecraft prime contractor, which are due to NASA employee participation. These costs must be reported on a full-cost accounting basis.

APPENDIX G

ACRONYM LIST

ANSI	American National Standards Institute
AO	Announcement of Opportunity
BPSK	Binary Phase Shift Keying
CCSDS	Consultative Committee for Space Data Systems
CD	Compact Disk
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CEV	Crew Exploration Vehicle
CFR	Code of Federal Regulations
CMB	Cosmic Microwave Background
CM&O	Center Management and Operations
Co-I	Co-Investigator
COTS	Commercial Orbital Transportation Services
CY	Calendar Year
DOE	Department of Energy
DSN	Deep Space Network
E/PO	Education and Public Outreach
EAR	Export Administration Regulations
EIA	Electronic Industries Alliance
ELV	Expendable Launch Vehicle
EPL	Explorer Program Library
EVM	Earned Value Management
FAR	Federal Acquisition Regulations
FMEA	Failure Modes and Effects Analysis
FTE	Full Time Equivalent
FY	Fiscal Year
GAO	Government Accountability Office
GDS	Ground Data System
GFE	Government Furnished Equipment
GN	Ground Network
GPR	Goddard Procedural Requirements
GSFC	Goddard Space Flight Center
G&A	General and Administrative
HBCU	Historically Black Colleges and Universities
HQ	Headquarters
IAT	Integration, Assembly, and Test
IBEX	Interstellar Boundary Explorer
ISS	International Space Station
ITAR	International Traffic in Arms Regulations
IV&V	Independent Verification and Validation
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center

KSC	Kennedy Space Center
LOA	Letter of Agreement
MA	Mission Analysis
MEL	Master Equipment List
MIDEX	Medium-class Explorer
MIP	Mission Integration Plan
MO	Mission of Opportunity
MO&DA	Mission Operations and Data Analysis
MOS	Mission Operations Services
MOU	Memorandum of Understanding
NAICS	North American Industry Classification System
NASA	National Aeronautics and Space Administration
NET	No Earlier Than
NFS	NASA FAR Supplement
NIAT	NASA Integrated Action Team
NISN	NASA Integrated Services Network
NODIS	NASA Online Directives Information System
NOI	Notice of Intent
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NSF	National Science Foundation
NSPIRES	NASA Solicitation and Proposal Integrated Review and Evaluation System
NSS	NASA Safety Standard
OMI	Other Minority Educational Institution
PAIP	Product Assurance Implementation Plan
P.L.	Public Law
PDF	Portable Data Format
PDR	Preliminary Design Review
PI	Principal Investigator
PM	Project Manager
PPC	Preproposal Conference
PRA	Probabilistic Risk Assessment
PS	Project Scientist
RY	Real Year
SC	Student Collaboration
SCaN	Space Communication and Navigation
SDB	Small Disadvantaged Business
SE	System Engineer(ing)
SEO	Science Enhancement Option
SMD	Science Mission Directorate
SMEX	Small Explorer
SN	Space Network
SOW	Statement of Work
TRL	Technical Readiness Level
URL	Uniform Resource Locator

U.S.	United States
U.S.C.	United States Code
UNEX	University-class Explorer
WBS	Work Breakdown Structure
WOSB	Women Owned Small Business
WYE	Work Year Equivalent

APPENDIX H

ROLES AND RESPONSIBILITIES FOR PRINCIPAL INVESTIGATOR, PROJECT SCIENTIST, AND PROJECT MANAGER

This is a short description of the roles and responsibilities for the PI, PS and PM of a space mission, instrument, experiment, or project.

These roles and responsibilities are applicable to PI-led projects of varying sizes that involve the development of space hardware, from a suborbital project, to an instrument, to a mission. The generic language should be interpreted in the context of those activities that are within the scope of the PI-led project.

The PI, PS, and PM of a space project all exercise responsibility, authority, and management in the areas of leadership, planning, implementation, and approval when carrying out their respective roles and responsibilities.

