National Aeronautics
and Space Administration

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Announcement of Opportunity

NASA's

Stand Alone Missions of Opportunity Notice (SALMON)

Notice of Intent to Propose Due Dates: **See program appendices**
Proposal Due Dates: **Through September 2, 2013; See program appendices**

OMB Approval Number 2700-0085

STAND ALONE MISSIONS OF OPPORTUNITY NOTICE (SALMON)
ANNOUNCEMENT OF OPPORTUNITY

FOREWORD

This National Aeronautics and Space Administration (NASA) Announcement of Opportunity (AO), entitled *Stand Alone Missions of Opportunity Notice (SALMON),* is intended to provide more frequent opportunities for science and technology investigations on space flight missions that advance the high priority science, technology, and exploration objectives of NASA's Mission Directorates.

Traditionally, Mission of Opportunity (MO) investigations have been solicited in conjunction with NASA's Science Mission Directorate's (SMD) Announcements of Opportunity (AO) for Principal Investigator (PI) led missions [e.g., Discovery, Explorer, Earth System Science Pathfinder (ESSP), Mars Scout, and New Frontiers]. This five-year omnibus AO will incorporate regular Program Element Appendices (PEAs) for general MO proposal opportunities, as well as focused proposal opportunities for specific flight opportunities. This AO includes U.S. and non-U.S.-led mission opportunities.

PEAs will solicit proposals addressing specific topics of interest from one or more of the NASA Mission Directorates. PEAs are added to this AO throughout the five years by amending the AO. Proposals will typically be solicited in one or more of five MO categories: Partner Missions of Opportunity, U.S. Participating Investigators, New Science Missions using Existing Spacecraft, Small Complete Missions, and Focused Opportunities.

Selection announcements are anticipated to occur within nine months of the release of the respective PEA. This approach will better enable NASA and the science and technology communities to maximize their participation in U.S. and non-U.S. space flight missions of opportunity.

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NOTICE

Proposers should be aware of the following significant changes in this AO from the Draft SALMON AO released for community comment on March 14, 2008.

- SALMON proposals will be submitted as paper proposals rather than as electronic proposals.
- For the Science Mission Directorate (SMD) only, U.S. Participating Investigators (USPI) proposals will be solicited with an amendment to the Research Opportunities in Space and Earth Sciences (ROSES) NASA Research Announcement (NRA). All SMD USPI proposals will be submitted following the requirements of ROSES.
- The way Co-Investigators indicate their commitment to the proposed investigation has changed (Section 4.6.9).
- The requirement for minimum cost reserves has been changed (Section 4.7.5).
- The spending cap on E/PO programs has been removed (Section 4.10.1).
- The requirement to submit a compliance checklist has been deleted (Appendix B).
- Two Program Element Appendices (PEAs) contained in the Draft SALMON AO are not included in this release of the SALMON AO while another PEA has been added.

In addition to the listed changes, this AO incorporates a large number of additional changes relative to the Draft SALMON AO 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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SUMMARY OF SOLICITATION

1.0 DESCRIPTION OF THE OPPORTUNITY

1.1 Introduction

The National Aeronautics and Space Administration (NASA) announces the opportunity to conduct science investigations and technology demonstrations of modest cost and scope as Missions of Opportunity (MO). Proposed investigations must address one or more of the goals established in the *2006 NASA Strategic Plan*, which establishes six major Strategic Goals over the next 10 years to achieve the national vision of extending the human presence across the Solar System, developing innovative technologies, and promoting international and commercial participation in exploration to further U.S. scientific, security, and economic interests. The *2006 NASA Strategic Plan* may be found at http://www.nasa.gov/about/reports/ or as NASA Policy Directive (NPD) 1001.0 in the NASA Online Directives Information Service (NODIS) at http://nodis.hq.nasa.gov/.

Working to meet these strategic goals are NASA's four Mission Directorates:

> The Science Mission Directorate (SMD) engages the Nation's science community, sponsors scientific research, and develops and deploys satellites and probes in collaboration with NASA's partners around the world to answer fundamental questions requiring the view from and into space. SMD carries out the scientific exploration of Earth and space to expand the frontiers of Earth science, heliophysics, planetary science, and astrophysics. See http://nasascience.nasa.gov/ for additional information.
>
> The Exploration Systems Mission Directorate (ESMD) develops capabilities and supporting research and technology that will make human and robotic exploration possible: develop a sustained human presence on the Moon; promote exploration, commerce, and U.S. preeminence in space; and serve as a stepping stone for the future exploration of Mars and other destinations. ESMD technologies ensure that astronauts are safe, healthy, and can perform their work during long-duration space exploration. ESMD does this by developing robotic precursor missions, human transportation elements, and life-support systems. See http://www.nasa.gov/directorates/esmd/ for additional information.
>
> The Space Operations Mission Directorate (SOMD) provides the Agency with leadership and management of NASA space operations related to human exploration in and beyond low-Earth orbit. SOMD also oversees low-level requirements development, policy, and programmatic oversight. Current exploration activities in low-Earth orbit are the Space Shuttle and International Space Station (ISS) programs. The directorate is similarly responsible for Agency leadership and management of NASA space operations related to Launch Services, Space Transportation, and Space Communications in support of both human and robotic exploration programs. See http://spaceoperations.nasa.gov/ for additional information.
>
> The Aeronautics Research Mission Directorate (ARMD) works to enhance the state of aeronautics for our nation. ARMD conducts cutting-edge, fundamental research in

traditional aeronautical disciplines and emerging fields to help transform the nation's air transportation system and to support future air and space vehicles. ARMD addresses the significant research challenges that must be overcome to create the Next Generation Air Transportation System and, as NASA looks to future challenges in space exploration, ARMD works to advance the fundamental understanding of key aeronautics disciplines to make it possible to safely fly through any atmosphere, whether our own or that of another planet. See http://www.aeronautics.nasa.gov/ for additional information.

NASA requires the flexibility to respond to and participate in flight missions of opportunity that advance high priority science, technology, and exploration objectives. The dynamic nature in which most national and international flight missions evolve from design concepts into funded missions requires solicitations for collaborative investigations to be reviewed, and awarded in a standard and expedient manner. The entire process – from the release of this Announcement of Opportunity (AO) or a solicitation amendment to proposal negotiation and award – is anticipated to take no more than twelve months. This short duration solicitation process allows NASA to tailor program requirements to meet national priorities for science, technology, and exploration, and it provides a standard mechanism for rapidly responding to flight opportunities on non-U.S. as well as U.S. Government and non-government spacecraft.

1.2 Overview of the SALMON Proposal Opportunity

NASA pursues its strategic goals using a wide variety of space flight programs that enable remote sensing, *in situ* investigations, and exploration. These investigations are carried out through flight of space missions in Earth orbit, to the Moon, and to or beyond objects in the Solar System, as well as through ground-based research activities that directly support these space missions.

This Stand Alone Mission of Opportunity Notice (SALMON) AO invites proposals for Missions of Opportunity. A Mission of Opportunity is a focused space flight investigation that offers high scientific or technical value for a modest cost to NASA.

For this SALMON AO, there are five categories of MO: Partner Missions of Opportunity (PMOs), U.S. Participating Investigators (USPIs), New Science Missions using Existing Spacecraft, Small Complete Missions (SCMs), and Focused Missions of Opportunity (FMOs).

- PMOs are investigations that provide a critical component of a non-NASA or non-US mission – such as a complete science instrument, hardware or software components, technology demonstrations, or microgravity research experiments.
- USPIs are complete science investigations that are realized through the participation of U.S. investigators on non-NASA missions and do not involve the development of hardware or software components or complete instruments or subsystems.
- New Science Missions using Existing Spacecraft are investigations that propose a scientific new use of existing NASA spacecraft.
- SCMs are scientifically or technically valuable investigations that can be realized within the specified cost cap, including the cost of their access to space if not provided by NASA.
- FMOs are investigations that address a specific, NASA-identified flight opportunity.

Further information on the five categories of MOs is provided in Section 5.

MO investigations may be proposed in response to specific Program Elements. Program Elements may provide a general proposal opportunity within a specific division of a NASA Mission Directorate for conducting science or technology investigations in space. Program Elements may also provide a focused solicitation directed at a specific opportunity identified by NASA for conducting science or technology investigations in space; an example of a focused opportunity would be NASA-provided instruments, hardware components, or microgravity experiments for a mission sponsored by another space agency with which NASA has established a strategic partnership. Each Program Element will specify a proposal due date as well as the constraints for that specific solicitation, including the sponsoring NASA Headquarters (HQ) division, the type of MO, the cost cap, and any launch-by or commitment-by dates. Program Elements will be added as appendices by amending the SALMON AO as needed. Program Element Appendices (PEAs) may contain sections that provide exceptions to the general SALMON requirements. Any such exceptions in the PEA take precedence over the requirements found in the main SALMON AO.

1.3 Terms Used in NASA's Mission Management Process

Proposals submitted in response to this AO must be for investigations encompassing all appropriate mission management processes. The NASA mission management process, as defined by NASA Procedural Requirements (NPR) 7120.5D, *NASA Space Flight Program and Project Management Requirements*, are: 1) Formulation, 2) Approval, 3) Implementation, and 4) Evaluation. *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 Missions of Opportunity is the step leading to a Confirmation Review with the appropriate Mission Directorate Associate Administrator. *Implementation* is divided into: Phase C – Final Design and Fabrication; Phase D – System Assembly, Integration and Test, and Launch (extending through in-orbit checkout); Phase E – Operations and Sustainment; and Phase F – Closeout. Phase E includes analysis and publication of data in the peer reviewed scientific and technical 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 NODIS.

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 NASA of the portion of the mission that is under PI management responsibility. This is the cost that is subject to any cost cap. (Section 4.7.4)
Value of any Contributions	The value of non-NASA contributions to the mission. (Section 4.7.2)
Total Mission Cost	PI Mission Cost + Value of any Contributions
Science/Technology Enhancement Option (STEO) Cost	The cost of any proposed STEO outside the cost cap. (Section 4.4.5)
Enhanced NASA Cost	PI Mission Cost + STEO Cost
Total Enhanced Mission Cost	Total Mission Cost + STEO Cost

The PI Mission Cost for all phases of the investigation will be an important factor in selection through this AO and in final confirmation for flight of selected investigation(s).

The Proposals submitted will constitute the investigation's Mission Concept (Pre-Phase A) as outlined in NPR 7120.5D. The evaluation of the proposals will constitute the Mission Concept Review toward the Key Decision Point (KDP) A, which is the gate into Phase A. The selection of proposals serves as KDP A.

1.4 Overview of Proposal Evaluation and Selection Process

Proposals will be assessed against criteria given in Section 7.2 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 NASA 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 appropriate Mission Directorate Associate Administrator and Management Council. The appropriate Mission Directorate Associate Administrator is the Selection Official, who will make the selections. Sections 7.1, 7.2, and 7.3 provide additional details on these activities.

2.0 NASA'S SAFETY PRIORITY

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 employees working under NASA award instruments), and
(4) high-value equipment and property.

3.0 PROPOSAL OPPORTUNITY PERIOD

Traditionally, Missions of Opportunity have been solicited in conjunction with SMD AOs for PI-led missions (e.g., Discovery, Explorer, Earth System Science Pathfinder (ESSP), Mars Scout, New Frontiers). To provide more frequent instrument development and flight opportunities,

NASA has developed this five-year omnibus SALMON AO. This SALMON AO incorporates PEAs for general MO proposal opportunities, as well as for focused proposal opportunities for specific flight opportunities.

Each PEA in this SALMON AO is a separate and independent solicitation. Each PEA has its own solicitation number in NSPIRES, its own proposal due date, and its own funding available for selected investigations.

In addition to the PEA opportunities released with this AO (Appendices H1- H5), additional Program Elements with corresponding proposal due dates will be released as amendments to this AO to meet general or specific mission opportunities. Selection announcements are anticipated to occur within nine months of the release of each respective PEA. This approach will better enable NASA and the research community to maximize their participation in U.S. and non-U.S. space flight missions of opportunity.

Specific schedules and due dates will be included in each Program Element Appendix.

4.0 CONSTRAINTS, GUIDELINES, AND REQUIREMENTS

4.1 Participation

Participation in this AO is open to all categories of organizations (U.S. and non-U.S.), including educational institutions, University Affiliated Research Centers (UARCs), industry, not-for-profit organizations, Federally Funded Research and Development Centers (FFRDCs), NASA Centers, the Jet Propulsion Laboratory (JPL), and other Government agencies. Non-U.S. participation is subject to the requirements in Section 4.8.

The NASA contract with Science Applications International Corporation (SAIC) for evaluation support under this AO 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 in proposal preparation and submission in any capacity under this AO.

4.2 General Constraints and Guidelines

This AO solicits investigations that address the NASA strategic science goals and research objectives outlined in the 2006 *NASA Strategic Plan* and can be executed within the scope of the SALMON AO cost cap (specific cost caps are listed in each PEA). Proposals must encompass all aspects of the investigation, from initial studies to delivery of the data to the appropriate NASA data archive, including a complete analysis of the data sufficient to accomplish the investigation’s science or technical objectives.

With appropriate NASA oversight, the responsibility for implementing a selected investigation rests with the PI and the investigation team, which will have a large degree of freedom to accomplish its proposed objectives and ensure mission success while keeping the cost within the proposed cost.

Each Program Element Appendix will identify the Program Office and associated NASA Center (or HQ) that has been assigned management responsibility for that Program Element of the SALMON AO. In this role, which is separate from the Center’s role as a possible partner in the investigation, the respective Program Office is responsible for NASA's fiduciary responsibility to ensure that SALMON investigations are achieved in compliance with the cost, schedule,

performance, reliability, and safety requirements committed to by the PI. In addition, the designated Program Office will be responsible for monitoring the PI's progress, and will maintain sufficient insight into the development activities to ensure that cost, schedule, and technical performance of the investigation remains within established boundaries. The level of each Program Office's involvement in this role may vary depending on the implementing organization and other programmatic considerations. NASA HQ will designate specific NASA Center teams that will work with the selected PIs and implementing organizations to define roles and responsibilities to fulfill this responsibility in the most effective manner.

If selected, mission teams shall abide by all applicable NASA and other Federal, state, and local laws and regulations.

Once an investigation has been selected, 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 investigation's technical objectives may be cause for its termination by NASA. Every aspect of a selected investigation must reflect a commitment to overall mission success while controlling total costs. 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 technical requirements do not exceed the constraints and guidelines identified in this AO and the PEAs will be considered as candidates for selection for flight.

4.3 Proposal Commitment

Proposals shall include a commitment by the PI and the proposing institution 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; where applicable, such cancellation will be taken by NASA regardless of the impact of this cancellation on any host mission. NASA funding for a selected investigation is subject to cancellation if there is a cost overrun charged to NASA for any reason, including a launch delay caused by any non-NASA partner. Any cancellation of the investigation will be consistent with the terms of the awarded contract, grant, or cooperative agreement.

4.4 Science and Technology Requirements

4.4.1 Scope of Proposed Investigations

The SALMON AO is intended to provide frequent opportunities for focused science and technology investigations that conclude with published articles in the peer-reviewed literature, as well as deposition of appropriately reduced and calibrated data in designated data archives. The relationship between the scientific or technical objectives, the data to be returned, and the payload to be used in obtaining the desired data shall be unambiguously and clearly stated by the proposer. SALMON investigation teams shall be responsible for initial analysis of the data, subsequent delivery of the data to NASA data archives, the publication of findings, and communication of results to the public.

Options for extended missions and other mission enhancements, if applicable, may be included in proposals to this AO as STEOs. Costs for such options will not count against the PI Mission Cost cap; however, selected proposers must understand that inclusion of such options in a selected proposal does not imply a commitment from NASA to also select these options (see Section II of Appendix A of this AO concerning partial selections).

4.4.2 Flow-down of Objectives

The science or technology goals, objectives, and necessary measurements that constitute the baseline mission shall be explicitly stated in the proposal.

The flow-down from investigation goals to measurement objectives and payload performance shall be stated clearly and supported by quantitative analysis where possible.

The scientific or technology validation requirements for the investigation shall be explicitly described and, where appropriate, these must be linked to the objectives of the host mission. The requirements that these objectives and observations impose on the mission design elements shall be discussed. An “objectives-to-measurements-to-mission traceability” discussion shall be included in the proposal in either narrative or tabular form.

Examples of a Science Traceability Matrix and a Mission Traceability Matrix are given in Tables B.3 and B.4, along with examples for elements in such matrixes.

4.4.3 Data Policies

In accordance with NASA policy, data is to be released as soon as possible after a brief validation period appropriate for the mission. SALMON investigators will be responsible for collecting the necessary scientific, engineering, and ancillary information 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 and technical community and to the general public and must be described in the proposal.

As a condition for confirmation of an investigation that is part of a non-NASA space mission, the organization sponsoring the full mission must make a commitment to enter into an appropriate agreement with NASA HQ that shall include provisions for sharing of flight data necessary for the completion of the selected SALMON investigation.

4.4.4 Data Analysis Requirements

The measurements to be taken in the course of the investigation, the data to be returned, and the approach that will be taken in analyzing the data to achieve the scientific objectives of the investigation shall be discussed in the proposal. This description shall identify the investigation to be performed, the quality of the data to be returned (e.g., resolution, coverage, pointing accuracy, measurement precision), and the quantity of data to be returned (e.g., bits, images). The relationship between the data products generated and the scientific/technical objectives, as well as the expected results, shall be explicitly described. A discussion of the scientific or engineering products (e.g., flight data, ancillary or calibration data, theoretical calculations, higher order analytical or data products, sample returns, witness samples, laboratory data) and how the science or engineering products and data obtained will be used to fulfill the objectives shall be included in the proposal. A discussion of how the data will be obtained, including a plan for delivery of the products, and the individuals responsible for the data delivery, shall also be provided.

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

4.4.5 Science/Technology Enhancement Options for Enlarging Impact

The baseline science or technology investigation proposed for this AO must be complete through Phase F – Closeout (see Section 1.3). This baseline investigation must contain, within the PI Mission Cost, all mission activities required to accomplish the proposed goals and objectives. STEOs for enlarging the science and technology impact beyond the baseline mission may be included in proposals to this AO. STEOs include, but are not limited to, activities such as extended missions, guest investigator programs, guest observer programs, participating scientist programs, interdisciplinary scientist programs, technology transfer, or archival data analysis programs. The proposal must define and describe any proposed STEO activities. As these proposed activities are options and are not included within the cost capped baseline investigation, the science and technology enabled by STEO activities are not considered as part of the scientific/technical merit of the proposed investigation.

Costs for STEO activities must be included in the estimate of Enhanced Mission Cost, but will not count against the PI Mission Cost (Section 4.7.4) and shall be listed separately in cost summary tables. Note that funding for STEO 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.

NASA considers any proposed STEO activities as options. Selection of a proposal which includes such options does not imply a commitment from NASA to fund them. NASA reserves the right to accept or decline proposed STEO 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 STEO activities may involve further reviews (e.g., a “Senior Review”). Proposals for extended SMD missions should be consistent with guidelines provided in the *SMD Mission Extension Paradigm* document; this document is included in the SALMON Reference Library (see Appendix C).

4.5 Technical Approach Requirements

4.5.1 General Policies

Proposals must encompass all aspects of the investigation, from initial studies to delivery of the data to the appropriate NASA data archive, including a complete analysis of the data sufficient to accomplish the investigation’s science objectives. NASA document NPR 7120.5D, *NASA Space Flight Program and Project Management Requirements*, defines the activities, milestones, and products typically associated with each mission phase, and shall be used as a guideline when defining a mission approach. Note that NPR 7120.5D levies requirements on missions, not proposals. Per NPR 7120.5D, investigations to be selected from this AO have been classified as Category 3 payloads. Investigations must be proposed at an appropriate risk classification per NPR 8705.4, *Risk Classification for NASA Payloads*, and may include a proposed payload designation of Class C or Class D as appropriate. Documents NPR 7120.5D and NPR 8705.4 may be found in NODIS. Investigations that intend to propose cost savings by defining PI roles or responsibilities that differ from the standard program requirements may require waivers; any such elements must be explicitly identified in the proposal and will require approval. The designated Program Office will be responsible for monitoring the PI’s progress and will maintain sufficient insight into the development activities to ensure that cost, schedule, and technical performance of the investigation remains within established boundaries. Mission teams shall abide by all applicable NASA and other Federal, state, and local laws and regulations.

4.5.2 Space Operations, Navigation, and Communication

As appropriate, mission operation requirements for SALMON investigations may 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 proposers. 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 Near-Earth Network (NEN), 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. Information on SCaN may be found at https://www.spacecomm.nasa.gov/spacecomm/.

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 Goddard Space Flight Center (GSFC) and JPL.

If required, costs for such services, whether obtained from NASA or other sources, shall be included in the mission cost estimate. Investigations shall conduct trade studies on the use of NASA-provided services versus any proposed alternatives after selection. SALMON investigations may optionally conduct such studies in Phase A, but shall conduct such studies no later than Phase B. NASA-provided services shall be employed whenever they meet objectives at a life-cycle cost to NASA that is less than or equal to any proposed alternatives.

As appropriate, SCaN will assist SALMON proposers in identifying SCaN services, prices, and cost trades. If the sponsoring NASA Mission Directorate and SCaN agree that the proposed approach does not result in the lowest life-cycle cost, the sponsoring NASA Mission Directorate may direct the SALMON investigation to modify its approach. Information on NASA-provided mission operation capabilities, including SCaN space communications services and costing, is given in the *NASA's Mission Operations and Communications Services* document, available in the SALMON Reference Library (Appendix C).

4.5.3 Launch Services

No launch vehicle will be provided by NASA through this solicitation unless otherwise described in a PEA.

4.5.4 Government Furnished Equipment (GFE)

No provision for GFE is anticipated or offered as part of this AO unless otherwise described in a PEA.

4.6 Management Requirements

4.6.1 General Management Requirements

For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort shall be described in the proposal.

4.6.2 Single Principal Investigator

SALMON 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; UARCs; industry or not-for-profit institutions; or from one of the NASA Centers, JPL, other FFRDCs, or other U. S. Government agencies. Teams may be formed from any combination of these institutions. Note that the level of detail required in the proposal is the same regardless of what organizations are partners in the investigation team, even a NASA Center.

A single PI shall be designated in each proposal and is the central person in charge of each investigation, with full responsibility for its scientific/technical integrity, for integrating with all of the 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 scientific/technical success of the investigation and must be prepared to recommend termination of the investigation when, in his or her judgment, the successful achievement of established minimum science/technical objectives, as defined in the proposal as the Minimum Investigation, is not likely to be achievable within the committed cost and schedule.

The PI is held responsible to NASA for all portions of the proposed project, including the publication of scientific or technical results, and must ensure that the project is completed within the committed cost and schedule, and that the proposed technical requirements of the mission are met.

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

The PI shall demonstrate within the proposal that his or her qualifications and experience are commensurate with the technical and managerial needs of the proposed investigation.

4.6.3 Management Plan and Structure for Flight Investigation

NASA intends to allow the PI and his or 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.

With the exception of USPI proposals, all PI-led investigations must have a qualified Project Manager (PM) named in the proposal. 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 shall be clearly defined. After selection for formulation, the proposed PM will oversee the Formulation Phase of the project. As part of the approval process that allows the project to move into the next Phase, NASA 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, and/or appropriate leads) during the performance of large or complex investigations may require concurrence by NASA; specific guidelines regarding NASA concurrence will be listed in the applicable PEAs. Commitment and past performance of the PM and his or her implementing institution will be important factors in the evaluation and selection of an investigation.

4.6.4 Risk Management

Each investigation shall define the risk management approach it intends to use to ensure successful achievement of the proposed objectives within established resource and schedule constraints. Included in this discussion of risk management shall be risk mitigation plans for any new technologies and plans 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 shall be identified. The proposer shall describe the approach for managing risk which will mitigate loss or serious degradation of the mission due to errors by human operators or errors or malfunctions in the mission data systems during the flight phase.

4.6.5 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. The role of each Co-I shall be described in the proposal. Other unfunded members of the proposal team may be included in the proposal as collaborators. PIs shall 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. Individuals with a minor or honorary role in the proposed investigation should not be included in the proposal. See Appendix B for details.

4.6.6 Contributions of Critical Goods and Services

The proposal shall describe all contributions of critical goods and services, the risks of these contributions, and adequate contingency plans for coping with the failure of a proposed cooperative arrangement. The commitment of every partner, U.S. or non-U.S., offering a contribution shall be documented in letters of commitment (Section 4.6.7). 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, or 3) do not have the required endorsement or a firm commitment to provide the offered contribution.

4.6.7 Letters of Commitment for Contributions

Letters of commitment signed by an institutional official must be provided from all organizations offering contributions of goods and/or services (both U.S. and non-U.S. but excluding Co-I

services) on a no-exchange-of-funds basis. This includes all non-U.S. organizations providing hardware or software to the investigation. Further details on the contents of proposed non-U.S. contribution letters of commitment are given in Section 4.8.3.

An institutional letter of commitment for a contribution shall 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-U.S. partners providing contributions may be judged noncompliant and may be rejected without review.

The required elements in a letter of commitment for a contribution are:

1. A precise description of what is being contributed by the partner and what assumptions are being made about NASA's role,
2. 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
3. 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. Letters shall be signed by institutional or Government officials authorized to commit their organizations to participation in the proposed investigation.

For non-U.S. individuals or institutions participating as team members or as contributors, requirements for letters of commitment may be found in Section 4.8.3.

4.6.8 Letters of Commitment for Major or Critical Participants

Letters of commitment are also required from all major or critical participants in the proposal, regardless of the source of funding. 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.

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:

1. A description of what is being provided,
2. The level of effort, and
3. A signature by someone authorized to commit the organization.

For organizations providing critical or major contributions, only a single letter of commitment is required.

Where the use of NASA's network services is within the capabilities described in the *NASA’s Mission Operations and Communications Services* document, no Letter of Commitment is required from the NASA network provider.

4.6.9 Statements of Personal Commitment for Co-Investigators

No personal or institutional letters of commitment are required for Co-Is in the Step 1 proposal. Co-Is indicate their commitment to the proposed investigation through NSPIRES (see Appendix B, Section IV for instructions). Personal and institutional letters of commitment for Co-Is will be required for Step 2 Concept Study Reports.

4.7 Cost and Schedule Requirements

4.7.1 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 NASA 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 the sponsoring NASA Mission Directorate 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 an effort complementary to the proposed investigation and the funding sources shall be identified.

Any non-NASA Federal Government elements of proposals must follow their organization's 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. There is a link to those standards in the SALMON Reference Library (Appendix C). In general, proposal budgets must include all costs that will be paid out of the resulting award.

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

Contributions of any kind, whether cash or non-cash (property and services), to SALMON investigations by organizations other than NASA are welcome. Values for all contributions of property and services shall be established in accordance with applicable cost principles. The value of non-U.S. contributions shall be converted to U.S. dollars using the official exchange rate. 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.

The cost of contributed hardware or software shall 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 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 shall 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 shall not 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.

4.7.3 Schedule Requirements and Constraints

For PMOs, it is incumbent on the proposing investigator to provide evidence in his or her proposal that the sponsoring organization (1) intends to fund the parent mission, and (2) that the endorsement of NASA for U.S. MO participation is required by the sponsoring organization prior to the endorsement date listed in the appropriate PEA. If NASA endorsement is not required by the sponsoring organization by the date listed in the respective Program Element, the proposal should be submitted in response to a future PEA solicitation.

4.7.4 Mission Cost Requirements and Constraints

The PI Mission Cost is the funding that NASA would be expected to provide to the investigation team over the course of the investigation, beginning with selection 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 launch services; ground data system including mission and data services provided by NASA's SCaN program, if required; labor (contractor); non-contributed NASA civil servant costs; reserves; contract fees, and other direct/indirect costs as applicable. Total funding limits are specified in each PEA. The PI Mission Cost is a consideration in the selection of investigations and in the continuing assessment of ongoing missions.

A selected investigation may result in a contract or a grant, depending on the nature of the proposal. Further information on grants is contained in NPR 5800.1E, *Grant and Cooperative Agreement Handbook*, available in NODIS and included in the SALMON Reference Library (see Appendix C).

4.7.5 Cost Risk Management

The proposal shall discuss the methods and rationale (cost models, cost estimating relationships of analogous missions, etc.) used to develop the estimated cost, and shall 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 shall be measured against the cost to complete all Phases (A-F) of the mission. A minimum 25% unencumbered cost reserve shall be required for Phase A through Phase D. Minimum unencumbered cost reserves are not specified in this AO for Phases E and F; the PI shall establish and identify adequate reserves for these phases of the mission. The PI Mission Cost shall not increase from that offered in the proposal. The cost reserves shall not include funded schedule reserves. Minimum funded schedule reserves are not specified in this AO for any phase; the PI shall establish and identify adequate funded schedule reserves for all phases of the mission.

4.7.6 Earned Value Management

It is not anticipated that the funding level for individual SALMON AO awards will require Earned Value Management (EVM) reporting. However, if an EVM requirement is specified in the Program Element, the requirements in NPR 7120.5D, Appendix F, Section 3.1.6(c) apply.

4.7.7 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. Offerors, other than small business concerns, are advised that contracts resulting from this AO may be 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. Subcontracting plans and proposed SDB participation targets, 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 during contract negotiation.

4.8 Overview of Non-U.S. Participation

NASA solicits research proposals from both foreign and domestic sources (see NASA FAR Supplement 1835.016-70). Owing to NASA's policy to conduct research with non-U.S. entities on a cooperative, no-exchange-of-funds basis, NASA does not normally fund non-U.S. research proposals or non-U.S. research efforts that are part of U.S. research proposals. Rather, cooperative research efforts are normally implemented via Agreements between NASA and the non-U.S. entity involved. Thus, non-U.S. proposers, whether as primary proposers or as participants in U.S. research efforts, are expected to arrange for non-U.S. financing for their portion of the research.

4.8.1 General Guidelines Applicable to Non-U.S. Proposals and Proposals Including Non-U.S. Participation

All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals, foreign and domestic, shall be typewritten in English and must comply with all submission requirements stated in this AO and in Appendix B of this AO.

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 international agreements, as well as for obtaining any necessary licenses for exchanges of goods and technical data. An adequate and realistic schedule must be allocated for having international agreements executed.

Any proposed non-U.S. 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 shall 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 proposal 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 shall take the form of the flowchart specified in Section XII.4 of Appendix B.

4.8.2 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 (including the PEAs). 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).

4.8.3 Letters of Commitment for Non-U.S. Participation

For participation by non-U.S. individuals and/or institutions as team members or as contributors to SALMON investigations endorsement by the institutions and governments involved is expected. If government funding or support is required, then a government commitment is also expected. The letter of commitment should 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 should be submitted with the proposal. Proposals without the required letters of commitment can be deemed noncompliant and returned to the proposer without review.

The expected 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 should be signed by an authorized officer or representative of the partner institution.

4.8.4 U.S. Export Laws and Regulations

Proposals that include international participation, either through involvement of non-U.S. nationals and/or involvement of non-U.S. entities shall contain 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. Proposers must also comply with NFS clause 1852.225-70 entitled “Export Licenses.” The proposal shall describe in detail the proposed international participation and is to include, but not be limited to, whether or not the international participation would require exporting or importing of hardware technical data or the provision of defense services and whether the prospective proposer will obtain 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*.

4.8.5 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 their respective responsibilities.

It is NASA's policy to establish formal international agreements for cooperative activities with non-U.S. partners. Owing to the short duration of the Phase A concept study, it may not be possible for NASA to conclude an international agreement prior to the conclusion of Phase A. Additionally, in some cases, interim agreements may be put in place until a more permanent arrangement is reached.

If applicable, proposals shall demonstrate how the Phase A concept study can be completed in the absence of an international agreement.

4.8.6 Requirements for Proposals Containing Non-U.S. Contributions

Contributions, particularly non-U.S. contributions, offer benefits but also represent complexity and risk to an investigation. Therefore, proposals shall 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 or holding reserves to develop the contribution directly. Reserves held for this purpose will be considered by NASA to be encumbered. When no mitigation is possible, this shall 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 shall be allocated for the execution of international agreements. Any proposed international participation shall 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 unselectable.

Proposals with non-U.S. participation are required to include a table listing (see Appendix B, Section XII.4):

1. Non-U.S. participants (individuals, institutions),
2. Roles and responsibilities,
3. Approximate value of contribution and method for estimating value,
4. Funding organization, and
5. Cross-reference to letters of commitment in the Appendix.

Proposals with non-U.S. participation shall 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.

4.9 Requirements for Export Controlled and Classified Material in Proposals

4.9.1 Export Controlled Material

While explicit inclusion of export controlled 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. In some circumstances this may complicate NASA's ability to evaluate the proposal, since occasionally NASA may use the services of non-U.S. 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 title 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.

4.9.2 Restriction on the use of Classified Material

It is NASA policy that proposals shall not contain security-classified material. However, should the project proposed require access to classified information, or should the result of the project generate such material, the proposer shall comply with all Government security regulations.

4.10 Education and Public Outreach (E/PO) Requirements

4.10.1 Overview

NASA invests in 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. NASA's E/PO portfolio includes higher education programs that provide research support and training to outstanding students pursuing degrees in all disciplines engaged in space science and technology development; 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 or other citizen scientists. NASA's past investments in E/PO have resulted in a continued supply of a competent workforce, and the development of new leaders in space exploration. In addition, many award winning programs have engaged educators in and informed the citizenry about recent advances in NASA programs, as well as touched millions of learners of all ages.

While recognizing the benefits of a robust E/PO program, due to the rapid response and limited funding envisioned for these unique mission opportunities, the SALMON AO does not require an E/PO element to the primary investigation. If an optional E/PO is proposed, a brief overview of the planned E/PO activities and their relationship to the proposed mission shall be provided in accord with the instructions provided in Section XI of Appendix B.

4.10.2 Student Collaboration (SC)

NASA recognizes the value of directly involving undergraduate and/or graduate students in a spaceflight experience. PI's are encouraged, but are not required, 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 disconnected from the flight mission activities are not allowed.

The proposal shall clearly identify any 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 proposal shall 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 element is not funded, encounters technical, schedule, or cost problems, or fails in flight. The proposal shall demonstrate that the SC is to be clearly separable from the rest of the proposed effort. The proposal shall also include a plan for the mentoring and oversight of students to maximize the opportunity for teaching, learning, and success in contributing to the mission.

Any proposed SC will be evaluated as described in Section 7.2.5 and in the *Explanatory Guide to the NASA Science Mission Directorate Educational Merit Evaluation Factors for Student Collaboration Elements* in the SALMON Reference Library (Appendix C). 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.

Student collaborations must involve higher education students (undergraduate and graduate students). 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 SC.

5.0 MISSIONS OF OPPORTUNITY CATEGORIES

5.1 Introduction

SALMON MO investigations fall into five categories – Partner Missions of Opportunity (PMOs) (Section 5.2), U.S. Participating Investigators (USPIs) (Section 5.3), New Science Missions using Existing Spacecraft (Section 5.4), Small Complete Missions (SCMs) (Section 5.5), and Focused Missions of Opportunity (FMOs) (Section 5.6).

By supporting U.S. participation in PMO investigations, NASA seeks to allow the scientific/technical community the opportunity to conduct a science investigation of interest to NASA by providing a critical part of a U.S. or non-U.S. space mission. USPIs participate in the science investigation of a non-NASA space mission without contributing to the mission implementation itself. The New Science Mission using Existing Spacecraft opportunity solicits proposals for new science investigations that utilize existing in-flight spacecraft that have completed their prime flight missions. The SCM opportunity permits targeted, compelling science investigations to be proposed at a much lower cost than Small Explorer (SMEX) missions. FMO investigations will address a specific, NASA-identified flight opportunity.

Although non-U.S. participation is allowed in SALMON investigations, none is required.

5.2 Partner Missions of Opportunity

For the purpose of this AO, a PMO is one in which the proposer offers to participate in a non-NASA space mission that is planned or that has been approved by its sponsoring organization. By funding U.S. participation in a non-NASA space mission, NASA seeks to allow the scientific community to conduct a science or technology investigation of interest to NASA as part of a non-NASA space mission. Such missions may be sponsored by non-U.S. governments, by other U.S. agencies, or by private sector organizations. PMO investigations on a military satellite are allowed as long as the satellite is not planned for weapons testing.

Participation in a non-NASA space mission could take many forms, such as providing a complete science instrument, hardware components, technology demonstrations, microgravity research experiments, or expertise in mission critical areas. Non-hardware mission critical areas include ground systems, pipeline data processing and archiving systems, space navigation and communication capabilities, etc. Contributions to a non-NASA space mission by individual Co-Is, such as participation in instrument design, modeling and simulation of the instrument's operation and measurement performance, calibration of the instrument, scientific analysis and/or research of the data returned, and/or development of innovative data analysis techniques, should be proposed as USPI investigations (Section 5.3).

NASA will evaluate the proposed 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 in the proposal their complete investigation and how it is accomplished in the sponsor's mission. This documentation must be sufficient to allow an evaluation of the adequacy of the sponsor's mission to provide all resources required for a successful investigation.

Note that selection by NASA through this AO does not constitute selection of a PMO investigation as part of the non-NASA mission, which is necessarily a decision made by the sponsor of the mission. Instead, selection is a commitment by NASA to fund the NASA portion of the MO investigation, with funding beyond basic studies not starting until detailed design of the mission itself

is underway. If a PMO investigation is selected both by NASA and by the mission sponsor, the PI is fully responsible to NASA for the scientific integrity, as well as the leadership and management, of the NASA contribution to the mission.

Any date constraints, including the timetable for the proposing PI to provide evidence that the sponsoring organization intends to fund the primary host mission and when the NASA commitment for U.S. participation is required by the sponsoring organization, will be listed in the individual PEA. Unless specified otherwise in the PEA, the launch date itself is not constrained.

As a matter of NASA policy, its sponsorship of an PMO 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 NASA, the PI may receive NASA funding for costs that include integration as well as launch support services, and will be responsible for payment of these costs. Federal law prohibits NASA from paying for any non-U.S. launch costs.

NASA scientific investigations are initiated primarily for the conduct and publication of scientific research and disseminating those results for the benefit of the U.S. science community. 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 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 agreement with the mission sponsor in advance of launch to ensure that this activity will be done. NASA recognizes that PMO investigation teams may justifiably incur additional data analysis responsibilities defined by the policies of the sponsor of the parent mission.

5.3 U.S. Participating Investigator

A proposed investigation as a U.S. Participating Investigator on a non-NASA space mission may be as a Co-I for an instrument, experiment, or technology demonstration that is being built and flown by a sponsor agency other than NASA. The Co-I role can include, but is not limited to, instrument design, modeling and simulation of the instrument’s operation and measurement performance, calibration of the instrument, scientific analysis and/or research of the data returned, and/or development of innovative data analysis techniques. A U.S. Participating Investigator may also serve as a member of a non-NASA space mission science or engineering team and participate in science team activities such as mission planning, mission operations, data processing, data analysis, and data archiving. No matter what the nature of the U.S. Participating Investigator role, an investigation proposed under this category must be for a science or technology investigation and must include some meaningful data analysis component, archiving of the complete data set, and the publication of science results in the peer reviewed literature. All aspects of the investigation through publication must be within the proposed cost.

Investigations requiring the provision of flight hardware should be proposed as a PMO investigation (Section 5.2).

SMD intends to solicit USPI investigations through its ROSES NRA. At the same time as the release of a USPI PEA in SALMON, NASA will release an amendment to ROSES. The USPI PEA will refer proposers to the ROSES amendment. USPI Notices of Intent (NOIs) to propose and proposals will be submitted in response to the ROSES amendment, will be subject to the proposal guidelines

specified in ROSES, and will be reviewed and selected using the proposal criteria specified in ROSES.

5.4 New Science Missions using Existing Spacecraft

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 once it 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 objectives of the research programs identified in the *NASA Strategic Plan* and in the respective PEA.
- The proposal must be solely for mission operations, data analysis, and/or ground hardware and not propose any hardware or other modifications to the spacecraft or its prime mission except when new onboard software is required to effect the investigation. In addition, the proposed investigation must not impose any changes on the requirements of the prime mission.

New investigations using science instruments or other technology currently aboard the ISS will be considered under this proposal category.

In addition to meeting other proposal requirements, a proposal for a new science mission 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 operations team. It is not required that the current mission operations team be a part of the new science mission proposal. However, in the case where the current mission operations team is not a part of the new science mission proposal, the proposer must show that operations can be transferred to the new science mission 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 extension is required by the date listed in the respective PEA.

5.5 Small Complete Missions

Under this AO, complete but small science, research, or technology investigations may be solicited by a specific Program Element. In such a case, scientifically or technically valuable proposals at any cost within the budget allocation listed in the PEA are permitted. The launch date timetable for proposed SCMs will be listed in the PEA.

The complete but small science, research, or technology investigation must include its own 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. Launch services, if provided, will be described in the appropriate PEA. Proposals for the delivery and use of science instruments or other technology to the ISS will be considered under the Small Complete Mission category.

5.6 Focused Missions of Opportunity

NASA may enter into strategic arrangements with other space agencies to collaborate on a mission. NASA's contribution may be a science, research, or technology investigation that requires the provision of an instrument, experiment, hardware components, or software for the other agency's mission. There may be other circumstances as well, where NASA identifies an opportunity for a space flight investigation and wants to solicit investigations. Such opportunities are called Focused Missions of Opportunity and may be solicited by a specific Program Element.

Focused Mission of Opportunity program elements will fully describe the nature of the opportunity including any schedule, cost, and technical constraints.

6.0 PROPOSAL PREPARATION AND SUBMISSION INFORMATION

6.1 Preproposal Activities

6.1.1 Technical and Scientific Inquiries

All inquiries of a general nature should be directed to the SALMON AO Program Executive as designated in this section, while inquiries specific to a Program Element should be addressed to the Program Element Point of Contact (POC) identified in each PEA to this AO. Inquiries are preferred in writing and may be sent by E-mail; the character string "SALMON AO" (without quotes) should be included in the subject line of all transmissions.

General inquiries may be addressed to **[Point of contact updated on November 1, 2010]:**

Dr. Paul Hertz
NASA Headquarters
Washington, DC 20546-0001
Tel: 757-846-0986
Email: paul.hertz@nasa.gov

Questions, concerns, or requests for information or clarification regarding this AO shall be directed only to formal points of contact designated here or in the appropriate PEA. No communications concerning this AO may be made to any other NASA official.

6.1.2 SALMON Acquisition Homepage

The SALMON Acquisition Homepage available at http://salmon.larc.nasa.gov/, will provide updates and information on any AO addendum during the SALMON AO solicitation process. It will provide the SALMON Reference Library with links to NASA and Mission Directorate documentation, information about the preproposal conference, responses to frequently asked questions, and other items related to the SALMON AO.

6.1.3 Preproposal Conference

The respective PEAs will state whether or not a preproposal conference will be held and identify the conference location approximately 3 to 6 weeks after the PEA release. Preproposal conference information, including date, location, and logistics, will be made available on the SALMON Acquisition Homepage at the address given in Section 6.1.2 above, prior to the preproposal conference.

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 NASA areas of interest. The preproposal conference also will address questions that are received by NASA at least one week prior to the preproposal conference. Questions should be addressed to the SALMON AO Program Executive at the address in Section 6.1.1 or to the appropriate Program Element POC at the address given in the PEA. 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. All answers will be made accessible to the public. Material presented at the preproposal conference, including answers to questions submitted in advance, will be posted on the SALMON Acquisition Homepage at the address given in Section 6.1.2.

6.1.4 Notice of Intent to Propose

To assist the planning of the proposal evaluation process, NASA encourages the submission of a NOI to propose by all prospective proposers in accordance with the schedule listed in the appropriate PEA. 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 SALMON AO updates as may occur, up to the time of the proposal due date. All updates will also be posted at the SALMON Acquisition Homepage at the address given in Section 6.1.2.

An NOI is submitted electronically by entering the requested information into the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at http://nspires.nasaprs.com/. Proposers who experience difficulty in using this site should contact the NSPIRES 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) Proposal Category and Program Element (see Section 5 and the appropriate PEAs). Each NOI and proposal can only be submitted to one PEA.

(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 investigation; and
   (ii) identification of any new technologies that may be employed as part of the investigation.

(e) The name of the Lead Representative from each organization (industrial, academic, not-for-profit, and/or Federal) included in the proposing team as may be known by the NOI due date. 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. Such individuals should ensure that they are registered in NSPIRES in time for proposal submission.

6.1.5 Teaming Interest

As a result of recent AOs similar to this one, commercial aerospace and technology organizations have requested a forum to inform potential proposers of their services and/or products. NASA is willing to offer this service with the understanding that the Agency does not endorse any information thus transmitted and does not accept responsibility for the capabilities or actions of these organizations. The organizations listed on the SALMON AO Teaming Interest page accessible from the SALMON AO Acquisition Homepage (see address given in Section 6.1.2) have expressed an interest in teaming with other organizations on SALMON AO proposals. This is not a comprehensive list of organizations that are capable of teaming but is simply a list of those organizations that have asked to be included. Proposers are not required to team with any organization on this list.

6.2 Format and Content of Proposals

6.2.1 Structure of Proposals

A uniform proposal format is required from all proposers to aid in proposal evaluation. General NASA guidance for proposals is given in Appendix A of this AO, which is considered binding unless specifically amended in this AO. The required proposal format and contents are summarized in Appendix B. Proposers are also required to respond to the specific proposal criteria included in each relevant PEA included in this AO. Failure to follow the applicable instructions and the required Program Element proposal formats may result in reduced ratings during the evaluation process or, in extreme cases, could lead to rejection of the proposal without review.

6.2.2 Requirements for Electronic Cover Page

This AO requires that the proposer register key data concerning his or her intended submission with NASA's master proposal database system, NSPIRES, located at http://nspires.nasaprs.com/. 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.

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). For additional information, see Appendix B, Section III.

6.2.3 Signature Authorization and Certifications and Commitments

Proposals must have a Cover Page that includes a Proposal Summary that is to be submitted electronically through the NSPIRES website, following the instructions given in Appendix B.

The authorizing institutional signature on the electronically submitted cover certifies that the proposing institution has read and is in compliance with the three required certifications printed in full in Appendix D.

6.3 Proposal Submission

6.3.1 Submittal Address

The original signed proposal; 55 hard copies of the proposal; and 56 clearly labeled, attached, Compact Discs that each contain: a single, searchable Portable Data Format (PDF) version of the proposal, a PDF version of the Fact Sheet, and Microsoft Excel versions of the required cost tables (in either separate files or a single file with multiple worksheets) shall be delivered to the following address by the proposal deadline. **[Address updated on November 1, 2010]**

NASA Research and Education Support Services (NRESS)
Suite 500
2345 Crystal Drive
Arlington, VA 22202

Phone for commercial delivery: 202-479-9030

6.3.2 Deadline

The proposal must be received no later than the time deadline on the proposal due date given in the relevant PEA. Unless stated otherwise in the relevant PEA, the deadline is 4:30 p.m. Eastern Time.

Proposals submitted later than the proposal due date and deadline and will be considered late. Proposers should be aware that neither NASA personnel nor the employees of the support contractor that receives and handles proposals for NASA are empowered to authorize the submission of a late proposal and, therefore, such permission should not be requested. The decision to submit a late proposal is solely that of the proposer. Proposals that are late will be handled in accordance with NASA's provisions for late proposals (Appendix A, Section VII). Proposals received after the due date may be rejected without review. If a late proposal is rejected, it is entirely at the discretion of the proposer whether or not to resubmit it in response to a subsequent appropriate solicitation.

6.3.3 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 two weeks after submittal of their proposals should contact the POC listed in the appropriate PEA.

7.0 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

7.1 Evaluation and Selection Process

7.1.1 Evaluation Process

All proposals will be initially screened to determine their compliance to requirements and constraints of this AO. Additional compliance checks occur during the evaluation process. Proposals that do not comply may be declared noncompliant and rejected without further review. A submission compliance checklist is provided in Appendix F. This checklist provides proposers a list of the items that NASA will check for compliance before releasing a proposal for evaluation. This checklist is for the convenience of proposers; it is not required to be submitted as part of a proposal.