Principal Investigator

The PI conceives an investigation and is responsible for carrying it out and reporting its results. The PI is responsible for overall project success as defined in the governing agreement. The PI sets priorities for all aspects of the project including cost, schedule, technical performance, and the reporting of scientific results. The PI and his/her deputies maintain sufficient insight into the development and operational activities to ensure that the cost, schedule, and technical performance of the project remain within established boundaries. The PI is responsible for ensuring that the project remains within its cost and schedule commitments. The PI roles and responsibilities entail exercising responsibility, authority, and management in the following four areas:

1. Leadership: Ensure overall project scientific and programmatic success as defined in the governing agreement. Ensure that the project meets all science, technical, cost, and schedule commitments.
2. Planning: Assemble and lead the science, management, and technical team to formulate, implement, and operate the project. Assume scientific leadership during all project phases. Establish an experienced team with the proper project management and infrastructure in place to manage and implement the project. For larger projects, approve the appointment of the PM and other key personnel. Organize and lead the science team. The PI may delegate day-to-day management of the project to a PM.
3. Implementation: Direct all aspects of project implementation, decision making, and reporting. Review and report technical and programmatic progress and status. Prepare and approve the science requirements document. Approve the project plan and other top level documentation. Approve and review project plans and tests relating to scientific performance and the attainment of science objectives.
4. Approval: Ensure that the project is ready to successfully pass all gateway reviews. For larger projects, demonstrate readiness to transition from Formulation to Implementation

at the Confirmation Review. Certify that the mission is ready for launch at the Mission Readiness Review. Approve budgets and make decisions regarding expenditure of resources.

Project Scientist

The PS provides the scientific leadership necessary for the scientific success of a project by insuring that the mission meets or exceeds the scientific requirements. The PS and her/his deputies are integral members of the project management team. The PS roles and responsibilities entail exercising responsibility, authority, and management in the following four areas:

1. Leadership: Provide scientific guidance and oversight of all elements of the project implementation, from the beginning of formulation to the end of science operations. Support development of science requirements, goals and objectives. Support definition of Level-1 specifications.
2. Planning: Takes lead in identifying scientific options for the PI (and PM for larger projects) in all matters regarding science, science policy, and science-engineering trades required to achieve the mission objectives within the schedule and resources available. Participate in project meetings/reviews and be responsible for confirming that scientific requirements will or will not be met.
3. Implementation: Oversee the implementation of the science observation program of the mission. Review and approve plans for calibration, operations, and data analysis.
4. Approval: Review and recommend approval of, and proposed modifications to, the science, and technical requirements. Provide recommendations on mission success criteria. Approve budgets and make decisions regarding expenditure of resources.

For smaller projects, the PS role carries other titles including Instrument Scientist and Experiment Scientist.

Project Manager

The PM is responsible for the formulation and implementation of the project per the governing agreement. The PM is responsible and accountable for the safety, technical integrity, performance, and mission success of the project, while also meeting programmatic (cost and schedule) commitments. Accomplishing this requires a breadth of skills that depend on the size and complexity of the project; he/she might need to be knowledgeable about governing laws, acquisition regulations, policies affecting project safety, training of direct-report personnel, risk management, environmental management, resource management, project-unique test facilities, software management, responding to external requests for audits, protecting intellectual property and technology, and other aspects of project management.

The PM roles and responsibilities are described in NPR 7120.5D, *NASA Space Flight Program and Project Management Requirements*, Sections 3.1.3 and 3.2.1. The PM roles and

responsibilities entail exercising responsibility, authority, and management in the following four areas:

1. Leadership: Exercise responsibility and accountability for the safety, technical integrity, performance, and mission success of the project, while also meeting programmatic (cost and schedule) commitments. Implement project budget. Manage project resources. Maintain knowledge of governing laws, acquisition regulations, policies affecting project safety, training of direct-report personnel, risk management, environmental management, resource management, project-unique test facilities, software management, protecting intellectual property and technology, and other aspects of project management.
2. Planning: Establish the project office and structure to direct and monitor tasks/activities within project. Initiate, support, and conduct project-level concept studies. Originate project requirements. Develop and approve Project Plan. Develop mission options, conduct trades, and develop cost estimates to support budget. Develop project launch readiness criteria. Support development of content of agreements with international and other government agencies.
3. Implementation: Assess project technical, schedule, and cost performance and take action, as appropriate, to mitigate risks. Communicate project performance, issues and risks to senior management and present recovery plans.
4. Approval: Prepare for and provide assessment of project readiness to enter Implementation. Conduct readiness reviews leading to key decision points for projects. Certify readiness to proceed past key decision points. Approve budgets and make decisions regarding expenditure of resources.

For smaller projects, the PM role carries other titles including Instrument Manager and Experiment Manager.