Proposals for each type of MO listed in Section 5, solicited in the applicable PEA, and deemed in compliance with this AO will be assessed against the evaluation criteria outlined in Section 7.2 by panels of individuals who are peers of the proposers. Reviewers will be instructed to evaluate all proposals independently and not to compare investigations. These panels may be augmented through the solicitation of non-panel (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.

7.1.2 Categorization Process

An *ad hoc* Categorization Subcommittee of the AO Steering Committee (Section 7.1.3), composed wholly of civil servants, will convene to consider the peer review results. This Subcommittee will categorize the proposals in accordance with procedures required by NFS Part 1872.403-1. These categories are defined as follows:

Amended on March 25, 2010. Definition has been corrected to match NFS 1872.403-1.

> 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.

7.1.3 Steering Process and Selection

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 the sponsoring NASA Mission Directorate. 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 the sponsoring NASA Mission Directorate, who will make the final selection(s). As the Selection Official, the Mission Directorate Associate Administrator may consult appropriate management councils concerning the selections.

Category III investigations, as described in Section 7.1.2, may be considered for development funding. Any Category III investigation selected for 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 during evaluation of the proposal. The revised statement of work will be reviewed by NASA.

7.2 Evaluation Criteria

7.2.1 Overview

The evaluation criteria below will be used to evaluate and categorize proposals as described in Section 7.1. For a PMO, U.S. Participating Investigator, or some Focused Opportunities, the proposed investigation will encompass 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 or technical merit of the proposed investigation;
- Implementation merit and the feasibility of the proposed investigation; and
- Technical, management, and cost feasibility, including cost risk, of the proposed investigation.

Standard evaluation factors for each of these criteria are described below. PEAs may specify additional evaluation factors for these three criteria, as may be appropriate.

The proposal categorizations discussed in Section 7.1.2 will be based on these criteria, which are discussed in more detail below. For categorization, scientific or technical merit is weighted 40%, implementation merit and feasibility of the proposed investigation is weighted 30%, and technical, management, and cost feasibility is weighted 30%.

7.2.2 Scientific or Technical Merit of the Proposed Investigation

Each proposed investigation will be evaluated for its scientific or technical merit as expressed in terms of specific major and minor strengths and weaknesses. To evaluate intrinsic 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 science, research, or technology programs identified in the *NASA Strategic Plan* (see Section 1). For science investigations, this evaluation will include how well the investigation fills gaps in the understanding of science and thereby provides for progress in one of the NASA science research programs, and/or how well the proposed investigation synergistically supports other ongoing science missions related to these research programs sponsored by NASA or a non-U.S. space agency, and whether or not it provides ancillary benefits to the U.S. science program. For technology investigations, this evaluation will include how well the investigation advances the current technology readiness level of the proposed technology, and how well the technology advancement addresses the needs of NASA missions. A major element in the assessment of scientific or technical merit will be whether the data that are proposed to be gathered will be sufficient to complete the proposed investigation. Merit will be evaluated for the baseline proposed investigation; science or technical enhancements beyond the baseline investigation will not contribute to the assessment of the merit of the proposed investigation.

This evaluation will result in narrative text, as well as an appropriate adjectival rating.

7.2.3 Implementation Merit and the Feasibility of the Proposed Investigation

Each proposed investigation will be evaluated for its scientific or technical implementation merit, including feasibility, resiliency, and the probability of success as expressed in terms of specific major and minor strengths and weaknesses. Implementation merit and feasibility will be evaluated by

assessing the degree to which the investigation will address the proposed scientific or technical goals and objectives, the degree to which the proposed instrument(s) or technology can be built using the proposed methods, the degree to which the proposed instrument(s) or technology 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 data analysis (i.e., calibration/validation) and archiving plan will include an assessment of planning and budget adequacy and evidence of plans for well documented, high level products and software usable to the entire community, an assessment for adequacy of resources for physical interpretation of data and reporting scientific or technical results in refereed journals, and the proposed plan for the timely release of the data to the public domain. Any science or technology enhancement options (such as an extended mission, a guest investigator program, a technology transfer program, or an archival data analysis program) will be evaluated as part of this criterion; the enhancement options will be evaluated for the potential of the selected activities to enlarge the impact of the mission, and the appropriate costing of the selected activities. 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. 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 each 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.

7.2.4 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 schedule and cost. The evaluation will consider, as appropriate, 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 schedule, the mission’s interdependencies, and associated schedule margins will also be evaluated. When appropriate, the likelihood of launching by the proposed launch date will be assessed. 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. This will include an assessment of the approach to descope the Baseline Investigation 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 (a *TRL Definitions* document may be found in the SALMON Reference Library), will be penalized for risk if adequate backup plans to ensure success of the investigations are not described.

The methods and rationale used to develop the estimated cost, and the discussion of cost risks, will be assessed. 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 investigations, etc.

The risk management approach the science investigation 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 or her implementing institution, against the needs of the investigation.

The role, qualifications, and experience of the PM (if assigned separately from the PI) will be assessed, as will the commitment and past performance of the PM and his or 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.

For PMO investigations that fly on non-NASA missions, factors involving spacecraft and launch vehicle capabilities will be considered in the evaluation to assess the adequacy of mission resources in support of a successful PMO investigation (Section 5.2).

USPI missions do not require the provision of flight hardware (Section 5.3), and only those factors relevant to a proposed USPI activity will be evaluated.

This evaluation will result in narrative text, as well as an appropriate adjectival rating.

7.2.5 Overall Merit of the E/PO and Student Collaboration

E/PO and SC activities are optional under this SALMON AO. If proposed, the overall merit of the E/PO and SC activity will be judged separately from the proposed primary investigation. SC proposals, if any, will be evaluated for overall merit and will not be penalized for any inherent higher cost, schedule or technical risk, as long as the SC is shown to be clearly separable from the primary objectives per Section 4.10.2. The necessary quality indicators that are used in all evaluations of SMD E/PO proposals are contained in the *Explanatory Guide to the NASA Science Mission Directorate Education and Public Outreach Evaluation Factors*, available on the web at: http://nasascience.nasa.gov/researchers/education-public-outreach/explanatory-guide-to-smd-e-po-evaluation-factors. The necessary quality indicators that are used in all evaluations of SMD SC proposals are contained in the *Explanatory Guide to the NASA Science Mission Directorate Educational Merit Evaluation Factors for Student Collaboration Elements*, available in the SALMON Reference Library (Appendix C).

7.3 Selection Factors

As described in Section 7.1, the results of the proposal evaluations based on the criteria above and the subsequent proposal categorizations will be considered in the selection process. In addition, the proposed cost to the sponsoring NASA Mission Directorate 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 select any proposals, including, but not limited to, available funding and maintaining a programmatic and scientific balance across the sponsoring NASA Mission Directorate. Although each NASA Mission Directorate develops and evaluates its program strategy in close consultation with the scientific community, each program is an evolving activity that ultimately depends upon the most current Administration policies and budgets, as well as the strategic priorities identified by the 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 each Program Element of this AO will be to maximize scientific or technical return and minimize implementation risk within the available budget for this program. Consistent with applicable Program Element funding availability, one or more investigations may be selected. Depending on the availability of proposals of appropriate merit, this objective may be achieved by the selection of a single investigation at the cost ceiling for specific Program Element investigations, one or more investigations significantly below the cost ceiling, or a combination of investigations of various costs.

A proposal may be selected for development 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. Any request for selection without a Phase A concept study must be fully justified in the proposal. For such a selection, the proposal must (1) conform to the SALMON guidelines for the appropriate category of investigation, and (2) contain a commitment by the PI for the cost, schedule, and scientific and technical performance of the investigation with the resolution equivalent to that expected at the end of a Concept Study. If required, a selected investigation not proposing Phase A activities will submit a concept study report to NASA for detailed review. This concept study report is expected to address plans for all programmatic objectives listed in this AO.

7.4 Implementation Activities

7.4.1 Notification of Selection

Following initial selection, the PIs of the selected investigations will be notified by telephone, followed by formal written notification. The formal notification may include special instructions or conditions for the selection and the implementation of the proposed investigation. The appropriate NASA Program Office will contact each selected PI as soon as possible after selection to clarify requirements and responsibilities of all parties having roles in each selected investigation. Proposers of investigations that were not selected will be notified in writing and offered a debriefing as described in Section 7.6.

7.4.2 Award Administration and Funding of Investigations

It is anticipated that grants or cooperative agreements will be awarded for any investigations selected under this AO that do not deliver flight hardware or software.

It is anticipated that contracts will be awarded for any investigations selected under this AO that deliver flight hardware or software. If the contract exceeds $650K, the contractor will have to certify the proposed costs for the contract, in accordance with FAR 15.406-2.

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. 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.

7.4.3 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. Results of this Confirmation Review is a decision to proceed or not. This decision will be based upon review of all aspects of the Phase B results, and evidence of satisfactory technical, cost, and schedule performance including demonstration of the required minimum unencumbered cost reserve. In addition, for any PMO, a commitment from the organization sponsoring the full mission to enter into an appropriate agreement with NASA is required by Confirmation Review. Failure to provide such an agreement may lead to a decision by NASA to terminate additional funding beyond Phase B. Once a mission is confirmed, no rephasing of Phase E costs to Phase C/D will be permitted.

7.5 Selection of Previously Submitted but Unfunded Proposals

If an investigation selected and awarded under this SALMON AO does not pass its Confirmation Review, or if additional sources of funding for this AO become available, NASA reserves the right to select for award another highly rated proposal that was previously submitted to this AO but not initially selected for funding.

7.6 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 HQ 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.

7.7 Agency Procurement Ombudsman

The Agency Procurement Ombudsman, designated in NPD 5101.32D, *Procurement*, 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. The clause at NFS 1852.215-84 (“Ombudsman”) is incorporated into this AO. The Agency Procurement Ombudsman is

Director, Contract Management Division
Office of Procurement
NASA Headquarters
Washington, DC 20546
Telephone: 202-358-0445

7.8 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
Telephone: 202-358-2090

8.0 CONCLUSION

This SALMON AO offers the US scientific community a new avenue to participate with NASA in accomplishing national science exploration goals, while generating opportunities to enhance education and engage the public in the excitement of science discoveries. NASA invites both the U.S. and non-U.S. science communities to participate in proposals for investigations to be carried out as a result of this Announcement.

Edward J. Weiler
Associate Administrator
for Science Mission Directorate

William H. Gerstenmaier
Associate Administrator
for Space Operations Mission Directorate

Richard J. Gilbrech
Associate Administrator
for Exploration Systems Mission Directorate

Jaiwon Shin
Associate Administrator
for Aeronautics Research 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 selecting official. In addition, NASA reserves the right to require use of Government instrumentation or property that subsequently becomes available, with or without modification, that meets the investigative objectives.

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 4.8 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 selecting official deems it to offer NASA a significant technical advantage or cost reduction. (See NFS 18-15.208.)

VIII. SOURCE OF SPACE INVESTIGATIONS

Investigators are advised that candidate investigations for space missions can come from many sources. These sources include those selected through this 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 down selection 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 down select 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.

END OF APPENDIX A

APPENDIX B: GUIDELINES FOR PROPOSAL PREPARATION

I. INTRODUCTION

The following guidelines apply to the preparation of proposals in response to this AO. The material presented is a guide for the prospective proposer and is not intended to be all encompassing. The proposer must, however, provide information relative to those items applicable to the PEA being responded to, as well as other items required by this AO.

In the event of an apparent conflict between the guidelines in the SALMON AO, Appendix A, Appendix B, and a PEA, the order of precedence is: the PEA, then the SALMON AO, then Appendix B, then Appendix A.

II. GENERAL GUIDELINES

Note carefully the following requirements for submission of a proposal:

• Every organization that intends to submit a proposal to NASA in response to this AO, including educational institutions, industry, not-for-profit institutions, JPL, NASA Centers, and other U.S. Government agencies, must be registered in NSPIRES. Registration must be performed by an organization's Electronic Business Point-Of-Contact (EBPOC) in the Central Contractor Registry (CCR).

• The top level of any organization requesting NASA funds through the proposed investigation must be listed on the Proposal Cover Page (Section 6.2.2). NASA will not fund organizations that do not appear on the Proposal Cover Page.

• Each individual team member (e.g., PI, Co-Is, etc.), including all personnel named on the proposal's electronic cover page, must be individually registered in NSPIRES.

• Each individual team member (e.g., PI, Co-Is, etc.), including all personnel named on the proposal's electronic cover page, must specify an organizational association. The organizational association specified must be the organization through which the team member is participating in the proposed investigation. If the individual has multiple associations, then this organization may be different from the individual's primary employer or preferred mailing address.

• Proposers must comply with any format requirements specified in this AO. Only appendices that are specifically requested in this AO will be permitted; proposals containing unsolicited appendices may be declared noncompliant.

• All documents must be written in English, use metric and standard astronomical units, and be clearly legible. Proposals must contain no more pages than given in the table below. 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. Fold out pages are permitted; each "n-page" foldout counts as "n" pages. Each side of a sheet containing text or an illustration counts as a page. Margins at the top, both sides,

and bottom of each page shall be no less than 1 inch if printed on 8.5 x 11 inch paper; no less than 2.5 cm at the top and both sides, and 4 cm at the bottom if printed on A4 paper.

Table B.1 provides restrictions and guidance on page count within the proposal. Note that some of the PEAs may specify different page limits for the main body of the proposal; if so, these page limits will be prominently given in the *Summary of Key Information* section that concludes each Program Element description.

General guidelines and requirements for each proposal section are described in the following subsections. Program Element proposals solicited under this AO may specify solicitation topics and additional specific requirements for proposal submission.

III. 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 electronically submitted by an official of the proposing organization who is authorized to commit the organization. This electronic 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. If the certifications need to be amended, they may be submitted as an additional proposal appendix.

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 Summary not to exceed 200 words. Categories of participants (e.g., collaborator, technical representative) must match the choices available in the electronic submittal system.

Every individual named on the proposal's electronic *Cover Page* form as a proposing team member in any role, including Co-Is and collaborators, must be individually registered in NSPIRES and that such individuals must perform this registration themselves; no one may register a second party, even the PI of a proposal in which that person is committed to participate. Every named individual must be identified with the organization through which they are participating in the proposal, regardless of their place of permanent employment or preferred mailing address. Proposers and their team members are strongly advised to visit this Web site well in advance to ensure that they are properly registered. This data site is secure, and all information entered is strictly for NASA's use only.

The cover page form is comprised of several distinct sections: a *Cover Page* that contains the identifier information for the proposing institution and personnel; a *Proposal Summary* that provides an overview of the proposed investigation that is suitable for release through a publicly accessible archive should the proposal be selected; a Team Member section; and the Program

TABLE B.1
RESTRICTIONS AND GUIDANCE ON PAGE COUNT

Section	Reference	Page Limits
Cover Page and Proposal Summary	App. B (III)	Electronic submission
Fact Sheet	App. B (V)	2
Table of Contents	App. B (VI)	No page limit
Scientific/Technical Investigation	App. B (VII)	20
Investigation Implementation Management and Schedule Cost and Cost Estimating Methodology	App. B (VIII) App. B (IX) App. B (X)	20
Cost Tables B.5 and B.6; Optional: Master Equipment List (MEL); Work Breakdown Structure (WBS); WBS Dictionary; WBS Cost Table; and Basis of Estimate Details	App. B (X)	No page limit
Optional: Plan for E/PO and SC	App. B (XI)	Up to 7 (2 for E/PO + 5 for SC)
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 between U.S. and International Participation 7. Orbital Debris Generation Acknowledgement 8. Compliance with Procurement Regulations by NASA PI Proposals 9. Heritage 10. Abbreviations and Acronyms List 11. Reference List (optional)	App. B (XII)	No page limit, but small size encouraged

Specific Questions, where questions about the type of proposal and top level budget information should be entered. The Budget portion 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 the sponsoring NASA Mission Directorate which is limited to the funding amount specified in the respective program element; and Total Mission Cost, which is the PI Mission Cost plus any contributions. The short title requested in this form is the science investigation or mission 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.

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.

Proposers are encouraged to begin their submission process early. Tutorials and other NSPIRES help topics may be accessed through the NSPIRES online help site at http://nspires.nasaprs.com/external/help.do. For any questions that cannot be resolved with the available online help menus, requests for assistance may be directed by E-mail to nspires-help@nasaprs.com or by telephone to 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.

IV. INSTRUCTIONS FOR CO-I APPROVAL IN NSPIRES

Every individual identified on the NSPIRES proposal cover page as a Co-I must indicate their commitment to the proposed investigation through NSPIRES prior to proposal cover page submission. A Co-I will receive an email from NSPIRES indicating that he/she has been added to the proposal as a Co-I and should log in to NSPIRES.

Once logged in, the Co-I should follow the link in the "Reminders and Notifications" section of his NSPIRES homepage, titled "Need Co-I Statement of Commitment For: Proposal to Solicitation <<solicitation number>>." On the "Team Member Statement of Commitment - Confirmation" page, the Co-I should read the commitment language, click the "Accept" button and then click "OK".

If the address information then displayed on the "Team Member Information" screen is out of date, the Co-I should click the "Account Mgmt" link in the NSPIRES navigation bar across the top and then edit the address book to accurately reflect the organization through which the individual is participating in this proposal. If the address information is accurate (or once it is), the Co- Investigator may log out of NSPIRES.

PI's may monitor the status of team member commitments by examining the "Commitment Confirmed" column on the Team Member page of the NSPIRES proposal cover page record.

V. 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, as applicable:

science/technical objectives (including the importance of the science to the NASA science research programs and/or technology to the NASA goals and objectives), investigation overview (including investigation objectives and major instrument or mission characteristics), science payload, key spacecraft characteristics, anticipated launch vehicle, management structure (including teaming arrangement as known, PI, and PM if assigned), 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.

VI. TABLE OF CONTENTS

The proposal shall contain a table of contents that parallels the outlines provided below in Sections VII through XII as applicable.

VII. SCIENTIFIC/TECHNICAL INVESTIGATION

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

B. Scientific or Technical Goals and Objectives. This section must discuss the goals and objectives of the investigation, their value to NASA's scientific or technical 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 and must directly address the evaluation criteria for scientific or technical merit described in the AO.

C. Investigation Requirements. This section must describe the observations and/or data required to meet the proposed scientific or technical objectives. The requirements for the investigation must be explicitly described and these must be linked to the scientific or technical objectives of the mission. The requirements that these objectives and observations impose on the mission design elements must be discussed.

   A Traceability Matrix describing the required "objectives-to-measurements-to-mission traceability" must be provided in tabular form. For the case of instrument and instrument suite proposals, this Traceability Matrix is also meant to clearly indicate which Measurement Parameters are to be supplied through the investigation and how it fits with data from the host mission and/or other available data or modeling sources.

   When applicable, a Mission Traceability Matrix describing the mission requirements traceability must also be provided. Examples of a Science Traceability Matrix and a Mission Traceability Matrix are given in Tables B.3 and B.4 along with examples for elements in such matrixes. Technology Demonstration proposals must provide a Technology Verification Traceability Matrix in place of the Science Traceability Matrix.

D. Measurement Data and Other Investigation Products. The measurements to be taken in the course of the investigation, the data to be returned, and the approach that will be taken in analyzing the data to achieve the scientific or technical objectives of the investigation must be discussed. This description should identify the investigation to be performed, the

quality of the data to be returned (e.g., resolution, coverage, pointing accuracy, measurement precision, etc.), and the quantity of data to be returned (bits, images, etc.). The relationship between the data products generated and the scientific or technical objectives must be explicitly described, as should the expected results. A discussion of the investigation 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 investigation products and data obtained will be used to fulfill the stated scientific or technical objectives must be provided. A discussion of how the investigation data will be obtained, including a plan for delivery of the products, and the individuals responsible for the data delivery, must also be provided. For instrument or instrument suite investigations, proposers should describe how they will coordinate their investigations with other host spacecraft investigations and how their data will collectively contribute to the achievement of the broader host mission and NASA goals. It is assumed that the above information will constitute the Baseline Investigation.

E. Descope Options. A description of potential descope options available to the Baseline Investigation, their phasing, their effect on meeting the scientific or technical objectives of the investigation, and their value during development (e.g., savings in cost, schedule, or risk), is encouraged. The proposer should consider all aspects of the investigation as applicable (e.g., launch vehicle, instrument, spacecraft, ground system) and not focus entirely on possible instrument descopes or mission length reductions.

F. Science/Technology Implementation: 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 investigation goals and objectives, must be discussed. The flow-down from investigation goals to measurement objectives and instrument performance must be stated clearly and supported by quantitative analysis where possible.

Investigations that require instrumentation in order to meet the investigation objectives must have proposals that describe all parameters of the instrument(s) that are pertinent to the accommodation of the instrument within the host spacecraft resources and configuration, plus any special requirements necessary for successful implementation. This information must be given in sufficient detail to permit an evaluation of both the concept and the practical feasibility of the hardware. These resources include, but are not limited to: volumetric envelope, mass, power, and thermal requirements (including preferred thermal limits); telemetry and command requirements; environmental sensitivities (e.g., to electrical cleanliness, magnetic fields, and contamination); any special spacecraft or launch vehicle integration requirements or constraints; field-of-view clearances; pointing requirements; and on-board data processing. Mass, power, and data processing preliminary budgets must be provided. The preliminary power discussion must outline average, cruise, and peak power use and a time profile of power needs. All enabling technologies must be identified and the NASA TRL level defined and justified. All enabling technologies are required to be at TRL 5 or higher before a project enters

Phase B, and at TRL 6 or higher by the end of Phase B. A plan to meet the required TRLs for each phase must be discussed.

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.

1. Mission Concept. The science/technology 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.

2. 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. The proposal must demonstrate that delivery of the data to the data archive takes place in the shortest time possible.

3. Science/Technology Team. This section must identify each necessary individual of the investigation science or technology development team and their roles and responsibilities. The capabilities and experience of all members of the proposed science/technology team must be described (the resumes in Section XII.3 may be used). 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.

G. Plan for Science/Technology Enhancement Options (STEO). NASA 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 STEO activities, where appropriate, to broaden the scientific impact of missions. These programs are usually initiated no earlier than Phase E. NASA will independently solicit and administer these programs using competitive peer review (Section 7.1).

VIII. INVESTIGATION IMPLEMENTATION

This section must provide, as applicable and to the extent known at the time of the proposal, 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 investigation 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 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 (or at any later time) to increase beyond the cost in the proposal.

If the proposed spacecraft bus is in the Rapid Spacecraft Development Office catalog (http://rsdo.gsfc.nasa.gov/Rapidii/catalog2.cfm), 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 as applicable for the proposed mission:

- 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 backup 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.

Instrument assembly, testing, and calibration (both pre- and during flight) must be described. The proposal shall include a flow diagram indicating the order of assembly, tests, and calibration. In addition, the proposer shall submit a verification matrix that describes the tests and calibrations that are to be performed on components, development units, and subassemblies.

In the case of proposals for instrument suites, both individual instruments and package parameters must be detailed to the extent possible. Proposals for multiple instruments are expected to justify each instrument. The instrument suite component level reserves and margin for resources such as mass, telemetry, and power must be identified. The mass, telemetry, and power and reserves and margins must be identified separately for all the necessary components of each instrument in case only an individual instrument is selected from the proposed suite (see below for definitions of reserve and margin). Discuss the allocation of reserves and margin to the instrument and/or suite.

This section must also address how the instrument design and planned instrument operations accounts for the expected environment (e.g., radiation, thermal cycle). The proposal must address planned mitigation of the potential environmental effects and describe how the science goals will be achieved in the expected environment.

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 and Technology Development, in addition to the information above, the specific data identified below must be provided (in tables) to the extent known at the time of the proposal due date and <u>as applicable</u> to the proposed mission configuration. For example, Section VIII.9 below does not apply to technology demonstrations.

1. <u>General Information</u>

   Launch date (including launch date flexibility), mission duration, orbit type (Earth orbit, heliocentric, etc.), and orbit information (semi-major 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.), and spacecraft telemetry is required for mission critical events to allow the cause of loss of mission to be determined. The approach and plans for how such data are to be measured and returned must be addressed.

5. Reserves 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:

Reserve (or *contingency*) when added to a resource, results in the maximum expected value for that resource. Percent reserve is the value of the reserve divided by the value of the resource less the reserve.
Margin is the difference between the maximum possible value of a resource (the physical limit or the agreed-to limit) and the maximum expected value for a resource. Percent margin for a resource is the available margin divided by its maximum expected value.

Example: A payload in the design phase has an estimated mass of 115 kg including a mass reserve of 15 kg. There is no other payload on the Expendable Launch Vehicle (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% reserve. 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 post-processing, spaceborne versus ground).

7. Instrument Characteristics

For each science instrument 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: 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:

Due to the limited funding and time-constrained schedules associated with SALMON AO flight opportunities, it is strongly encouraged that instruments proposed for this SALMON AO be at or above NASA TRL-6. TRL claims must be substantiated. If any instrument or spacecraft components are proposed below this readiness level, then a portion of the Mission Implementation section must include a discussion and justification of the proposed new technologies/advanced developments and the approach that will be taken to reduce their associated risks to MO cost, schedule, and science objectives. 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;
- 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
- Identification of alternatives to any proposed new technology or advanced development that may be implemented to retain mission schedule, cost, and baseline scientific objectives, and the decision milestones for their implementation.

Investigations proposing new technology, i.e., technologies having a TRL less than 6, will be assessed a higher risk rating if adequate backup plans to ensure success of the investigation are not described.

IX. 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 PM must be clearly stated. 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, 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.

Proposals should specifically address how the investigation team will interrelate with the sponsor of the parent mission, if applicable, organizationally and managerially. 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 mission 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 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 reserve (funded and unfunded) must be clearly identified. The Mission Operations 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 investigation 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 investigation 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 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 in the proposal.

X. 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 the Program Element, as applicable, of the AO. In the event an offeror is proposing profit or fee as part of their cost proposal, FAR 17.207(f)(3) requires options to include a fixed fee amount, a maximum fee amount, or a formula for determining the fixed or maximum fee amount in order for the options to be legally exercisable.

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 B.5, which will not be counted against the page limit. The top portion of Table B.5 requests

cost data relative to the sponsoring NASA Mission Directorate Cost. The lower portion addresses contributions. The rows in Table B.5 may be modified as appropriate for the proposal. The cost elements in Table B.5 are defined in Appendix E. Provide the data requested in Table B.6, which will not be counted against the page limit, for the sponsoring NASA Mission Directorate Cost by mission phase. The columns in Tables B.5 and B.6 must be labeled with the appropriate fiscal years. Table B.7 gives the NASA inflation index to be used to calculate real year dollars.

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 encouraged but not required 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 B.5, the last two columns in the WBS Cost Table would be the Total in real year dollars and the Total in FY2008 dollars. Basis of estimate details include complete cost model input data, vendor quotes, and comparisons to analogous investigations.

XI. PLAN FOR EDUCATION AND PUBLIC OUTREACH, AND STUDENT COLLABORATION

E/PO activities are optional for SALMON AO proposals. If an E/PO component is proposed, the proposer must provide a 2-page overview of the planned E/PO activities and their relationship to the proposed science investigation. This overview must include a brief discussion of any unique characteristics of the investigation which might provide unusual opportunities for E/PO. The proposer must declare any intention to include any SC as defined in Section 4.10.2 The SC must be fully described in its impact to educational opportunities as well as technical, maturity, processes, and mission risks. The SC must require a space flight. The proposer must discuss how the SC can be incorporated into the mission on a non-impact basis. Per Table B.1, the SC may allocate a separate 5 pages to discuss its approach and implementation.

XII. 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 except if the certifications need to be amended in which case they may be submitted as an additional proposal appendix.

1. Letters of Commitment.

   Letters of commitment must be provided from all organizations (i) offering critical goods and/or services (excluding 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 4.6.7 and Section 4.8.3.

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. The SOW must include general tasks statements for Phases A/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 between NASA and the proposing team is required, 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 personnel. The resume must clearly show experience related to the job the individual will perform on the proposed investigation. If the PI (and PM, if assigned) has project management experience, it must be included in their resume. Resumes should be organized alphabetically after that of the PI.

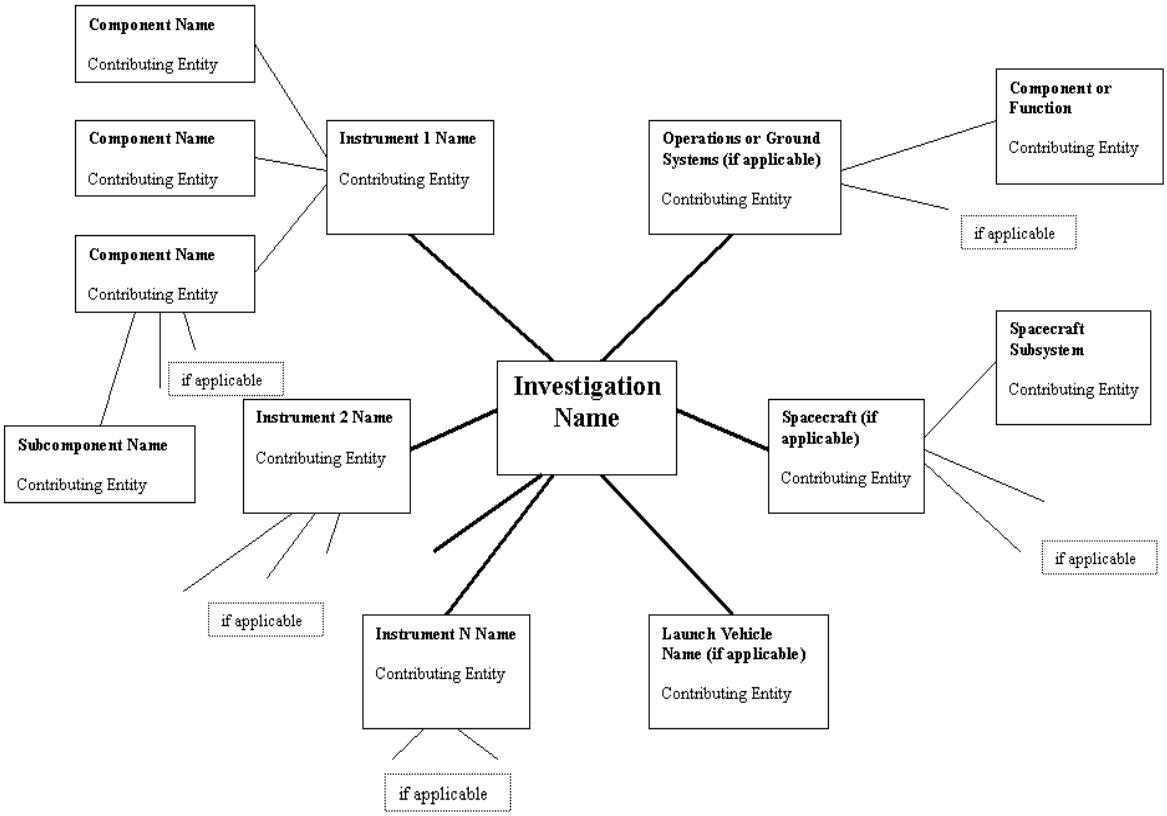
4. Summary of Proposed Program Cooperative Contributions.

   The following requirement for additional information does not apply to investigations 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). 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:

   a. An “exploded diagram” of the investigation (see Figure B.1) that provides a clear visual representation of cooperative contributions incorporated in the proposed implementation approach. All cooperative contributions, including those that will require an international agreement, or interagency MOU, 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. *Non-U.S. or U.S. goods and services obtained by contract using NASA funds are not cooperative contributions and are also not to be shown.*

FIGURE B.1
SAMPLE "EXPLODED DIAGRAM"



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 non-U.S. or U.S.;
   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 non-U.S. 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.

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 SALMON Reference Library.

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 SALMON missions.

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 SALMON missions and SCMs, will be required to submit an assessment following Appendix A.1 of NASA-STD-8719.14. MOs which are not complete missions, including PMOs, 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 Debris*, is available in NODIS and NASA-STD-8719.14, *NASA Process for Limiting Orbital Debris*, is available through the NASA Standards and Technical Assistance Resource Tool at http://standards.nasa.gov/.

8. Compliance with Procurement Regulations by NASA PI Proposals.

NFS 1872.308 - Proposals submitted by NASA investigators.

This appendix is required only for proposals submitted by NASA PIs or NASA Centers (excluding JPL). Proposals submitted by NASA Centers must comply with regulations governing proposals submitted by NASA PIs (NASA FAR Supplement 1872.308). Additional instructions may be found in Procurement Information Circular (PIC) 05-15 at http://www.hq.nasa.gov/office/procurement/regs/pic.html.

(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-Is. 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, formal assembly of the 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-Is.

(i) The proposal should describe the open and competitive process that was used for selecting proposed team members. While a formal solicitation is not required, the process should include the following competitive aspects: notice of the opportunity to participate to potential sources, submissions from and/or discussions with potential sources, and objective criteria for selecting team members among interested sources. If proposed team members are selected without using an open and competitive process, the proposal should contain a full justification consistent with the requirements of FAR Subpart 6.3.

(ii) The proposal should also include a representation that the NASA investigator has examined his or her financial interests and has determined that no personal conflict of interest exists.

(2) Supplies and support services.

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

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

(iii) The proposal should explain the basis of a justification for acquiring the supplies or services noncompetitively (see FAR Subpart 6.3).

(c) A selection decision approving the non-Government team members as selected Co-Is satisfies legal and regulatory requirements without further competition or justification (see 1872.702).

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

9. 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 Table B.2. The evaluation team will use a scale with at least three levels (full, partial, or none) as illustrated in Table B.2.

10. List of Abbreviations and Acronyms

11. 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 B.2
INSTRUMENT HERITAGE

	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

TABLE B.3
SCIENCE TRACEABILITY MATRIX

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

TABLE B.4
MISSION TRACEABILITY MATRIX

Mission Requirement	Spacecraft Requirement	Ground System Requirement	Operations Requirement

Kinds of information (as applicable) to be addressed in Tables B.3 and B.4 (not all inclusive):

Instrument Functional Requirements
Parameter range and resolution
Accuracy
Sensitivity
Data rate
Number of sensors
Field of view

Mission Functional Requirements
Orbit information (type, altitude range, inclination range)
Launch date and launch date flexibility
Launch vehicle and any upper stages
Mission duration
Number of satellites

Requirements on Spacecraft/Host
Control method (3-axis stabilized, spinner, etc.)
Mounting requirements (ram facing, nadir facing, clearances, etc.)
Accommodation of investigation-supplied booms, plates, armatures, etc.
Pointing control, knowledge, and jitter
Data storage
Thermal requirements
Power required by instruments
Slew rates
Radiation sensitivity
Electrostatic and magnetic cleanliness (indicate spatial range required)

Requirements on Communications and Ground Data System
Data volume (Mbytes per day)
Number of data dumps per day
Real time requirements

Requirements on Mission Operations
Commanding and monitoring
Special calibration operations
Maneuvering, including constraints on maneuvering
Impact of thruster firings on instrument operation

TABLE B.5
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]									
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[7] (specify)									
Total Enhanced Mission Cost	$	$	$	$	$	$	$	$	$

Notes for Table B.5

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 Assurance/Systems Engineering
3 IAT - Integration, Assembly and Test
4 GDS/MOS - Ground Data System/Mission Operations Services
5 E/PO - Education /Public Outreach (Optional)
6 MO&DA - Mission Operations and Data Analysis
7 Optional. See Appendix E
8 Also include within Phase B and within PI Mission Cost

TABLE B.6
MISSION PHASE SUMMARY FOR COST
(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/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 B.7
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	1.000	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.

END OF APPENDIX B

APPENDIX C: SALMON REFERENCE LIBRARY

Science

The Vision for Space Exploration (February 2004)
The fundamental goal of this vision is to advance U.S. scientific, security, and economic interests through a robust space exploration program.

NPD 1001.0 - 2006 NASA Strategic Plan (February 7, 2006)
This NASA Policy Directive (NPD) describes NASA's strategy to extend the frontiers of human exploration.

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.

New Frontiers in the Solar System: An Integrated Exploration Strategy (2002)
This National Research Council (NRC) survey was requested by NASA to determine the contemporary nature of solar system exploration and why it remains a compelling activity today. A broad survey of the state of knowledge was requested. In addition NASA asked for the identification of the top-level scientific questions to guide its ongoing program and a prioritized list of the most promising avenues for flight investigations and supporting ground-based activities.

SMD Mission Extension Paradigm
This document describes the guidelines used by SMD Senior Reviews when reviewing extended mission proposals

NASA Astrobiology Roadmap (April 2008)
This NASA Astrobiology Roadmap outlines multiple pathways for research and exploration and indicates how they might be prioritized and coordinated.

NASA/CP-2007-214565 Astrobiology Small Payloads (June 2007)
This report summarizes the activities and recommendations of the Astrobiology Small Payloads Workshop.

Earth Observations from Space: The First 50 Years of Scientific Achievements (2007)
This report describes how the ability to view the entire globe at once, uniquely available from satellite observations, has revolutionized Earth studies and ushered in a new era of multidisciplinary Earth sciences.

Earth Science and Applications from Space: National Imperatives for the Next Decade And Beyond (2007)
This report presents a vision for the Earth science program; an analysis of the existing Earth Observing System and recommendations to help restore its capabilities; an assessment of and

recommendations for new observations and missions for the next decade; an examination of and recommendations for effective application of those observations; and an analysis of how best to sustain that observation and applications system.

Committee on Earth Observation Satellites (CEOS)

This is the homepage for CEOS and its members. CEOS membership encompasses the world's government agencies responsible for civil Earth observation satellite programs, along with agencies that receive and process data acquired remotely from space.

Coordinating Group on Meteorological Satellites (CGMS)

This is the homepage for CGMS which is part of the World Meteorological Organization and provides a forum for the exchange of technical information on geostationary and polar orbiting meteorological satellite systems, such as reporting on current satellite status and future plans, telecommunications matters, operations, intercalibration of sensors, data processing algorithms, satellite products and their validation and data transmission standards and formats.

Management

NPR 7120.5D – Space Flight Program and Project Management Requirements (March 6, 2007)

This NASA Procedural Requirements (NPR) 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-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.

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.

Technology Readiness Level (TRL) Definitions

Technology Readiness Levels (TRLs) are a systematic metric/measurement system that supports assessments of the maturity of a particular technology and the consistent comparison of maturity between different types of technology.

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

This Goddard Procedural Requirements (GPR) 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.

2008 NASA Guidebook for Proposers (January 2008)

Detailed instructions for the preparation and submission of proposals to the Research Opportunities in Space and Earth Sciences 2008 (ROSES-08) NASA Research Announcement (NRA). SMD USPI proposals will be submitted through ROSES.

Astrobiology Small Payloads Proposer's Information Package (February 21, 2008)

This Proposal Information Package is a resource for information regarding mission architectures, payload/instrument development and management, platform constraints and capabilities, launch opportunities, and other information on relevant topics.

Fundamental Space Biology Proposer's Information Package

This website contains information on fundamental space biology and past, current, and related missions and activities.

International

Directorate of Defense Trade Controls, U .S. Department of State

Includes links to the International Traffic in Arms Regulations (ITAR).

Bureau of Industry and Security, U. S. Department of Commerce

Includes links to the Export Administration Regulations (EAR).

Letter of Agreement (LOA) Template

Example of such an agreement for the Interstellar Boundary Explorer (IBEX).

Financial Management Service

Website which includes the Treasury Department official exchange rate.

Education and Public Outreach

Explanatory Guide to the NASA Science Mission Directorate Education and Public Outreach Evaluation Factors (April 2008)

Provides descriptions and elaborates on each of the SMD Education and Public Outreach evaluation factors. Provides answers to frequently asked questions.

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

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

Orbital Debris

NPR 8715.6 - Procedural Requirements for Limiting Orbital Debris (August 17, 2007)

This document provides requirements to implement NASA's policy for limiting orbital debris generation per the U.S. National Space Policy of 2006, Section 11, the U.S. Government Orbital Debris Mitigation Standard Practices, and as a part of NASA's policy for safety and mission assurance programs as defined in NPD 8700.1, paragraph 1a. Any noncompliances to orbital debris requirements, including those for reasons of mission requirements and cost effectiveness, require a variance to this NPR.

NASA-STD-8719.14 – NASA Process for Limiting Orbital Debris (August 28, 2007)

This document serves as a companion to NPR 8715.6 and provides specific requirements and methods to comply with the NASA requirements for limiting orbital debris generation. NASA-Standard (NASA-STD) 8719.14 updates NASA Safety Standard (NSS) 1740.14, which went into effect in August 1995. This NASA-STD helps ensure that spacecraft and launch vehicles meet acceptable standards for limiting orbital debris generation.

Procurement

Federal Acquisition Regulations (FAR) General Services Administration

NASA FAR Supplement Regulations

NPD 5101.32D – Procurement (April 13, 2003)

This document provides policy direction of procurement and financial assistance activities (excluding Space Act Agreements).

NPR 5800.1E -- Grant and Cooperative Agreement Handbook (May 7, 2002)

This handbook prescribes policies and procedures relating to the award and administration of NASA grants and cooperative agreements.

Federal Accounting Standards Advisory Board (FASAB)

This website provides access to all publications issued by FASAB including exposure drafts, the volumes presenting Original Pronouncements and current text, newsletters, minutes and meeting agendas.

Procurement Information Circular (PIC) 05-15 (December 29, 2005)

Provides guidance on the competitive procedures that apply to NASA Centers in forming teams and preparing proposals in response to NASA Broad Agency Announcements.

Focused Opportunity for Lunar Atmosphere and Dust Environment Explorer (LADEE) Mission

The Scientific Context for Exploration of the Moon (2007)
This final NRC report presents a review of the current understanding of the early earth and moon; the identification of key science concepts and goals for moon exploration; an assessment of implementation options; and a set of prioritized lunar science concepts, goals, and recommendations.

LADEE Science Definition Team (SDT) Report (May 21, 2008)
This report summarizes the activities and recommendations of the SDT.

Level 2 Functional Requirements Document (March 7, 2008)
Template for the instrument Functional Requirements Document (FRD) which will provide an accurate functional description of the investigation hardware and software at the instrument level, as well as at the instrument subsystem level.

Interface Requirements Document (March 7, 2008)
Template for the instrument Interface Requirements Document (IRD) which will define the interface requirements to the LADEE spacecraft.

Science Instrument Experiment Implementation Plan (EIP) (March 7, 2008)
Template for the EIP which will describe the PI's technical and management approach to completing the instrument design, fabrication and verification of the flight unit, supporting integration with LADEE, supporting LADEE acceptance testing, and subsequent launch operations and post-launch checkout.

GSFC-STD-1001 Criteria for Flight Project Critical Milestone Reviews (February 2005)
This document provides standard criteria for the flight project critical milestone reviews that comprise the Integrated Independent Reviews.

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.

430-HDBK-000007 Generic Instrument Product Assurance Implementation User's Guide (May 30, 2005)
User's Guide to the development of a Performance Assurance Implementation Plan (PAIP) for the Robotic Lunar Exploration Program.

410-RQMT-0036 Small Explorer (SMEX) Program Low Priority, High Risk Payload (Class D) Mission Assurance Requirements (September 24, 2007)

The LADEE Project has adopted the SMEX Mission Assurance Requirements (MAR). This document describes the responsibilities of the Instrument PI with regard to Safety, Reliability, and Quality Assurance. The PI's approach to meeting or tailoring the SMEX MAR are captured in each of the instrument's PAIP.

END OF APPENDIX C

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

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:

1. Are not presently debarred, suspended, proposed for debarment, declare ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

2. 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;

3. 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;

4. 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)

1. 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.

2. 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:

1. 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;

2. 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.

3. 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.

END OF APPENDIX D

APPENDIX E: 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 science investigations or missions, reserves must include those 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 pre-allocated to the flight system and instrument payload, with another portion held at the science investigation level, specific dollar amounts to fund each must be identified.

Project Management/Mission Assurance/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 Assurance is an engineering process performed over the life cycle of a project to identify and mitigate deficiencies to establish a reasonable degree of confidence in mission success. 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).

Instrument Integration, Assembly, and Test (IAT)
Instrument integration, assembly and test is the process of integrating all instrument subsystems into a fully tested, operational instrument. The total cost of IAT for an instrument includes research/requirements specification, design and scheduling analysis of IAT procedures, ground support equipment, instrument test and evaluation, and test data analyses. Typical instrument 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 SALMON Reference Library.) 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 investigation'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 SALMON Reference Library.)

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 not include costs of any STEO activities.

STEO Activities
Options for enlarging the science/technology impact beyond the baseline investigation, such as extended missions, guest investigator programs, general observer programs, or archival data analysis programs are termed STEO activities. These costs do not count against the funding cap.

Project-Unique Facilities
If the proposed science investigation requires construction or lease of any ground facilities, include here only the portion of costs to be borne by the proposed investigation, 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, post-flight mission data evaluation, oversight of the launch service and coordination of mission-specific integration activities.

NASA Center Costs (all categories)
Additional costs born by the science investigation 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.

END OF APPENDIX E

APPENDIX F: COMPLIANCE CHECKLIST

Administrative	
1. Proposal arrived on time	PEA
2. Meets page limits	Appendix B
3. Meets general guidelines	Appendix B
4. Required appendices included	Appendix B
5. No additional appendices included	Appendix B
6. Budgets are submitted in required formats	Appendix B
Scientific	
7. Addresses solicited NASA Mission Directorate programs	PEA
8. Requirements traceable from science to hardware to mission	Appendix B
9. Appropriate data archiving plan	§4.4.3
10. Defines both a baseline investigation and potential descope options	Appendix B
11. Allocation of sufficient resources for data analysis has been demonstrated	§4.4.4
Technical	
12. Proposed complete investigation (Phases A-F) for MO category	§1.3, §5.1,
13. Description of E/PO outline and commitment, if any (E/PO is optional)	Appendix B
14. Includes subcontracting and SDB commitments (if applicable)	§4.7.7
15. Team led by a single PI	§4.6.2
16. Proposed budget within cost cap	PEA
17. Phase A costs within cost limit	PEA
18. Co-I cost in budget	§4.6.5
19. Commitment date prior to cutoff	PEA
20. Co-Is indicate their commitment to the proposed investigation through NSPIRES	§4.6.9
21. U.S. letters of commitment from all organizations contributing critical goods and services, from all major participants, and from any required funding organizations	§4.6.7, §4.6.8, Appendix B
22. Table describing non-U.S. participation	§4.8.6
23. Non-U.S. letters of commitment from participating institution	§4.8.3
24. Non-U.S. letters of commitment from funding agencies including binding law statement	§4.8.3, §4.8.5

END OF APPENDIX F

APPENDIX G: ACRONYMS AND ABBREVIATIONS

ARMD	Aeronautics Research Mission Directorate
ASI	Italian Space Agency
AO	Announcement of Opportunity
BPSK	Binary Phase Shift Keying
CCSDS	Consultative Committee for Space Data Systems
CCR	Central Contractor Registry
CEOS	Committee on Earth Observation Satellites
CFR	Code of Federal Regulations
CGMS	Coordinating Group on Meteorological Satellites
CM&O	Center Management and Operations
Co-I	Co-Investigator
DSN	Deep Space Network
EAR	Export Administration Regulations
E/PO	Education and Public Outreach
EBPOC	Electronic Business Point of Contact
EIP	Experiment Implementation Plan
ELV	Expendable Launch Vehicle
ESMD	Exploration Systems Mission Directorate
ESSP	Earth System Science Pathfinder
EVM	Earned Value Management
FAQ	Frequently Asked Questions
FAR	Federal Acquisition Regulations
FASAB	Federal Accounting Standards Advisory Board
FFRDC	Federally Funded Research and Development Center
FMO	Focused Mission of Opportunity
FRD	Functional Requirements Document
FY	Fiscal Year
G&A	General and Administrative
GAO	Government Accountability Office
GCOM	Global Change Observation Mission
GDS	Ground Data System
GEVS	General Environmental Verification Standard
GFE	Government Furnished Equipment
GPR	Goddard Procedural Requirements
GSFC	Goddard Space Flight Center
HBCU	Historically Black Colleges and Universities
HQ	Headquarters
IAT	Integration, Assembly, and Test
IBEX	Interstellar Boundary Explorer

ICD	Interface Control Document
IRD	Interface Requirements Document
ISRO	Indian Space Research Organization
ISS	International Space Station
ITAR	International Traffic in Arms Regulations
JAXA	Japan Aerospace Exploration Agency
JPL	Jet Propulsion Laboratory
KDP	Key Decision Point
LADEE	Lunar Atmosphere and Dust Environment Explorer
LAGEOS	Laser Geodynamics Satellites
LEAM	Lunar Ejecta and Meteorites
LOA	Letter of Agreement
MA	Mission Analysis
MAR	Mission Assurance Requirements
MEL	Master Equipment List
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
NASA-STD	NASA-Standard
NEN	Near-Earth Network
NFS	NASA FAR Supplement
NISN	NASA Integrated Services Network
NODIS	NASA Online Directives Information System
NOI	Notice of Intent
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NRA	NASA Research Announcement
NRC	National Research Council
NSPIRES	NASA Solicitation and Proposal Integrated Review and Evaluation System
NSS	NASA Safety Standard
OMI	Other Minority Educational Institution
PAIP	Performance Assurance Implementation Plan
PDF	Portable Data Format
PDR	Preliminary Design Review
PEA	Program Element Appendix
PI	Principal Investigator
PIC	Procurement Information Circular
P.L.	Public Law

PM	Project Manager
PMO	Partner Missions of Opportunity
POC	Point of Contact
ROSES	Research Opportunities in Space and Earth Sciences
SAIC	Science Applications International Corporation
SALMON	Stand Alone Missions of Opportunity Notice
SC	Student Collaboration
SCaN	Space Communication and Navigation
SCM	Small Complete Mission
SDB	Small Disadvantaged Business
SDT	Science Definition Team
SE	System Engineer(ing)
STEO	Science/Technology Enhancement Option
SMD	Science Mission Directorate
SMEX	Small Explorer
SN	Space Network
SOMD	Space Operations Mission Directorate
SOW	Statement of Work
TRL	Technical Readiness Level
UARC	University Affiliated Research Center
URL	Uniform Resource Locator
U.S.	United States
U.S.C.	United States Code
USPI	United States Participating Investigator
WBS	Work Breakdown Structure
WOSB	Women Owned Small Business

END OF APPENDIX G

PROGRAM ELEMENT APPENDICES

PEA H1: LUNAR AND PLANETARY SCIENCE U.S. PARTICIPATING INVESTIGATOR

NASA solicits proposals for USPI investigations that address the Planetary Science Research Program objectives listed in the *Science Plan for NASA's Science Mission Directorate 2007 – 2016* (found in the SALMON Reference Library). Proposed investigations that address the lunar science priorities listed in the *2007 NASA Science Plan* are highly encouraged.

The Science Mission Directorate is soliciting Lunar and Planetary Science USPI investigations through its Research Opportunities in Space and Earth Sciences 2008 (ROSES-08) NASA Research Announcement (NRA).

This proposal opportunity may be found in Appendix C.25 of the ROSES-08 NRA. Lunar and Planetary Science USPI proposals submitted in response to the ROSES solicitation are subject to the proposal guidelines specified in ROSES and will be reviewed and selected using the proposal criteria specified in ROSES.

ROSES-08 may be found at http://nspires.nasaprs.com/ (select "Solicitations" then "Open Solicitations" then "NNH08ZDA001N").

Date for Pre-proposal conference	September 26, 2008
Due date for Notices of Intent (NOIs) to propose	October 15, 2008
Due date for proposals	December 2, 2008

END OF PEA H1

PEA H2: LUNAR AND PLANETARY SCIENCE PARTNER MISSIONS OF OPPORTUNITY

I. BACKGROUND

Advancements in Planetary Science are achieved through the exploration of the Solar System. It is through this grand human enterprise that NASA seeks to discover the nature and origin of the celestial bodies among which we live and to explore whether life exists beyond Earth. The scientific foundation for the Planetary Science Division is described in the National Research Council (NRC) Decadal Survey in Planetary Science, *New Frontiers in the Solar System: An Integrated Exploration Strategy* (NRC 2002, available through SALMON Reference Library). The quest to understand our origins is universal. How did we get here? Are we alone? What does the future hold? Modern science, and especially space science, provides extraordinary opportunities to pursue these questions. Current tools and those that will become available in the coming years will enable us to develop a vast range of mission opportunities. We are at the leading edge of a journey of exploration that will yield a profound new understanding of our home planet, and of ourselves.

These grand themes are captured in five fundamental science questions which form the basis for NASA's approach to the exploration of the Solar System:

- How did the Sun's family of planets and minor bodies originate?
- How did the Solar System evolve to its current diverse state?
- What are the characteristics of the Solar System that led to the origin of life?
- How did life begin and evolve on Earth and has it evolved elsewhere in the Solar System?
- What are the hazards and resources in the Solar System environment that will affect the extension of human presence in space?

These fundamental science questions transcend the traditional boundaries of astronomy, physics, chemistry, biology, and geology. To address them requires the same multidisciplinary approach that NASA has championed from the early Lunar science missions of the Apollo Era, a tradition which continues today through this SALMON PEA solicitation of Lunar and Planetary Science Partner Missions of Opportunity (PMO) investigations.

II. SCIENCE AND PROGRAM OBJECTIVES

NASA solicits proposals for Lunar and Planetary Science PMO investigations that address the Planetary Science Research Program objectives listed in the *Science Plan for NASA's Science Mission Directorate 2007 – 2016* (found in the SALMON Reference Library and hereafter referenced as the *2007 NASA Science Plan*). Proposed investigations that address the lunar science priorities listed in the *2007 NASA Science Plan* are highly encouraged.

III. PROPOSAL OPPORTUNITY PERIOD AND SCHEDULE

The following schedule applies to this Partner Mission of Opportunity program element.

- A Preproposal Conference will be held. Further information about the Preproposal Conference will be posted on the SALMON Acquisition Homepage (see Section 6.1.3 of this SALMON AO).

- A Notice of Intent (NOI) to propose is encouraged, and is due no later than 11:59 p.m. Eastern time on the date given in Section VII of this PEA. Section 6.1.4 of this SALMON AO provides information on electronic NOI submission through NSPIRES.
- Proposals are due no later than 4:30 p.m. Eastern time on the date given in Section VII of this PEA. Proposal submission requirements are outlined in Section V of this PEA.

Selection announcements are targeted for 5 months after receipt of proposals. Funding for selected proposals will begin as soon as appropriate funding vehicles can be put in place; commonly this is 4-8 weeks following selection.

IV. REQUIREMENTS AND CONSTRAINTS

A. Type of Mission of Opportunity

Partner Mission of Opportunity: For the purpose of this AO, a PMO is one in which the proposer offers to participate in a non-NASA space mission that is planned or that has been approved by its sponsoring organization. By funding U.S. participation in a non-NASA space mission, NASA seeks to allow the scientific community to conduct a science or technology investigation of interest to NASA as part of a non-NASA space mission. Such missions may be sponsored by non-U.S. governments, by other U.S. agencies, or by private sector organizations. PMO investigations on a military satellite are allowed as long as the satellite is not planned for weapons testing. This participation can take many forms including the provision of flight hardware, but the NASA-funded element of the partnership must represent a necessary and enabling component of the mission. See Section 5.2 of this SALMON AO for additional details.

B. Cost and Schedule Constraints

One or more PMO investigations may be selected depending on the availability of proposals of appropriate merit, provided they can be accommodated within the $35M total budget allocated for this Program Element. Single investigations may not be proposed in which the PI Mission Cost exceeds $35M (FY2008 dollars) for all phases of the investigation. Multiple proposals may be selected for award if the aggregate cost falls within the total budget allocated for this Program Element. 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. A single PMO investigation costing $35M may be selected if it is scientifically and technically compelling enough to justify using the entire Program Element budget. Further specifications on the PMO implementation can be found in Section 7.4 of this SALMON AO.

The latest sponsoring organization's required date for NASA commitment for U.S. participation is given in Section VII of this PEA. The due date for proposals is given in Section VII of this PEA .

NASA reserves the right to make no selection if there are no proposals of appropriate merit.

C. Technical Requirements and Constraints

In addition to the requirements given in the SALMON AO, all proposed investigations must also demonstrate: (1) their formal relationship with the sponsoring agency's mission (e.g., already selected contribution, invited contribution, or proposed contribution); (2) the status of the mission within the sponsoring agency (i.e., Pre-Phase A, Phase A, or Phase B) including the level of commitment that the sponsoring agency has made to complete the mission; (3) a detailed

description of the proposed provisions for sharing of necessary flight data, and plans that scientific data returned from at least those aspects of the mission in which NASA is involved shall be made available to the U.S. scientific community in a timely way and deposited in the Planetary Data System (http://pds.nasa.gov), and the status of the sponsoring agency's commitment to enter into an appropriate agreement with NASA for data sharing; and (4) a detailed explanation of how the U.S. planetary science community benefits from this participation.

D. Launch Vehicle Services and Funding

No launch vehicle will be provided by NASA through this solicitation. In addition, NASA is prohibited by law from purchasing non-U.S. launch vehicles, nor may NASA funds provided to an investigation be used to purchase a launch vehicle from a non-U.S. source.

V. PROPOSAL PREPARATION AND SUBMISSION

A. Proposal Content Requirements

Proposal content must conform to the guidelines set forth in Section 6.2 and Appendix B of this SALMON AO.

B. Exceptions to General SALMON Requirements

This PEA contains no exceptions to the proposal preparation and submission requirements outlined in this SALMON AO.

C. Proposal Submission Requirements

Proposals must be submitted according to the guidelines set forth in Section 6.3 of this SALMON AO and in Section III of this PEA.

VI. PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

A. Scientific Evaluation Factors

Proposals will be evaluated per the evaluation criteria set forth in Section 7.2 of this SALMON AO. In addition to the factors for implementation merit given in Section 7.2.3 of this SALMON AO, the implementation merit of a proposal will also include:

- The demonstrated scientific merit that this investigation's archived data adds to the Planetary Science community.

B. Specific Selection Factors

Proposals will be selected according to the guidelines set forth in Section 7.3 of this SALMON AO.

The Selection Official for this PEA is the Associate Administrator for Science Mission Directorate.

C. Implementation Activities

Proposal selection and award will be implemented according to the guidelines set forth in Section 7.4 of this AO and Section IV.B of this PEA. Awards for investigations related to Mars will be implemented by the Mars Exploration Program Office at Jet Propulsion Laboratory. All

other proposal selections and awards for this PEA will be implemented by the Discovery and New Frontiers Program Office at the Marshall Space Flight Center.

VII. SUMMARY OF KEY INFORMATION

Partnering Mission of Opportunity Cost Cap	$35M (FY08$)
Latest sponsoring organization's required date for NASA commitment for U.S. participation	December 31, 2010
AO release date	September 3, 2008
Date for Preproposal conference	September 26, 2008
Due date for NOI to propose	October 15, 2008
Due date for proposals	December 2, 2008
Submission medium	Hard and electronic copies; see Section 6.3.1 of this SALMON AO
Web site for submission of electronic cover page via NSPIRES	http://nspires.nasaprs.com/ (help desk available at 202-479-9376 or nspires-help@nasaprs.com)
NASA POC concerning this Program Element	Dr. Carlos Liceaga SALMON AO Program Executive NASA Headquarters Washington, DC 20546-0001 Tel: 757-846-5880 Email: Carlos.A.Liceaga@nasa.gov

END OF PEA H2

PEA H3: SMALL COMPLETE MISSIONS OF OPPORTUNITY IN ASTROBIOLOGY AND FUNDAMENTAL SPACE BIOLOGY

This reissued Program Element Appendix (PEA) supersedes all information provided in the H3 PEA originally issued on September 3, 2008, and amended on October 16, 2008, and November 24, 2008. The previous version of the PEA, as amended, is deleted in its entirety and it is replaced in its entirety by this text.

1.0 BACKGROUND

1.1 Astrobiology

Astrobiology is the study of the origins, evolution, distribution, and future of life in the Universe. It requires fundamental knowledge of life and habitable environments that will help us to recognize biospheres that might be quite different from our own. Astrobiology embraces the search for potentially inhabited planets beyond our Solar System, the exploration of Mars and the outer planets, laboratory and field investigations of the origins and early evolution of life, and studies of the potential of life to adapt to future challenges, both on Earth and in space. Interdisciplinary research is needed that combines molecular biology, ecology, planetary science, astronomy, information science, space exploration technologies, and related disciplines. The broad interdisciplinary character of astrobiology compels us to strive for the most comprehensive and inclusive understanding of biological, planetary, and cosmic phenomena.

1.2 Fundamental Space Biology

Fundamental Space Biology (FSB) is the study of how living systems from cells to complex organisms respond and adapt to gravity and space environments. The force of gravity plays a major role in shaping life forms and determines many aspects of their behavior. Space flight offers the only opportunity to systematically determine the response of living systems to gravity levels less than that of Earth. In addition, the radiation environment on Earth differs from radiation environments in space, because Earth's magnetic field and atmosphere shield life on Earth from some components of space radiation. Rapid advances in biological technology and the increasingly rapid pace of new knowledge provide opportunities to examine the foundations of life. Fundamental Space Biology flight experiments use the space environment to probe the fundamental nature of life to enhance our understanding of fundamental biological phenomena.

2.0 SCIENCE, TECHNICAL, AND PROGRAM OBJECTIVES

2.1 Astrobiology Small Payloads

Life is a central theme that unifies NASA's vision and mission. The *NASA Astrobiology* Roadmap, found at http://astrobiology.arc.nasa.gov/roadmap, outlines the multiple pathways for research and exploration that are components of Astrobiology and indicates

how they might be prioritized and coordinated. The *Astrobiology Roadmap* is formulated in terms of seven science goals that outline key domains of investigation:

- Understand the nature and distribution of habitable environments in the Universe;
- Explore for past or present habitable environments, prebiotic chemistry, and signs of life elsewhere in our Solar System;
- Understand how life emerges from cosmic and planetary precursors;
- Understand how past life on Earth interacted with its changing planetary and Solar System environment;
- Understand the evolutionary mechanisms and environmental limits of life;
- Understand the principles that will shape the future of life, both on Earth and beyond; and
- Determine how to recognize signatures of life on other worlds and on early Earth.

Spaceflight offers a unique opportunity to address these questions in ways that are not otherwise tractable. It is not possible to simulate microgravity, Lunar, or Martian gravity environments on Earth, except for very short time periods on parabolic aircraft flights. Spaceflight also provides access to the space radiation environment, including cosmic rays and solar particle events. Ground based accelerators can simulate certain components of this environment, but not the entire spectrum of multidirectional particles.

Research relevant to each of the astrobiology goals can be performed using small satellites. This research will be conducted in the context of NASA's ongoing exploration of our stellar neighborhood and the identification of biosignatures for *in situ* and remote sensing applications. It is envisioned that appropriate research in the near term will be largely focused on payloads that perform experiments along with demonstration of some remote sensing concepts. Emerging capabilities with small satellites and payloads may later enable the incorporation of additional remote sensing and instrument concepts, including suitcase-science payloads to support human exploration needs.

For additional background on the use of small satellites and payloads to address science questions in astrobiology, consult the Astrobiology Small Payloads (ASP) workshop report at http://nai.arc.nasa.gov/asp/asp_report.pdf. This report may also be found in the Proposer Information Package (PIP) provided at http://salmon-h3-pip.arc.nasa.gov/.

2.2 Small Missions in Fundamental Space Biology

To elucidate the effects of space environments on life and provide an understanding of life's foundations on Earth and beyond, Fundamental Space Biology strives to expand our knowledge in the following four broad areas:

2.2.1. Life at Molecular and Cellular Levels

Alterations in gravity and the space environment may affect cells in many ways, including cell proliferation, chromosomal aberrations, gene expression, and processes of reproductive cell formation. The research targets include: analyzing unique genetic,

protein, and metabolic responses to gravity and space radiation; determining the gravity-detection mechanisms in cells and their relationship to cellular metabolism; determining the gravity-detection and gravity response mechanisms in small organisms; determining the signaling pathways involved in gravity sensing, transduction, and response; determining mutation rates; and testing cellular responses to space environments using model systems.

2.2.2. Organisms throughout their lives

The developmental, physiological, and maturation processes of life at many levels, including tissues, organs, organ systems, and whole organisms can change over the course of an organism's life cycle. Research targets for this goal include: characterizing and modeling the processes by which organisms detect and respond to gravity; determining gravity-induced changes and their underlying mechanisms at critical life stages; and identifying radiation-induced changes and other mechanisms of change in organisms in spaceflight.

2.2.3. Interactions between organisms

Research is needed to determine the effect of space environments on interrelationships between the organisms that populate constructed ecosystems. Research targets include: examining how differences in species affect ecological processes in space environments; studies to determine the sensitivity of ecological processes to the environmental conditions in space; and identifying and testing key biological characteristics of ecological systems, including microbial virulence.

2.2.4. Life across generations

Long term exposure to the space environment provides opportunities to determine how living systems adapt and evolve to this unique environment over many generations. Research targets to address this goal include: identifying effects of altered gravity on patterns of reproduction and phenotype/genotype over multiple generations in organisms with short life cycles and assessing changes in reproductive capacity induced by space environments and the consequences to development.

Spaceflight is critical to addressing these subject areas. Small satellite free flyer missions of opportunity that perform hypothesis-driven research as secondary payloads have the capability of providing an avenue to conducting relevant Fundamental Space Biology flight research.

3.0 PROPOSAL OPPORTUNITY PERIOD AND SCHEDULE

The following schedule applies to this Small Complete Mission (SCM) of Opportunity program element.

- A Preproposal Conference is not planned as part of this PEA. Please address questions concerning any portion of this PEA to individuals listed in Section 7.0 of this PEA, as appropriate.

- A Notice of Intent (NOI) to propose to this PEA is extremely valuable to NASA, and, therefore, is encouraged. NOIs are due no later than 11:59 p.m. Eastern time on the date given in Section 7 of this PEA. Section 6.1.4 of this SALMON AO provides information on electronic NOI submission through NSPIRES.

- Proposals are due no later than 4:30 p.m. Eastern time on the date given in Section 7 of this PEA. Proposal submission requirements are outlined in Section 5 of this PEA. Funding for selected proposals will begin as soon as appropriate funding vehicles can be put in place; commonly this is 4-8 weeks following selection.

4.0 REQUIREMENTS AND CONSTRAINTS

4.1 Types of Missions of Opportunity

A proposal for a SCM is one in which the proposer describes a complete and self-contained investigation (e.g., spacecraft, payload, launch, mission operation, spacecraft communications and navigation, data analysis and data archiving, etc.) that fulfills the solicited objectives and includes all of the elements specified in this PEA and Appendix B of this SALMON Announcement of Opportunity (AO).

The FSB component of this PEA refers to two individual investigations, the first called Mission of Opportunity-1 (MoO-1) and the second is Mission of Opportunity-2 (MoO-2).

The ASP component of this PEA refers to one SCM investigation, called ASP.

Three different mission formats may be used by proposers to this solicitation, each of which requires the proposer to describe and account for all aspects of the proposed investigation. The different mission formats allow for the incorporation of a range of Government contributions offered by the Ames Research Center Small Spacecraft Division (ARC SSD), to best ensure the execution of PI-proposed science investigations:

- Mission Format 1) PI Science Only: Investigators may propose to utilize existing hardware in which to perform the desired experiment(s), as well as launch and communications services, all of which would be provided by the ARC SSD. It is likely that proposals to FSB MoO-1 will adopt this format. This format may be chosen by proposers to ASP whose experiments can be accommodated within existing hardware.

- Mission Format 2) Teaming: Investigators may propose to work cooperatively with the ARC SSD, during a short Phase A study, to modify and further develop ARC SSD hardware to meet the needs of the PI's proposed investigation. It is

likely that proposals to FSB MoO-2 will adopt this format. This format may be chosen by proposers to ASP when modifications to SSD-provided hardware are anticipated to be sufficient to accomplish the science goals of the PI.

- Mission Format 3) PI-supplied Hardware: Investigators may propose to provide a completed satellite for launch by the ARC SSD – such proposals would utilize only integration, launch, and communications services provided by ARC. This format may be chosen by proposers to ASP who wish to construct their own hardware. Proposals to FSB must not adopt this format.

4.2 Technical Requirements and Cost and Schedule Constraints

All opportunities outlined in this PEA are soliciting investigations that follow the schedule given in Section 7.

Proposers to the opportunities described in this PEA should refer to the PIP available at http://salmon-h3-pip.arc.nasa.gov/. Information on available nanosatellite hardware, related past and current nanosatellite mission information, and an estimated mission budget breakdown including the costs for hardware and services provided by ARC SSD, are included in the PIP.

Proposals must provide information regarding all components of the mission, including appropriate budget allocations to fund ARC-provided hardware and services within the capped total mission cost.

Mission Format 1: Proposals to use existing ARC-provided hardware should allocate no more than $400K (not including reserve) for science experiment development, which may include up to $150K for costs associated with very minor mission-specific science instrument/payload development. Proposals must include the cost of the ARC-provided hardware and services within the total mission cost. For these proposals, the minimum unencumbered cost reserve required for Phase A through Phase D is reduced to 15%.

Mission Format 2: Proposers wishing to make modifications to ARC-provided hardware will develop detailed engineering implementations after selection for a Phase A study. Proposals intending to perform experiments in modified ARC-provided hardware, in cooperation with the ARC SSD, should allow up to $700K for the science investigations. The engineering implementation component of such an effort is anticipated to cost between $500-750K and must be described briefly in the proposal. Proposals must include the cost of the ARC-provided hardware and services within the total mission cost.

Mission Format 3: Proposers wishing to utilize only ARC-provided integration, launch services, and postlaunch communications support should refer to the PIP for information on how to budget for those components of the SCM, which are likely to require between $500-750K. Proposers should allocate the budget remaining within the cost cap as necessary to accomplish the proposed work in accordance with NASA policies and requirements.

For the FSB component of in this PEA, it is expected that up to two individual investigations may be selected, depending on the availability of compliant proposals of appropriate merit and provided they can be accommodated within the total cost caps of $1.5M allocated for MoO-1 and $2M allocated for MoO-2.

For the ASP component of this PEA, it is expected that one or more SCM investigations may be selected, depending on the availability of compliant proposals of appropriate merit and provided they can be accommodated within the total cost cap of $2M allocated for ASP. Proposals requesting $1M or less for all phases of the investigation are at a high priority for selection by ASP, and multiple proposals may be selected for award if the aggregate cost falls within the total budget of $2M allocated for this ASP opportunity.

For missions that propose to achieve a rendezvous with the Earth's Moon or another Solar System body, it is required that proposers include a plan to make formally archived data available to the planetary science community through the Planetary Data System (http://pds.nasa.gov/).

Proposals with budgets that exceed the stated overall budget guidelines or caps will be returned without review or consideration.

		Cap on Science Experiment Development	ARC-provided hardware and services	Total Mission Cap
Mission Format 1	MOO-1	$400K	See PIP	$1.5M
Mission Format 1	ASP	$400K	See PIP	$2M
Mission Format 2	MOO-2	$700K	See PIP	$2M
Mission Format 2	ASP	$700K	See PIP	$2M
Mission Format 3	ASP	None	$550-700K	$2M

4.3 Launch Vehicle Services and Funding

Launch vehicle accommodations and provisions for mission operations must be clearly identified in the proposal, and launch-accommodation flexibility will be a consideration during the selection process.

Estimated costs for launch accommodations and integration provisions are provided in the PIP and must be included in total proposed costs for the mission. Actual flight accommodations will be provided and managed by ARC-SSD. For selected FSB missions, these will be similar to accommodations utilized for the first two FSB microsatellite missions, GeneSat-1 and Pharmasat, as described in the PIP.

Other options for launching selected ASP missions will be considered on a case-by-case basis, if these may be accomplished within cost and schedule constraints. These could include secondary payload opportunities that are in development for launch over the next several years, such as existing and planned free flying spacecraft (e.g., the Russian Bion

platform, Super Strypi, SpaceX Falcon, EELV, etc.). However, use of existing platforms and launch vehicles will be favored over development of new platforms and launch accommodations.

5.0 PROPOSAL PREPARATION AND SUBMISSION

5.1 Proposal Content Requirements

Proposal content must conform to the guidelines set forth in Section 6.2 and Appendix B of this SALMON AO.

Investigators should identify which opportunity (MoO-1, MoO-2, or ASP) they feel is most suitable for their proposal and should choose the desired mission format.

Proposers to the FSB opportunities should demonstrate, using statistics, that the proposed experiment will, if the hardware performs within the predicted variability, have the power to resolve the stated hypothesis within the given N or sample size. Proposers should also describe how the proposed hardware will support the experimental conditions necessary to provide statistical confidence in the results and what specific analyses will be performed to test the hypothesis. If the PI determines that no statistical analysis is needed, then that conclusion must be clearly supported in the proposal.

Questions concerning the content provided in this PEA, or in the PIP, may be directed to the NASA points of contact listed in Section 7.0 of this PEA.

5.2 Exceptions to General SALMON Requirements

This Program Element Appendix contains the following exceptions to the SALMON proposal preparation and submission requirements outlined in this SALMON AO.

Table H3-1, *Cost Funding Profile Template,* should be used in lieu of the format provided for Table B.5 in Appendix B of this SALMON AO.

Table H3-1 SALMON-H3 Cost Funding Profile Template

7120 Element	2009	2010	2011	2012	Grand Total
PI Cost					
1 Project Management	$ -	$ -	$ -	$ -	$ -
Reserves	$ -	$ -	$ -	$ -	$ -
2 Systems Engineering	$ -	$ -	$ -	$ -	$ -
3 Safety and Mission Assurance (SMA)	$ -	$ -	$ -	$ -	$ -
4 Science/Technology	$ -	$ -	$ -	$ -	$ -
5 Payload/Instruments	$ -	$ -	$ -	$ -	$ -
6 Spacecraft	$ -	$ -	$ -	$ -	$ -
7 Mission Operations	$ -	$ -	$ -	$ -	$ -
8 Launch Vehicle	$ -	$ -	$ -	$ -	$ -
9 Ground Systems	$ -	$ -	$ -	$ -	$ -
10 System Integration & Testing	$ -	$ -	$ -	$ -	$ -
11 Education & Public Outreach	$ -	$ -	$ -	$ -	$ -
Contributions	$ -	$ -	$ -	$ -	$ -
PI Total Cost	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Govt Contribution Cost (includes reserve)	$ -	$ -	$ -	$ -	$ -
Total Equivalent Mission Cost	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

Table H3-2, *Mission Phase Summary for Cost*, should be used in lieu of the format provided for Table B.6 in Appendix B of this SALMON AO.

Table H3-2 Mission Phase Summary for Cost

7120 Element	A	B	C	D	E	F	Grand Total
PI Cost							
1 Project Management	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Reserves	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2 Systems Engineering	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3 Safety and Mission Assurance (SMA)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4 Science/Technology	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5 Payload/Instruments	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6 Spacecraft	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7 Mission Operations	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8 Launch Vehicle	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9 Ground Systems	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10 System Integration & Testing	$ -	$ -	$ -	$ -	$ -	$ -	$ -
11 Education & Public Outreach	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Contributions	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PI Total Cost	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Govt Contribution Cost (includes reserve)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Equivalent Mission Cost	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

5.3 Proposal Submission Requirements

Proposals must be submitted according to the guidelines set forth in Section 6.3 of this SALMON AO and in Section 3.0 of this PEA.

6.0 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

6.1 Scientific/Technical Evaluation Factors

Proposals will be evaluated per the evaluation criteria set forth in Section 7.2 of this SALMON AO except that an accommodation review performed at NASA Ames Research Center will take the place of the technical, management, and cost feasibility,

including cost risk, evaluation set forth in Section 7.2.4 of this SALMON AO. Proposals will be reviewed to evaluate whether the proposed investigations can be accommodated by the proposed spacecraft platform and payload subsystem. The review will also evaluate whether any proposed instrument modifications can be accommodated within cost and schedule constraints.

For missions proposed to achieve a rendezvous with the Earth's Moon or another Solar System body, in addition to the factors for implementation merit given in Section 7.2.3 of this SALMON AO, the implementation merit of a proposal will also include the demonstrated scientific merit that this investigation's archived data adds to the Planetary Science community.

6.2 Specific Selection Factors

Proposals will be selected according to the guidelines set forth in Section 7.3 of this SALMON AO.

The Selection Official for Astrobiology Small Payloads missions is the Director of the Planetary Science Division within the Science Mission Directorate. The Selection Official for Fundamental Space Biology missions is the Director for the Advanced Capabilities Division within the Exploration Systems Mission Directorate.

6.3 Implementation Activities

Proposal selection and award will be implemented according to the guidelines set forth in Section 7.4 of this SALMON AO and Section 6.0 of this PEA with the following amendments:

i) Notification of Selection

Following initial selection, the PIs of the selected investigations will be notified by telephone, followed by formal written notification. The formal notification may include special instructions or conditions for the selection and the implementation of the proposed investigation. The appropriate NASA Program Office (SMD for the Astrobiology Small Payloads opportunity, ESMD for the Fundamental Space Biology opportunity) will contact each selected PI as soon as possible after selection to clarify requirements and responsibilities of all parties having roles in each selected investigation. Proposers of investigations that were not selected will be notified in writing and offered a debriefing as described in Section 7.6 of this SALMON AO.

ii) Award Administration and Funding of Investigations

To accommodate the opportunities provided in this PEA, it is anticipated that a variety of funding vehicles through the NASA Ames Research Center may be appropriate for any non-NASA investigations selected under this AO. Generally, proposals intending to use the existing ARC SSD-provided hardware and services will be funded through a grant or cooperative agreement (as appropriate), proposals which require further development of

the SSD hardware will be funded through a cooperative agreement and funded incrementally to accommodate required reviews; and proposals providing a complete satellite for launch will be funded by a contract funded incrementally to accommodate required reviews.

- Selected proposals intending to use existing ARC SSD-provided hardware will be issued awards through applicable funding vehicles (provide intra-agency funding to NASA Centers and JPL, award grants to non-NASA institutions).

- Proposers intending to team with ARC SSD personnel to further develop SSD hardware must establish a cooperative agreement with ARC SSD to perform this work. Funding will be provided to support a short Phase A study that must pass review prior to approval of funding for Phases B/C/D and E/F.

The funding vehicles to support further formulation and implementation will conform to all applicable Federal and NASA procurement requirements. Grants and cooperative agreements will be subject to the provisions of the *NASA Grants and Cooperative Agreement Handbook* (http://prod.nais.nasa.gov/pub/pub_library/grcover.htm). For contracts, if the contract exceeds $650K, the contractor will have to certify the proposed costs for the contract.

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.

iii) Confirmation of Investigations

Proposals that have been selected for further development during a short competitive Phase A will be reviewed at the end of Phase A, and a downselect will be made by the Selection Official. At the end of Phase B, each selected project will be reviewed and the Selection Official will take a decision whether to proceed with the mission, based upon the Phase B results and evidence of satisfactory technical, cost, and schedule performance. Once a mission proceeds to Phase C, no rephasing of Phase E costs to Phase C/D will be permitted.

ASP missions that exceed their proposed budget will be cancelled without further consideration.

7.0 SUMMARY OF KEY INFORMATION

PI Mission Cost Cap	Astrobiology Small Payloads: $2M; see Section 4.2 of this PEA. Small Complete Missions in Fundamental Space Biology: not to exceed cap (incl reserves) of $1.5M for MoO1, and $2.0M for MoO2; see Section 4.2 of this PEA
Award Type	Mission Format 1: Grant or Cooperative Agreement; Mission Format 2: Cooperative Agreement; Mission Format 3: Contract; see Section 6.3(ii) of this PEA
Latest Launch Date	June 30, 2012
AO Reissue Date	September 30, 2009
Date for Preproposal Conference	Not applicable
Due Date for NOI	October 28, 2009
Due Date for Proposals	December 18, 2009
End of Phase A (when applicable)	Summer 2010
Submission Medium	Hard and electronic copies; see Section 6.3 of the SALMON AO
Web site for submission of electronic cover page via NSPIRES	http://nspires.nasaprs.com/ (help desk available at 202-479-9376 or nspires-help@nasaprs.com)

NASA points of contact concerning this Program Element	
For science questions associated with Astrobiology Small Payloads:	Dr. Catharine A. Conley Planetary Science Division Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Tel: 202-358-3912 E-mail: Cassie.Conley@nasa.gov
For science questions associated with Small Missions in Fundamental Space Biology:	Dr. David L. Tomko Advanced Capabilities Division Exploration Systems Mission Directorate NASA Headquarters Washington, DC 20546-0001 Tel: 202-358-2211 E-mail: dtomko@nasa.gov
For technical information regarding both small satellite / small payload opportunities (TPOC)	Mr. John W. Hines Chief Technologist Engineering Directorate NASA Ames Research Center Moffett Field, CA 94035 Tel: 650-604-5538 E-mail: ARC-DL-SCM-INFO@MAIL.NASA.GOV

END OF PEA H3

PEA H4: EARTH SCIENCE U.S. PARTICIPATING INVESTIGATOR

NASA solicits proposals for USPI investigations that address the Earth Science Research Program objectives listed in the *Science Plan for NASA's Science Mission Directorate 2007 – 2016* (found in the SALMON Reference Library). Proposed investigations that address the science questions listed in the *2007 NASA Science Plan* are highly encouraged. Examples include, but are not limited to, Earth science investigators responding to the Japan Aerospace Exploration Agency (JAXA) Global Change Observation Mission (GCOM-W) AO, Indian Space Research Organization (ISRO) Oceansat-2 call for proposals, and those interested in utilizing the upcoming Laser Geodynamics Satellites (LAGEOS) mission to be launched by the Italian Space Agency (ASI).

The Science Mission Directorate is soliciting Earth Science USPI investigations through its Research Opportunities in Space and Earth Sciences 2008 (ROSES-08) NASA Research Announcement (NRA).

This proposal opportunity may be found in Appendix A.29 of the ROSES-08 NRA. Earth Science USPI proposals submitted in response to the ROSES solicitation are subject to the proposal guidelines specified in ROSES and will be reviewed and selected using the proposal criteria specified in ROSES.

ROSES-08 may be found at http://nspires.nasaprs.com/ (select "Solicitations" then "Open Solicitations" then "NNH08ZDA001N").

Date for Pre-proposal conference	September 26, 2008
Due date for Notices of Intent (NOIs) to propose	October 15, 2008
Due date for proposals	December 2, 2008

END OF PEA H4

PEA H5: LADEE DUST INSTRUMENT

I. BACKGROUND

NASA is committed to launching a lunar orbiter in the 2011 timeframe. The Lunar Atmosphere and Dust Environment Explorer (LADEE) will seek new information about the tenuous lunar atmosphere and dust environment before that environment is altered by extended human activity on the Moon, as recommended by the recent National Research Council report *The Scientific Context for Exploration of the Moon* (science goals 8a and 8b) included in the SALMON Reference Library (Appendix C).

The LADEE mission is a small focused mission intended to address the following objectives:

- Objective 1: Determine the composition of the lunar atmosphere and investigate the processes that control its distribution and variability, including sources, sinks, and surface interactions.
- Objective 2: Characterize the lunar exospheric dust environment and measure any spatial and temporal variability and impacts on the lunar atmosphere.

To address these objectives, the LADEE Science Definition Team (SDT) has recommended a three instrument payload consisting of a neutral mass spectrometer, a UV/Vis spectrometer, and an *in-situ* dust detector. The SDT report is included in the SALMON Reference Library (Appendix C). This SALMON PEA seeks proposals for the *in-situ* dust detector instrument.

II. SCIENCE AND PROGRAM OBJECTIVES

While there is ample evidence from Surveyor images and the Apollo Lunar Ejecta and Meteorites (LEAM) experiment for significant dust transport near the lunar surface, the inference of high altitude lofted dust is more controversial, relying on Apollo astronaut sketches and limited analysis of Apollo photographs. LADEE seeks to definitively answer those questions.

NASA solicits proposals for an instrument to address the lunar dust environment at the roughly 50 km expected LADEE orbit. We are seeking proposals for an in-situ instrument that directly counts dust grains. It is expected that the lunar surface-lofted dust component will consist of sub-micron grains traveling at relatively slow speeds. The densities at 50 km are expected to be on the order of 10^{-4}/cc.

LADEE anticipates a nominal four month mission with a circular retrograde orbit at an altitude below 50 km and an inclination of 180° ± 20°. The spacecraft is 3-axis stabilized using reaction wheels during science data acquisition, but may do slow spins for thermal control when not doing active science data acquisition.

NASA is seeking an existing instrument (such as flight spares and engineering models) that could be quickly flight qualified, accommodated, and flown on LADEE in order to address science objective #2. NASA is also interested in potential “build to print” possibilities from existing flight instruments.

III. PROPOSAL OPPORTUNITY PERIOD AND SCHEDULE

The following schedule applies to this Focused Mission of Opportunity program element:

- There will be no pre-proposal conference for this opportunity.
- A Notice of Intent to propose (NOI) is encouraged, and is due no later than 11:59 p.m. Eastern time on the date given in Section VII of this PEA. Section 6.1.4 of this SALMON AO provides information on electronic NOI submission through NSPIRES.
- Proposals are due no later than 4:30 p.m. Eastern time on the proposal due date given in Section VII of this PEA. Proposal submission requirements are outlined in Section V of this PEA.
- Selection announcement is targeted for 2 months after receipt of proposals. Funding for the selected instrument will be available as soon as appropriate funding vehicles can be put in place; commonly this is 4-8 weeks following selection.

IV. REQUIREMENTS AND CONSTRAINTS

A. Type of Mission of Opportunity

This PEA is a Focused Mission of Opportunity (FMO); the solicitation is for a complete science investigation that requires delivery of an instrument to be placed on the LADEE mission. The instrument team will be responsible for delivering the instrument, operating the instrument through Phase E, preparing and archiving the data products, analyzing the data, and reporting the results of the science investigation in the science literature. The instrument team should only be large enough to accomplish the tasks listed in the previous sentence. NASA will solicit participating scientists for this instrument and the other LADEE instruments before launch.

B. Cost and Schedule Constraints

It is expected that one proposal will be selected through this PEA. LADEE anticipates a 2011 launch, which provides a compressed timeline for instrument acquisition. The selected instrument will be expected to be prepared for final delivery no later than October 2010. NASA is allocating approximately $5M for this investigation.

C. Technical Requirements and Constraints

In addition to the requirements given in the SALMON AO, all proposed investigations must meet the following spacecraft limitations:

- Total Instrument Mass: 3 kg;
- Power provided: 28 Volts unregulated;
- Continuous Power: 5 W (higher peak power may be available at times);
- Continuous science data rate: 1 kbps (on-board data storage available);
- Pointing capability of spacecraft: 5 deg; and
- Pointing knowledge provided by spacecraft: 1 degree.

V. PROPOSAL PREPARATION AND SUBMISSION

A. Proposal Content Requirements

Proposal content must conform to the guidelines set forth in Section 6.2 and Appendix B of this SALMON AO, with the exceptions noted in Section V.B of this PEA.

B. Exceptions to General SALMON Requirements

Referring to Table B.1 of this SALMON AO, the page limit for “Scientific/Technical Investigation” is reduced from 20 pages to 10 pages.

Soon after instrument selection, the LADEE Mission has its Preliminary Design Review (PDR). If any of the following documents are available (e.g. prepared for past instruments), proposers may include them as an appendix, with or without updating them for LADEE:

- Instrument Functional Requirements Document (FRD),
- Instrument Interface Requirements Document (IRD), and
- Experiment Implementation Plan (EIP).

The inclusion of any of these documents will not be deducted from the proposal page limits. Templates and guidelines for these documents are available in the SALMON Reference Library (Appendix C).

This PEA contains no other exceptions to the proposal preparation and submission requirements outlined in this SALMON AO.

C. Proposal Submission Requirements

Proposals must be submitted according to the guidelines set forth in Section 6.3 of this SALMON AO and Section III of this PEA.

VI. PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

A. Scientific Evaluation Factors

Proposals will be evaluated per the evaluation criteria set forth in Section 7.2 of this SALMON AO.

B. Specific Selection Factors

A proposal will be selected according to the guidelines set forth in Section 7.3 of this SALMON AO.

The Selection Official for this PEA is the Director of the Planetary Sciences Division of the Science Mission Directorate.

C. Implementation Activities

Proposal selection and award will be implemented according to the guidelines set forth in Section 7.4 of this AO and Section IV.B of this PEA. It is anticipated that contracts will be awarded for any non-NASA investigations selected under this AO through NASA Goddard Space Flight Center. If required, a contract will be awarded for short Phase A concept study with an option for a Bridge Phase to continue on to Phases B/C/D and E/F while these phases are added to the contract. The contract for further formulation and implementation will conform to all applicable Federal and NASA procurement requirements.

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.

D. Exceptions to General SALMON Requirements

Each proposal will be evaluated for its technical, management, and cost feasibility, including cost risk. 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 instrument within the proposed schedule and cost. The methods and rationale used to develop the estimated cost, and the discussion of cost risks, will be assessed.

VII. SUMMARY OF KEY INFORMATION

Focused Mission of Opportunity Cost Target	$5M
Latest instrument delivery date	October 2010
AO release date	September 3, 2008
Due date for Notice of Intent (NOI) to propose	September 24, 2008
Due date for proposals	November 4, 2008
Submission medium	Hard and electronic copies; see Section 6.3.1 of SALMON AO
Web site for submission of electronic cover page via NSPIRES	http://nspires.nasaprs.com/ (help desk available at 202-479-9376 or nspires-help@nasaprs.com)
NASA point of contact concerning this Program Element	Dr. Tom Morgan Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Tel: 202-358-0828 Email: Thomas.H.Morgan@nasa.gov

END OF PEA H5

Program Element Appendix (PEA) H6:
EXOMARS TRACE GAS ORBITER INSTRUMENTS

Amended on March 25, 2010. Section 5.2.3 has been added to the Appendix H6, ExoMars Trace Gas Orbiter Instruments, of the SALMON AO.
Amended on May 5, 2010. Section 6.2.1 has been added to the Appendix H6, ExoMars Trace Gas Orbiter Instruments, of the SALMON AO.

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Appendix H6:
EXOMARS TRACE GAS ORBITER INSTRUMENTS

1 BACKGROUND

1.1 Programmatic Overview

In late 2008, ESA and NASA began investigating the possibility of combining resources to implement joint missions in a collaborative program to explore Mars. Initial discussions focused on mission concept studies for the 2016 and 2018 Mars launch opportunities; however, the ultimate objective of the joint program is the implementation of an international Mars Sample Return (MSR) effort.

The outcome of this initial process led to the definition of joint mission concepts for the 2016 and 2018 opportunities.

The 2016 mission is ESA-led and launched by NASA. ESA will provide a Mars orbiter and an Entry, Descent and Landing (EDL) demonstrator. The ExoMars Trace Gas Orbiter will accommodate scientific instruments for the detection of atmospheric trace gases, the study of their temporal and spatial evolution, and the localization of their source regions. Additionally, the 2016 orbiter will provide surface telecommunications support for the 2018 mission and for other landed assets until 2022.

1.2 Organization of the 2016 ExoMars Trace Gas Orbiter Mission

The structure of the joint 2016 mission provides that ESA will:

- Act as the overall mission lead;
- Provide the spacecraft, including the orbiter and EDL demonstrator, and the science payload interface;
- Provide and jointly operate the Earth-Mars telecommunication subsystem for the orbiter;
- Provide accommodation for 125 kg of scientific instruments to conduct the trace gas and imaging scientific objectives;
- Coordinate the provision of some instruments for the orbiter. Instruments will be selected through the joint process described in this Announcement of Opportunity.
- Contribute participating scientists for the orbiter science operations;
- Lead the operations of the spacecraft during all phases of the mission for science support and telecommunications;
- Jointly conduct the Mars orbit insertion and aerobreaking operations of the orbiter and EDL demonstrator; and
- Jointly conduct the science operations.

For the joint 2016 mission, NASA will:

- Provide an EELV-class launch vehicle and associated launch and cruise operations;
- Provide the proximity communications package (Electra) and coordinate its operations with the ESA operations lead;
- Provide a Ka-Band "string" for the orbiter's Mars-Earth telecommunications package;
- Provide some instruments for the orbiter. Instruments will be selected through the joint process described in this Announcement of Opportunity.
- Contribute participating scientists for the orbiter science operations;
- Jointly conduct the Mars orbit insertion and aerobreaking operations of the orbiter and EDL demonstrator; and
- Lead the science operations

1.3 Purpose of this Announcement of Opportunity (AO)

Within the context of the 2016 joint mission, and as outlined above, it is the purpose of this announcement to solicit proposals for the ExoMars Trace Gas Orbiter's scientific instruments.

It should be noted that this announcement is being released jointly by NASA and ESA. The intention of the two agencies is to conduct a joint evaluation and a coordinated selection process leading to a mutually agreed payload.

Proposals will be reviewed by both U.S. reviewers and by reviewers from ESA participating states. All reviewers will sign nondisclosure Agreements. The review process will not include reviewers from countries on the U.S. prohibited list (22 CFR 126.1, *Prohibited Export and Sales to Certain Countries*). For U.S. proposers this is important because of implications with respect to the International Trade in Arms Regulations (ITAR) referred to in the overarching SALMON AO (see Section 4 of this program element appendix for an explanation of the SALMON AO).

1.4 Responding to this AO

All proposals to participate in the opportunity described here must be submitted in response to this AO.

It is NASA's policy to conduct research with non-U.S. entities on a cooperative, no-exchange-of-funds basis. NASA does not normally fund non-U.S. research proposals or non-U.S. research efforts that are part of U.S. research proposals. Rather, cooperative research efforts are normally implemented via agreements between NASA and the non-U.S. entity involved. Thus, non-U.S. proposers, whether as primary proposers or as participants in U.S. led research efforts, are expected to arrange for non-U.S. funding for their portion of the research.

ESA does not fund the development and exploitation of instruments for its spacecraft. However, under ESA coordination, the national agencies and research institutions taking part in ESA's Aurora Programme and submitting proposals to this opportunity will be responsible for funding any instruments selected in response to this Announcement.

Given that this mission is part of the joint ESA-NASA Mars Exploration Program, instrument proposals having an international dimension are encouraged. In particular, participation is encouraged from scientists in the U.S. and in countries contributing to ESA's Aurora Programme (Austria, Belgium, Canada, Denmark, France, Greece, Germany, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom).

2 SCIENCE AND PROGRAM OBJECTIVES

2.1 NASA Planetary Science and Mars Exploration Goals

The Scientific goals underlying NASA's Planetary Science program are articulated in the NASA Science Plan (http://nasascience.nasa.gov/about-us/science-strategy/):

- How did the Sun's family of planets and minor bodies originate?
- How did the solar system evolve to its current diverse state?
- What are the characteristics of the solar system that led to the origin of life?
- How did life begin and evolve on Earth and has it evolved elsewhere in the solar system?
- What are the hazards and resources in the solar system environment that will affect the extension of human presence in space?

In formulating the Mars Exploration Program within the Planetary Science Division, these science goals have been made more specific to Mars itself. These goals are:

- To search for evidence of life,
- To understand the history of the solar system, and
- To prepare for future human exploration.

2.2 ESA ExoMars Science and Exploration Goals

The ESA objectives for the ExoMars Programme, which consists of the 2016 and 2018 mission opportunities, can be found in the ExoMars Science Management Plan (see the AO Library at the location given in Section 7 of this program element appendix).

The ExoMars technology objectives are:

- Entry, Descent, and Landing (EDL) of a payload on the surface of Mars;
- Surface mobility with a Rover;
- Access to the subsurface to acquire samples; and
- Sample acquisition, preparation, distribution, and analysis.

The ExoMars scientific objectives are:

- To search for signs of past and present life on Mars;
- To investigate the water/geochemical environment as a function of depth in the shallow subsurface; and
- To study Martian atmospheric trace gases and their sources.

2.3 Science Goals for the 2016 ExoMars Trace Gas Orbiter

Observations from the Planetary Fourier Spectrometer (PFS) on *Mars Express* and from very high spectral resolution spectrometers using ground-based telescopes have detected variable amounts of methane in the atmosphere of Mars. However, current photochemical models cannot explain the reported rapid variations in space and time. The presence of methane suggests ongoing activity in the subsurface. The nature of the processes that could be producing methane and other trace gases is unknown, as is the location and the areal extent of the exchange with the atmosphere.

ESA and NASA convened the Mars Orbiter Joint Instrument Definition Team (JIDT) to recommend science objectives for a detailed study of the presence and variation of methane and other trace gases in the Martian atmosphere. The JIDT report from October 2009 provides the following prioritized guidelines for the scientific objectives of the 2016 mission:

1. Detect a broad suite of atmospheric trace gases and key isotopes;
2. Characterize the spatial and temporal variation of methane and other key species, ideally representing families of photochemically important trace gases (HOx, NOx, hydrocarbons, etc.) and their source molecules (e.g. H_2O);
3. Localize the sources and derive the evolution of methane and other key species and their possible interactions, including interactions with atmospheric aerosols and how they are affected by the atmospheric state (temperature and distribution of major source gases; e.g. water); and
4. Image surface features possibly related to trace gas sources and sinks.

In addition to these scientific goals, the requirements to support the EDL demonstrator and communications for the 2018 mission rovers impose several constraints on the orbiter's attitude and orbit around Mars. These are detailed in the JIDT report and other referenced material (see the AO library at the location given in Section 7 of this program element appendix) and may be important for the proposed instruments and their operation.

The JIDT report discusses a potential set of instruments to address the mission science goals outlined above. Proposers should note that this was offered as a proof of concept and does not represent any preselection by either ESA or NASA of instruments or techniques to accomplish the mission science goals.

2.3.1 Detection of Trace Gases

The highest scientific priority is assigned to detection of a broad suite of trace gases with high sensitivity to establish the atmospheric inventory, but also to provide insights into the nature of the trace gas source through detection of suites of gases or through ratios of gases and isotopologues (e.g., volcanic in nature or biogenic?). The ability to map certain key species (e.g., methane) is also given high priority.

The JIDT panel considered that solar occultation measurements would provide the highest sensitivity for trace gas detection. This has clear implications for the spacecraft orbit and altitude,

which is also constrained by other elements of the mission. Potential proposers should consult the experiment proposal information package (E-PIP) for the details (see the AO library at the location given in Section 7 of this program element appendix).

Molecules of potential interest include, but are not limited to: CO_2, CO, H_2O, H_2O_2, NO_2 N_2O, O_3, CH_4, C_2H_2, C_2H_4, C_2H_6, H_2CO, HCN, N_2S, OCS, SO_2, HCl, and CO. The isotopologues of these molecules are also of interest.

2.3.2 Characterization of Spatial and Temporal Variability

The second priority is assigned to measurements and low resolution imaging of atmospheric state (aerosols, temperature, and winds) and to mapping of key trace gas species. Characterizing the spatial and temporal variability of selected species may require:

- Measurements on several relevant timescales to study:
  - Daily fluctuations due to diurnal variations of insolation;
  - Longer term variations due to atmospheric transport;
  - Seasonal variations due to changes in sunlight, atmospheric aerosols, and water vapor.
- Measurements to separate seasonal and local time effects, with observations covering the diurnal cycle multiple times in a Mars year.
- Measurements of different environments distributed over the planet.

2.3.3 Localization of Sources

Localization of the sources of trace gases in the Mars atmosphere is expected to be a difficult task within the constraints of this mission. Therefore, it was given a lower priority in the science goals. The objective is to determine if particular gases are emanating from specific areas on or near to the surface of Mars.

Several possible techniques were envisaged by the JIDT. Most of these required high-resolution imaging or a high degree of modeling.

2.3.4 Imaging of Surface Features

The imaging capabilities should, among other possible subsidiary objectives, provide information on the geological context for any sources detected. Within this context, desirable attributes of an imager are in order of decreasing priority: high resolution, color differentiation, and stereoscopic capabilities.

3 PROPOSAL OPPORTUNITY PERIOD AND SCHEDULE

This solicitation is an Appendix to the NASA Stand Alone Mission of Opportunity Announcement of Opportunity (SALMON AO). The SALMON AO provides the overall structure and guidelines for several types of mission of opportunity solicitations. Each new opportunity is announced with a program element appendix (PEA). This document is such a PEA. In particular, this is a Focused Mission of Opportunity (FMO). The SALMON AO (NNH08ZDA009O) can be found in NSPIRES at http://nspires.nasaprs.com/.

This Announcement of Opportunity serves as the only mechanism for proposals from ESA participating state investigators wishing to participate in the ExoMars Trace Gas Orbiter Science.

The following schedule applies to this Focused Mission of Opportunity program element.

- A Preproposal Teleconference is planned as part of this solicitation. Further information will be available at the SALMON AO ExoMars Trace Gas Orbiter Instruments website (see Section 7 of this program element appendix) prior to the Preproposal Teleconference.
- Please address questions concerning any portion of this appendix to the Points of Contact given in Section 7 of this program element appendix, as appropriate. The period for questions will close two weeks before the proposal due date.
- A Notice of Intent (NOI) to propose to this announcement is extremely valuable to ESA and NASA, and, therefore, is encouraged. NOIs are due no later than 23:59 hours Eastern Time on the date given in Section 7 of this program element appendix (4:59 Greenwich Mean Time on the following date). Section 6.1.4 of this SALMON Announcement of Opportunity (AO) provides information on electronic NOI submission through the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES: http://nspires.nasaprs.com/.)
- All proposals are due no later than 23:59 hours Eastern Time on the date given in Section 7 of this program element appendix (4:59 Greenwich Mean Time on the following date). Proposal submission requirements are outlined in Section 5 of this program element appendix.
- For proposals to be funded by NASA, funding for selected proposals will begin as soon as appropriate funding vehicles can be put in place; commonly this is four to eight weeks following selection.
- For proposals to be funded through ESA participating states, funding for selected proposals will begin as soon as the appropriate agreements can be put in place, following ESA Programme Board (PB-HME) approval.

4 REQUIREMENTS AND CONSTRAINTS

4.1 Type of Mission of Opportunity

For NASA, this program element appendix is a Focused Mission of Opportunity (FMO). An FMO is one that addresses a specific, NASA-identified flight opportunity that fulfills the solicited objectives and includes all of the elements specified in this document and in Appendix B of this SALMON AO.

ESA agrees to utilize the relevant sections of the SALMON AO as an instrument for ensuring that the format and content of all proposals to be submitted are the same. Specific deviations from the SALMON requirements applicable to proposals submitted by investigators from ESA-participating states are identified in Section 4.4 of this program element appendix.

This opportunity solicits proposals for complete science investigations that include an instrument to be included in the ESA-led Mars 2016 ExoMars Trace Gas Orbiter mission. The instrument PI

is responsible for conducting the proposed science investigation which includes, but is not limited to, delivering the instrument, operating the instrument through Phase E, preparing and archiving the data products, analyzing the data, and reporting the results of the science investigation in the science literature. Proposals shall designate all Co-Is, describe the role of each Co-I in the development of the mission, and justify the necessary nature of the role; see Section 4.6.5 of the SALMON AO.

4.2 Cost and Schedule Constraints

It is expected that sufficient instruments will be selected in response to this opportunity to address as many of the mission's scientific objectives as can be accommodated on the orbiter and following the scientific priorities given above.

NASA expects to fund up to $100M for its portion of the suite of instruments to be flown, with the remainder of any cost to be borne by international partners, either as contributions to NASA led and funded instruments, or as complete instruments provided by the international partner. NASA funds are not restricted to funding NASA-led instruments and could be used to fund a U.S. contribution to an investigation led by an international partner.

Instrument contributions from countries that participate in ESA's Aurora Programme will be financed by the appropriate national funding institution, in coordination with ESA. Proposals from investigators in ESA participating states must provide letters of financial endorsement from the relevant funding sources.

The opportunity described in this program element appendix requests proposals for investigations that follow the schedule given in Section 7 of this program element appendix and whose funding profiles will accommodate the mission schedule as described in the E-PIP.

Proposers to the opportunity described in this program element appendix should refer to the E-PIP available at the URL listed in Section 7 of this program element appendix.

4.3 Technical Requirements and Constraints

More complete details of the technical requirements and constraints can be found in the E-PIP. This section provides an overview.

It is the intention of ESA and NASA to select a suite of instruments that does not exceed the following constraints:

- Total mass of instrument payload: 125 kg(see Section 5.2 of the E-PIP).
- Maximum average power: 190 Watts
- Data rate: 4.8 Gbit/day at maximum Earth-Mars range.
  8 Gbit/day average during the remaining prime science mission.

The ExoMars Trace Gas Orbiter will be in a 400-km orbit with an inclination of 74°. After reaching the prime science orbit, the prime science data acquisition mission is planned to be one

Martian year (687 Earth days). With the arrival of the 2018 mission at Mars, priority will be given to providing communications support to the 2018 mission rovers, though it should still be possible to conduct scientific measurements. The ExoMars Trace Gas Orbiter's science orbit is planned to be Sun inertial pointed during sunrise and sunset to allow Sun occultation measurements, and nadir pointed during the rest of the orbit. The details of the platform pointing law are provided in the E-PIP. One advantage of the generally Sun-pointed approach (accomplished by yaw steering) is to maintain the one face of the orbiter (+X direction) as a cold plane throughout.

The selected instruments must meet the applicable planetary protection requirements for a Mars orbiter mission. (See E-PIP requirements in the AO library).

4.4 Exceptions to General SALMON Requirements

This program element appendix contains the following exceptions to the SALMON proposal preparation and submission requirements outlined in this SALMON AO.

1. Proposal must be submitted only electronically and not with hard copy and CD as described in Section 6.3 of this SALMON AO; see Section 5.1 of this program element appendix.
2. The Notification process will be coordinated between ESA and NASA, as described in Section 6.3 of this program element appendix.
3. Proposals or portions of proposals requesting NASA funding should report proposal costs in Real Year (RY) dollars; there is no requirement to report costs in FY2008 dollars. All other proposals or portions of proposals, i.e. those not requesting NASA funding, should be reported in Real Year (RY) Euros or Euro-equivalents. This instruction supersedes and cancels the request for costs in FY2008 dollars described in Appendix B of this SALMON AO including Table B-5 and Table B-6.
4. Data policies for instruments selected in response to this appendix will follow the general guidelines of Section 4.4.3 of this SALMON AO. However, proposals should quantify the brief validation period after which the data will be placed in a publically available archive. It is expected that this brief period should be less than six calendar months. Please note that NASA and ESA reserve the right to direct or conduct processing and release of data needed for mission or program planning and also to support public engagement.
5. Rather than identifying the Lead Representative in the NOI, as described in Section 6.1.4(e) of this SALMON AO, the NOI should include the name of the organizational lead from each organization (industrial, academic, nonprofit, and/or Federal) included in the proposing team, and the organization's role in the proposed investigation, as may be known at the time of the NOI.
6. Proposals should not include a plan or a budget for science/technology enhancement options (STEOs); this supersedes Section 4.4.5 of this SALMON AO.
7. Proposers for NASA funding will be required to coordinate their education and public outreach (E/PO) activities, including any student collaboration, with and to complement the overarching Mars Public Engagement Plan. Detailed E/PO or student collaboration implementation plans will be developed by each selected investigation and delivered in conjunction with its Phase A/B activities. Proposals for NASA funding may include a proposed plan with a budget for E/PO or student collaboration activities, as described in

Section 4.10 of this SALMON AO. If the proposal is selected for NASA funding, NASA will provide feedback on the proposed E/PO or student collaboration plan. However approval or disapproval of the proposed E/PO or student collaboration plan will be deferred until later in Phase A/B. Proposed E/PO or student collaboration plans will not be formally evaluated at this time nor will they be a selection factor for this solicitation; this supersedes Section 7.2.5 of this SALMON AO.

8. Proposers from ESA participating states will be required to coordinate their communications and outreach plan with ESA. Proposers from ESA participating states should include funding for these activities in their proposals.

5 PROPOSAL PREPARATION AND SUBMISSION

5.1 Proposal Content Requirements

5.1.1 Proposal Content

Proposal content must conform to the guidelines set forth in Appendix B of this SALMON AO.

It is unnecessary to download the NSPIRES-generated Proposal Cover Page and incorporate it into the Proposal Document. NSPIRES will automatically route the two parts of the proposal (Cover Page form, proposal document) to the appropriate peer or NASA reviewers.

5.1.2 Limit on Size of Electronic Proposals

Proposals must be submitted electronically as a single PDF file (see Section 5.2.1 of this program element appendix).

There is a 15 Mbyte file size limit for each proposal; this limit applies to the single PDF file that is uploaded.

All PDF files generated and submitted must meet NASA requirements on creating PDF documents that are compliant with NSPIRES (see http://nspires.nasaprs.com/tutorials/PDF_Guidelines.pdf). This will ensure that proposals can be read by community reviewers and NASA and ESA program officers using a wide variety of computers, operating systems, and PDF readers.

It is the responsibility of each applicant to verify the accuracy and completeness of his/her proposal, including all text, figures, tables, foldouts, and required forms. NSPIRES allows applicants to verify, prior to submission, that all information contained in proposal PDF file(s) being provided to NSPIRES is complete and accurate. Well in advance of the proposal due date, the applicant is encouraged to use the “Generate” the “Complete Proposal” (found on the “View Proposal” page within NSPIRES) and to review the file they have generated using NSPIRES to ensure that all text, figures, tables, foldouts, and required forms are complete and accurate. The applicant must immediately call the NSPIRES Help Desk prior to proposal submission for assistance with any proposal if that proposal does not appear to be complete and correct after being “generated” in NSPIRIES. This use of this tool is optional and, if done, should be started well before the submittal deadline to allow adequate time to process the proposal document and to allow time to resolve any problems that might be encountered. Please note that in order to

avoid being classified as a "late proposal", proposals must be submitted prior to the deadline, even if they did not appear to be correct and complete after being "generated" in NSPIRES.

5.1.3 Identification of Export Controlled Material

The key data associated with the electronic submission of proposals (see Section 5.2.1 of this program element appendix) includes questions indicating whether or not a proposal contains export controlled information (see Section 4.8.4 of this SALMON AO). All proposers must answer these questions YES or NO when completing the electronic submission; these questions shall not be left unanswered.

All proposals must identify any export controlled material in the proposal as instructed in Section 4.9.1 of this SALMON AO. To the extent possible, ITAR sensitive material should be organized into separate clearly marked sections.

5.2 Proposal Submission Requirements

5.2.1 Submittal Address: Electronic Submission

Proposals must be submitted electronically via NASA's master proposal data base system, the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at http://nspires.nasaprs.com/. This data site is secure and all information entered is strictly for NASA's use only. This instruction supersedes and cancels the instructions for hardcopies and CDs in Section 6.3 of this SALMON AO.

In order to submit a proposal via NSPIRES, this AO requires that (i) the proposing organization be registered in NSPIRES, (ii) the proposer register key data concerning the intended submission by completing an electronic cover page within NSPIRES, (iii) all proposal team members who are named on the proposal's electronic cover page be registered in NSPIRES, (iv) all proposal team members commit to the proposal through NSPIRES, and (v) the proposal is submitted by an Authorized Organizational Representative(AOR) (not the PI) through NSPIRES. This final requirement serves as the proposing organizations "electronic signature" for the proposal.

Potential proposers are urged to access this site well in advance of the NOI and proposal due dates to familiarize themselves with its structure and enter the requested identifier information. The following sections of this program element appendix supplement Section 6.2.2 of this SALMON AO.

5.2.1.1 Registration of Proposing Organizations in NSPIRES

Every organization that intends to submit a proposal to NASA in response to this solicitation, including educational institutions, industry, not-for-profit institutions, the Jet Propulsion Laboratory, NASA Centers, other U.S. Government agencies, state and local Government agencies, non-U.S. organizations, and other organizations, must be registered in NSPIRES. Registration for NSPIRES must be performed by an organization's electronic business point-of-contact (EBPOC) in the Central Contractor Registry (CCR).

Organizations must obtain a Data Universal Numbering System (DUNS) number (http://www.ccr.gov/pdfs/DUNSGuideGovVendors.pdf). Note that an organization must also be

registered in the Central Contractor Registration (CCR) and obtain a CAGE Code before registration in NSPIRES (http://www.ccr.gov/). The CCR approval process can take several days (at minimum). CCR registration should be performed by an organization's electronic business primary point-of-contact.

Information on registration in NSPIRES is available at https://nspires.nasaprs.com/external/aboutRegistration.do and tutorials are available at http://nspires.nasaprs.com/tutorials/index.html.

5.2.1.2 Registration of Proposal Team Members in NSPIRES

Every individual named on the proposal's electronic Cover Page form (see below) as a proposing team member in any role, including co-investigators and collaborators,

- must be individually registered in NSPIRES and that such individuals must perform this registration themselves; no one may register a second party, even the PI of a proposal in which that person is committed to participate;
- must be identified with the organization through which they are participating in the proposal, regardless of their place of permanent employment or preferred mailing address; and
- must indicate their commitment to the investigation via NSPIRES.

See Appendix B, Section IV, of this SALMON AO for instructions. Note that this requirement applies to more than just Co-investigators; it applies to all team members named on the proposal's electronic Cover Page form

5.2.2 Deadline

The proposal must be received no later than the time deadline on the proposal due date given in Section 7 of this program element appendix. This time supersedes and cancels the time given in Section 6.3 of this SALMON AO.

Amended on March 25, 2010. Section 5.2.3 has been added to the Appendix H6, ExoMars Trace Gas Orbiter Instruments, of the SALMON AO.

5.2.3 Submission of Proposals by Non-U.S. Organizations

In order to be able to submit a proposal to NASA, the PI needs to be "affiliated" with an NSPIRES organization and have an authorizing official from that organization submit the proposal; PIs cannot submit proposals themselves. Because many foreign organizations have not registered in NSPIRES, an organization has been created within NSPIRES that can be used to submit a proposal under the following conditions:

- The proposing organization is a non-U.S. organization. U.S. organizations must be registered in NSPIRES and proposals from U.S. organizations must be submitted by an authorizing official from the proposing organization.
- The proposing organization is not already registered in NSPIRES.
- In lieu of the proposal being submitted by an authorizing official of the proposing organization, the proposal must include a Letter of Submission that is signed by an authorizing official of the proposing organization. The Letter of Submission should be placed following the Fact Sheet and preceding the proposal Table of Contents. The Letter

of Submission, if appropriately worded, can also serve the purpose of the letter of financial endorsement referenced in section 4.2 of this program element appendix.

- PI's considering taking advantage of this option must notify the ESA contact prior to April 1 (e-mail to: jorge.vago@esa.int, cc to albert.haldemann@esa.int).

5.2.3.1 Guidance for Proposals Submitted by Non-U.S. Organizations that are not Registered in NSPIRES

A guidance document titled "Submission of proposals to NASA using 'NASA Foreign PI Support Organization'" is available on the SALMON index page for this program element appendix (http://nspires.nasaprs.com/) and in the ExoMars Reference Library on the SALMON Additional Information Website (http://salmon.larc.nasa.gov/). This guidance document provides step-by-step instructions for the PI to affiliate with the NSPIRES organization that has been created for this purpose and for the PI to request that the proposal be formally submitted before the proposal deadline. These actions should be taken well in advance of the proposal deadline so that NSPIRES registration and affiliation issues do not prevent the proposal from being received on time.

5.2.3.2 Request for NASA Funding in a Proposal Submitted by a Non-U.S. Organization

Teaming arrangements of all kinds are permitted, including those in which U.S. investigators participate in an investigation proposed by a non-U.S. organization. If the U.S. investigators are requesting NASA funding, then the following information must be included in the proposal as a required Appendix 12:

- A Letter of Submission that is signed by an authorizing official of the U.S. organization that is requesting NASA funding (i.e., the lead U.S. organization);
- A statement of work (SOW) describing briefly the work package that is being proposed for U.S. organizations to conduct with NASA funding; and
- A budget describing the NASA funding requested for U.S. organizations. The budget should be reported using Tables B-5 and B-6 subject to the exceptions described in Section 4.4 of this program element appendix.

If this information appears elsewhere in the proposal, it should either be duplicated in Appendix 12 or Appendix 12 should contain a clear reference to its location elsewhere in the proposal.

Please be reminded of the 15 MB proposal file size (Section 5.1.2); scanned letters should be appropriately sized so the proposal document does not exceed this limit

5.3 Questions

In order to make sure that all proposers receive the same information, all questions concerning the content provided in this appendix, or in the E-PIP, should be sent to the E-mail address for questions listed in Section 7 of this program element appendix. When appropriate, responses will be posted on the website also listed in Section 7 of this program element appendix.

The deadline for receipt of questions is two weeks before the proposal due date listed in Section 7 of this program element appendix.

6 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

6.1 Scientific/Technical Evaluation Factors

Proposals will be evaluated according to the evaluation criteria set forth in Section 7.2 of this SALMON AO.

In addition to the evaluation factors given in Section 7.2 of this SALMON AO, the evaluation of scientific merit also includes the following factors:

- The extent to which the proposed investigation addresses high priority science objectives, as defined in the JIDT report.

In addition to the evaluation factors given in Section 7.2 of this SALMON AO, the evaluation of scientific implementation merit also includes the following factors:

- The extent to which the proposed instruments and sensors are compatible with the ExoMars Trace Gas Orbiter design, as given in the E-PIP.
- The maturity of the design or the demonstration of a clear path to achieve the necessary TRL on the schedule given in the E-PIP (see Section 7.2.4 of this SALMON AO for details regarding appropriate TRL levels).

6.2 Selection Process

Proposals will undergo a joint ESA-NASA review process. Following categorization of proposals, as described in Section 7.1 of this SALMON AO, an accommodation study will be conducted jointly by NASA and ESA for all selectable proposals. NASA's responsibility for the joint accommodation study will be led by the Mars Program Office at JPL and will include the participation of the TMC (technical, management, and cost) peer review panel under the management of the Science Office for Mission Assessments at the NASA Langley Research Center.

The selection of investigations by NASA will be coordinated with ESA and with ESA's selection of ESA-led ExoMars Trace Gas Orbiter instruments.

6.2.1 Accommodation Study Information Requirements

In order to conduct the accommodation study and assess the compatibility of proposed instruments with the spacecraft described in the E-PIP, all proposers are required to submit the information requested in Annex 1 of this PEA in the format requested. Details of the individual information items requested and the required format are provided in Annex 1.

Annex 1 must be submitted as an Excel spreadsheet. The completed Annex 1 with the information requested must be submitted by 18:00 hrs (6 p.m.) Eastern Daylight Time (EDT) on Friday, May 14, 2010 to the Science Mission Directorate as detailed in the notes to Annex 1.

6.3 Implementation Activities

Proposal selection and award will be implemented according to the guidelines set forth in Section 7.4 of this SALMON AO and Section 7 of this program element appendix with the following amendments:

Proposals from ESA participating state investigators will be implemented according to ESA procedures.

6.3.1 Notification of Selection

Notification of selection by NASA for proposals requesting NASA funding will follow the procedures of Section 7.4.1 of this SALMON AO. Notification of selection for all other proposals will be via formal written notifications from ESA.

Proposers of investigations that were not selected, and that requested NASA funding, will be subject to the procedures of Section 7.4.1 of this SALMON AO.

Proposers of investigations that were not selected, and that did not request NASA funding, will be notified in writing by ESA. They will be offered oral debriefings for themselves and a representative from each of their main partners (if any). Such debriefings may be in person at ESA ESTEC 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.

6.3.2 Award Administration and Funding of Investigations

NASA led instruments will be managed from JPL and will be subject to the requirements of NPR 7120.5 as well as other review requirements which are detailed in the ESA E-PIP. It is expected that NASA participation in non-NASA led instruments will be funded through JPL, but will follow the requirements of the non-NASA entity to which they are contributing. Details of ESA required reviews can be found in the E-PIP.

Should a U.S. proposal with non-U.S. participation be selected by NASA, NASA's Office of External Relations, Science Division, will arrange with the non-U.S. sponsoring agency for the proposed participation to go ahead 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.

6.3.3 Approval of Investigations

Instruments selected from this competition will be subject to a number of reviews and technical requirements detailed in the E-PIP. Failure to comply in a timely and satisfactory manner is a factor in confirmation for flight, jointly approved by ESA and NASA.

7 SUMMARY OF KEY INFORMATION

Funding available for all NASA selected activities	upto $100M for all development phases of the NASA funded instruments; see Section 4.2 of this program element appendix.
Funding available for all ESA selected activities	To be arranged with the instrument's national Lead Funding Agency (LFA)
Date for Pre-Proposal Tele-Conference	February 9, 2010; see the SALMON additional information page at http://salmon.larc.nasa.gov/ for logistical information
Due Date for NOI	February 19, 2010
Due Date for Proposals	11:59 p.m. Eastern Time on April 15, 2010 (04:59 GMT on April 16, 2010)
Web site for SALMON AO additional information including ExoMars Trace Gas Orbiter Instruments	http://salmon.larc.nasa.gov/
Web site for ExoMars Trace Gas Orbiter Instruments AO Library	http://salmon.larc.nasa.gov/SALMONreflib.html#ExoMars
Submission Medium	Electronic copies only; see Section 5.2 of this program element appendix
Web site for submission of electronic proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at 202-479-9376 or nspires-help@nasaprs.com)

ESA and NASA points of contact concerning this Program Element	Dr. Philippe Crane Planetary Science Division Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Tel: +1 202-358-0716 E-mail: Philippe.Crane@nasa.gov Dr. Jorge L. Vago ExoMars Project Scientist ESA/ESTEC (SRE-SM) Noordwijk The Netherlands Tel: +31 71 565 5211 E-mail: jorge.vago@esa.int
For questions:	Please submit questions electronically to the following address: HQ-ExoMars-TGO-2016@nasa.gov Questions will be accepted up to 2 weeks before the proposal due date.
E-PIP	http://salmon.larc.nasa.gov/SALMONreflib.html#ExoMars

END OF PEA H6

NNH08ZDA009O-EXPMO11
Program Element Appendix (PEA) H7:
EXPLORER 2011 SCIENCE MISSIONS OF OPPORTUNITY
Amended through Amendment 8 on December 3, 2010: Sections 5.6, 6.1, 6.2

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SALMON Program Element Appendix (PEA) H7: EXPLORER 2011 SCIENCE MISSIONS OF OPPORTUNITY

1 Introduction

1.1 Proposal Opportunity

The National Aeronautics and Space Administration (NASA) issues this SALMON Program Element Appendix (PEA) for the purpose of soliciting proposals for Mission of Opportunity (MO) science investigations to be implemented through its Explorer Program. All investigations proposed in response to this solicitation must support the goals and objectives of the Explorer Program (Section 2.2 of this PEA), must be implemented by Principal Investigator (PI) led investigation teams (Section 4.6.2 of the SALMON AO), and must be implemented through the provision of space investigations (including partner missions of opportunity, investigations on the International Space Station (ISS) and on high altitude scientific balloon platforms, and investigations launched as secondary or hosted payloads).

Three MO types may be proposed in response to this PEA – Partner Missions of Opportunity (PMOs), New Science Missions using Existing Spacecraft, and Small Complete Missions (SCMs), including investigations requiring flight on high altitude scientific balloon platforms, investigations on the International Space Station (ISS), investigations launched as secondary payloads, or investigations launched as hosted payloads. A fourth MO type, U.S. Participating Investigators (USPIs), may be proposed in response to the NASA Research Announcement (NRA) NNH10ZDA001N, Research Opportunities in Space and Earth Sciences (ROSES) (Section 5.1 of this PEA).

1.2 Changes from the Draft Solicitation

Proposers should be aware of the following major changes in this AO from the Draft SALMON PEA for Explorer 2010 Science Missions of Opportunity (NNH10ZDA009J) that was released on June 22, 2010.

- This PEA has been renamed Explorer 2011 Science Missions of Opportunity.
- A ROSES program element appendix soliciting Explorer Program U.S. Participating Investigators is being released as the same time as this AO (Section 2.4 of this PEA)
- Changes in NASA's management of programs and projects since the SALMON AO was released are described in a new section (Section 4 of this PEA).
- Partner MOs may not be proposed for specific potential strategic partnership missions (Section 5.2 of this PEA).
- Partner MOs may be proposed for nonstrategic NASA missions (Section 5.2 of this PEA).
- Phase A funding cap is stated (Section 5.3).
- Requirements for Letters of Acknowledgement from the Space Station Payloads Office and Letters of Feasibility have been added for investigations requiring flight on the ISS (Section 5.4 of this PEA).
- Exceptions to general SALMON requirements have been specified (Section 6.2 of this PEA).
- The evaluation criteria have been spelled out (Section 7.1 of this PEA).
- Revised or clarified tables specific for this solicitation are provided (Section 10 of this PEA).

2 Announcement Objectives

2.1 NASA Strategic Goals

Two of NASA's strategic goals are to (a) "Understand the Sun and its interactions with Earth and the solar system" and (b) "Discover how the universe works, explore how the universe began and developed into its present form, and search for life elsewhere." Further information on NASA's strategic goals may be found in NASA Policy Directive (NPD) 1001.0, *The 2006 NASA Strategic Plan*, available through the Program Library (Appendix D).

The NASA Science Mission Directorate (SMD) addresses these strategic goals by conducting programs of heliophysics and astrophysics science designed to answer the following science research objectives:

For heliophysics research, the strategic objectives are to

- Understand the fundamental physical processes of the space environment from the Sun to Earth, to other planets, and beyond to the interstellar medium;
- Understand how human society, technological systems, and the habitability of planets are affected by solar variability interacting with planetary magnetic fields and atmospheres; and,
- Maximize the safety and productivity of human and robotic explorers by enabling the capability to predict the extreme and dynamic conditions in space.

For astrophysics research, the strategic objectives are to

- Understand the origin and destiny of the universe, and the nature of black holes, dark energy, dark matter, and gravity;
- Understand the many phenomena and processes associated with galaxy, stellar, and planetary system formation and evolution from the earliest epochs to today; and,
- Generate a census of extra-solar planets and measure their properties.

Further information on the goals and objectives of NASA's heliophysics and astrophysics programs may be found in the *2010 Science Plan for NASA's Science Mission Directorate* and the *2009 Heliophysics Roadmap*, available through the Program Library.

It should be noted that while the National Research Council has recently released the 2010 Astronomy and Astrophysics Decadal Survey report, *New Worlds, New Horizons in Astronomy and Astrophysics* (http://www.nap.edu/catalog.php?record_id=12951), NASA has not fully absorbed this report into its program planning. For the purposes of this solicitation, investigations proposing to address the goals and objectives of astrophysics programs will be reviewed in the context of the *2010 Science Plan for NASA's Science Mission Directorate* only.

2.2 Explorer Program Goals and Objectives

The goal of NASA's Explorer Program is to provide frequent flight opportunities for high quality, high value, focused heliophysics and astrophysics science investigations that can be accomplished under a not-to-exceed cost cap and that can be developed relatively quickly, generally in 36 months or less, and executed on-orbit in less than 3 years.

The Explorer Program accomplishes these world-class space science investigations utilizing efficient management approaches to contain mission cost through commitment to, and control of, design, development, and operations costs. The Program also seeks to enhance public awareness of and appreciation for space science by incorporating educational and public outreach activities as integral parts of the investigations.

The Explorer Program provides an effective means of timely achievement of strategic goals. By conducting a rapid series of science investigations, NASA is responsive to new knowledge, technology, and science priorities. Pressing questions in heliophysics and astrophysics science are addressed, permitting a steady improvement in our understanding of space science systems and the processes that affect them. The frequent, steady nature of the investigations ensure a continuing stream of fresh scientific data to the broader science community, thus maintaining the excellence of the U.S. space science program and the inspiration of a new generation of investigators.

The Explorer program science objectives are to:

- Understand the Sun and its interactions with Earth and the solar system, and
- Discover how the universe works, explore how the universe began and developed into its present form, and search for life elsewhere.

The Explorer Program strives to:

- advance scientific knowledge of heliophysics and astrophysics processes and systems;
- add scientific data and other knowledge-based products to data archives for all scientists to access;
- publish scientific progress and results in the peer-reviewed literature to encourage, to the maximum extent possible, the fullest commercial use of the knowledge gained;
- expand the pool of well-qualified Principal Investigators and Program Managers for implementation of future missions in other NASA programs;
- implement technology advancements prepared in related programs; and
- announce scientific progress and results in popular media, scholastic curricula, and materials that can be used to inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.

Investigations may target any heliophysics or astrophysics scientific investigation, in order to advance the objectives outlined in Section 2.1 of this PEA. Investigations that address NASA goals in other areas, such as Earth science or planetary science, are not solicited in this PEA.

2.3 Explorer Program Background

The Explorer Program is the oldest continuous program in NASA. It is comprised of a longstanding series of space science missions that are independent, but share a common funding and NASA oversight/insight management structure. Initiated with the Explorer 1 launch in 1958 and including the Nobel Prize winning Cosmic Background Explorer (COBE) mission, the Explorer program has launched over 90 missions.

Though historically not always this way, the program currently administers only Principal Investigator (PI)-led science investigations for SMD’s Heliophysics and Astrophysics Divisions.

Competitive selection ensures that the most current and best strategic science will be accomplished.

Since the early 1990s, the Explorer Program has provided several classes of flight opportunities for the science program areas described in Section 2.1 of this PEA. These mission classes are designed to increase the number of flight opportunities in response to recommendations from the scientific community.

Explorer Missions of Opportunity are investigations generally characterized by being part of a host space mission other than a strategic SMD mission. Missions of Opportunity also include small complete missions and new science investigations utilizing existing spacecraft. NASA generally solicits proposals for MO with each Explorer Program AO issued. For each AO, the budget available for a MO vary, as do the types of investigations that may be proposed.

Explorer Program MOs are now being solicited through this NASA Announcement of Opportunity (NNH08ZDA009O), Stand Alone Missions of Opportunity Notice (SALMON).

2.4 Related Explorer Program Solicitations

NASA has released simultaneously with this PEA a solicitation for Explorer (EX) Missions through the Explorer 2011 AO (NNH11ZDA002O). Mission proposals submitted in response to that solicitation will be reviewed at the same time by the same review panels as proposals submitted in response to this PEA for Explorer Missions of Opportunity. A single selection meeting will select proposals, and all Explorer selections will be funded from the same Explorer future mission budget; there is no separate budget for Explorer MOs (see Section 5.3 of this PEA). The Explorer 2011 AO is available for download at http://nspires.nasaprs.com/.

One class of MO is the U.S. Participating Investigator (USPI) class. NASA has released simultaneously with this PEA a solicitation for Explorer Program U.S. Participating Investigators through the ROSES NRA (NNH10ZDA001N). USPI proposals submitted to that solicitation will be reviewed at the same time by the same science peer review panel as the EX full missions and Explorer MOs. A single selection meeting will select proposals, and all Explorer selections will be funded from the same Explorer future mission budget. There is no separate budget for USPIs. The Explorer USPI program element appendix of the ROSES NRA is available for download at http://nspires.nasaprs.com/.

3 Proposal Opportunity Period

This solicitation has a single submission deadline. The following schedule describes the major milestones for this PEA:

PEA Release Date	November 1, 2010
Preproposal Conference	November 23, 2010
Notice of Intent to Propose Deadline	December 9, 2010
Proposal Submittal Deadline at 4:30 p.m. Eastern Time	February 16, 2011
Letters of Commitment due (with proposal)	February 16, 2011
Step 1 Selections announced (target)	August 2011
Initiate Phase A Concept Studies (target)	September 2011
Phase A Concept Study Reports due (target)	August 2012
Down-selection of investigation(s) for flight (target)	February 2013
Commitment need date for Partner MO	December 31, 2013
Decision date for New Missions Using Existing Spacecraft	December 31, 2013
Launch Readiness Date for Small Complete Mission MO	NLT December 31, 2018

All proposals, U.S. and non-U.S., must be received before the proposal submittal deadline. Those received after the deadline will be treated in accordance with Appendix A, Section VII of the SALMON AO.

4 Policies Applicable to this Announcement

4.1 NASA Flight Program and Project Requirements

Proposals selected in response to this AO will be implemented in accordance with NASA mission management processes. NASA mission management processes, as defined by NASA Interim Directive (NID) NM 7120-81[1], *NASA Space Flight Program and Project Management Requirements,* are Formulation, Approval, Implementation, and Evaluation. The NASA mission management processes are subdivided as follows:

Formulation is divided into:

- Phase A – Concept Study and Technology Development; and
- Phase B – Preliminary Design and Technology Completion.

Approval is the Confirmation process for transitioning into Implementation.

Implementation is divided into:

- Phase C – Final Design and Fabrication;
- Phase D – System Assembly, Integration and Test, and Launch (extending through in-orbit checkout);
- Phase E – Operations and Sustainment; and
- Phase F – Closeout.

[1] NM 7120-81 is the NASA Interim Directive (NID) for NASA Procedural Requirements (NPR) 7120.5D. Effective September 22, 2009, NM 7120-81 is the governing NPR until NPR 7120.5 is formally revised.

Evaluation is the ongoing independent review and assessment of the project's status during both Formulation and Implementation, as described in NM 7120-81, which may be found in the Program Library.

A Key Decision Point (KDP) occurs before the project is approved to begin the next phase of development; KDPs are defined in NM 7120-81. For missions selected as a result of this AO, KDP-A is the selection of a Step-1 proposal for a Phase A concept study, KDP-B is the downselection of a mission to enter Phase B following evaluation of Concept Study Reports, KDP-C is the culmination of the Confirmation process, KDP-D is a transition that occurs after the Systems Integration Review, KDP-E is the handoff from development to operations following in-orbit checkout, and KDP-F is the decision to terminate operations after completion of the mission. Scientific and other analyses may continue under project funding in Phase F. If the decision at downselection is to maintain the selected investigation in an extended Phase A, then a separate KDP-B will be required.

4.2 NASA Program Management

Owing to the significant expenditure of Government funds on these space flight investigations, as well as to their expected complexity, NASA intends to maintain an essential degree of insight into mission development; NASA will exercise essential oversight to ensure that the implementation is responsive to NASA requirements and constraints. NASA requirements and constraints are spelled out in NM 7120-81, in the *Explorer Program Safety, Reliability, and Quality Assurance Requirements* document, and in other NASA requirements documents available in the NASA Online Directives Information System (NODIS, http://nodis.hq.nasa.gov/) and in the Program Library. The Associate Administrator for SMD has established an Explorer Program Office at the NASA Goddard Space Flight Center to be responsible for project oversight. The Explorer Program Manager at the NASA Goddard Space Flight Center reports to the Director of the Heliophysics Division, Science Mission Directorate, at NASA Headquarters.

NM 7120-81 defines project management responsibilities, and it presumes that project management is assigned to a NASA Center or JPL. If an organization other than a NASA Center or JPL is proposed and selected to provide project management for an investigation, then the NASA Center's project management responsibilities under NM 7120-81 will be assigned to the implementing project management organization. That organization must be prepared to carry out these responsibilities. In such cases, the Explorer Program Office at the NASA Goddard Space Flight Center will retain the Technical Authority (TA), as described in NM 7120-81, that would otherwise be invested in an implementing Center or JPL.

The *Explorer Program Safety, Reliability, and Quality Assurance Requirements* document, available through the Program Library, will apply to investigations that are selected for Phase A concept studies. Selected investigations that reside at institutions that have NASA-approved safety and mission assurance (S&MA) programs may utilize their own institutional practices in lieu of the guidelines and requirements in this document. Although this document may impose requirements on selected investigations, it does not impose requirements, either implicitly or explicitly, on Step-1 proposals.

In addition to its role as the site of the Explorer Program Office, the NASA Goddard Space Flight Center is eligible to participate in proposals that are submitted in response to this AO. The

Explorer Program Office will have access to the AO before it is released; this is necessary so that the Explorer Program Office can review the AO and ensure that it correctly describes the postselection project management processes. Other than that, the Explorer Program Office plays no role in the AO process; specifically they play no role in defining the scientific scope of the AO, writing the AO, evaluating proposals, or selecting proposals. The Science Mission Directorate at NASA Headquarters will manage the evaluation and selection process. In order to manage the NASA Goddard Space Flight Center's two roles, SMD has established functional and organizational firewalls between the Explorer Program Office and those parts of Goddard Space Flight Center that might participate in proposals. These firewalls ensure that personnel identified as supporting the Explorer Program Office and the AO process will protect all nonpublic information from all proposers, including those at the NASA Goddard Space Flight Center, and will be free of financial and other conflicts of interest with proposers.

4.3 NASA Center Role in Public Affairs and Outreach

Successful media relations activities require close cooperation between NASA and the selected investigations. NASA Centers and JPL have specific expertise in media relations and/or public affairs, especially as they pertain to Earth and space science missions. All selected investigations will coordinate media relations and/or public affairs with a NASA Center or JPL. If a selected investigation does not include a NASA Center or JPL as part of their investigation team, the investigation will utilize the public affairs guidance and resources of the Explorer Program Office at the NASA Goddard Space Flight Center.

NASA is to be informed in a timely manner of any newsworthy mission event or issue before public release of information. Strategies for using new and social media also will be developed collaboratively to ensure common and consistent messaging will occur in a timely manner. NASA and the selected investigation will establish and maintain a detailed coordination media relations plan and communications process.

Selected investigations also must work with NASA to ensure their mission website follows NASA requirements for incorporating content for the agency's primary public website at http://www.nasa.gov/. NASA, and through NASA the selected investigation, is required under the Information Quality Act (44 U.S.C. 3504(d)(1) and 3516) and associated guidelines to maximize the quality, objectivity, utility, and integrity of information and services provided to the public.

4.4 Eligibility to Participate in this Proposal Opportunity

The NASA Evaluations, Assessments, Studies, Services, and Support (EASSS) contract with Earth Resources Technology Inc. (ERT) for evaluation support under this AO creates an unmitigatable organizational conflict of interest for ERT in the event that any business unit of ERT has a proposed role as prime contractor, subcontractor, or participating organization. Because of this organizational conflict of interest, ERT is precluded from participating in any capacity in support of a respondent under this AO.

As the evaluating organization is not Science Applications International Corporation (SAIC), SAIC is not precluded from participating in response to this solicitation; this supersedes Section 4.1 of the SALMON AO.

The Aerospace Corporation will not be used for evaluation support. There is no limitation on the participation of Aerospace Corporation in any capacity in response to this solicitation.

5 Requirements and Constraints

5.1 Type of Mission of Opportunity

Three MO types may be proposed in response to this PEA – Partner Missions of Opportunity (PMOs), New Science Missions using Existing Spacecraft, and Small Complete Missions (SCMs), including investigations requiring flight on high altitude scientific balloon platforms, investigations on the International Space Station (ISS), investigations launched as secondary payloads, or investigations launched as hosted payloads.

A fourth MO type, U.S. Participating Investigators (USPIs), may be proposed in response to the NASA Research Announcement (NRA) NNH10ZDA001N, Research Opportunities in Space and Earth Sciences (ROSES). At the same time as the release of this PEA in SALMON, NASA will release an amendment to ROSES for Explorer USPI proposals. USPI Notices of Intent (NOIs) to propose and proposals will be submitted in response to the ROSES amendment, will be subject to the proposal guidelines specified in ROSES, will be subject to the constraints (cost, schedule, technical) and requirements specified in ROSES, and will be reviewed and selected using the proposal criteria specified in ROSES.

See Section 5 of the SALMON AO for complete descriptions of these types of MOs.

5.2 Constraints on Proposing to Specific Partner Missions

Investigations intended to be flown on the European Space Agency (ESA) Euclid and PLATO mission candidates are not solicited in this PEA. NASA and ESA are continuing to discuss the potential for a strategic collaboration on the Euclid mission candidate. U.S. science opportunities are offered by NASA to all proposers via a separate solicitation through the ROSES NRA. ESA has requested that NASA not solicit mission of opportunity investigations for the PLATO mission candidate at this time.

Partner MOs may be proposed for participation in nonstrategic NASA missions. A partner MO may be proposed for participation in a PI-led NASA mission from a program other than Explorer (an Explorer MO may not be proposed for an Explorer mission). Such a proposal must satisfy the following requirements: (i) The PI of the host mission provides a Letter of Commitment endorsing the partnership and (ii) the feasibility assessment of the host mission, i.e., the TMC evaluation in Step 1 and Step 2, includes the accommodations for the partner MO instrument.

5.3 Cost and Schedule Constraints

The PI-managed Mission Cost cap for an Explorer MO, including all mission phases and the cost of accommodation on and/or delivery to the host mission, if applicable, is $55M in Fiscal Year (FY) 2011 dollars.

For Partner MOs, the proposing PI must provide evidence that the sponsoring organization intends to fund the primary host mission and that the NASA commitment for U.S. participation

is required by the sponsoring organization prior to December 31, 2013. The launch date itself for a Partner MO is not constrained.

For Small Complete Mission MOs, proposers must specify the launch date in the proposal, which is to be no later than December 31, 2018. Explorer MO investigations with an anticipated launch date requirement later than the end of calendar year 2018 should be proposed in response to a subsequent opportunity.

Proposers should be aware, however, that the Explorer program budget is heavily committed prior to 2014. It may be necessary for NASA to adjust the launch date and definition phasing of selected investigations from that proposed in order to conform to the available Explorer program budget profile and/or NASA's ability to negotiate a launch opportunity to the International Space Station; therefore, the degree of launch date flexibility must be indicated in the proposal.

It is intended that proposed investigations be evaluated and selected through a two-step competitive process (Section 7 of the SALMON AO). Step 1 is the solicitation, submission, evaluation, and selection of proposals prepared in response to this PEA. As the outcome of Step 1, one or more Step 1 proposals may be selected for Phase A study and review if their perceived value to the Explorer Program is significant. NASA will issue awards (provide funding to NASA Centers and the Jet Propulsion Laboratory (JPL), award contracts to non-NASA institutions, or utilize other funding mechanisms, as applicable) to the selected proposers to conduct Phase A concept studies and submit Concept Study Reports to NASA. Step 2 is the preparation, submission, evaluation, and continuation decision (downselection) of the Concept Study Reports. As the outcome of Step 2, NASA may continue one or two investigation(s) into the subsequent phases of mission development for flight and operations.

Proposers selected through this AO will be awarded a contract to conduct a Phase A concept study with a duration of approximately 11 months and capped at $250K Real Year (RY) dollars.

The SALMON AO, Section 7.3, provides that a proposal may be selected for development without first completing a Phase A concept study. The proposal must make the case that it is not only necessary, but that it is also technically feasible for the project to be selected for development without a competitive Phase A concept study. The proposer must recognize that NASA would only make such a decision without a Phase A competition if the MO proposal was especially compelling.

The currently approved Explorer Program planning budget is sufficient to select and execute at least one full Explorer mission to proceed into Phase B and subsequent mission phases. Assuming sufficient Explorer Program budget authority, NASA intends to select and execute a second full Explorer mission or one or more Mission(s) of Opportunity. NASA is fully prepared to select only one full mission (either astrophysics or heliophysics) if it receives mission of opportunity proposals that offer outstanding science opportunities.

The due date for proposals is given in Section 3 of this PEA.

5.4 Technical Requirements and Constraints

In addition to the requirements given in the SALMON AO, all proposed Explorer MO investigations must also provide: (1) a detailed description of the proposed provisions for sharing

of science data, plans that scientific data returned from at least those aspects of the mission in which NASA is involved shall be made available to the U.S. scientific community in a timely way, and the status of the host mission sponsoring agency's commitment to enter into an appropriate agreement with NASA for data sharing; and (2) a detailed explanation of how the U.S. heliophysics or astrophysics science community benefits from the proposed investigation.

In addition to the requirements given in the SALMON AO, all proposed partner MO investigations must also demonstrate: (1) their formal relationship with the sponsoring agency's host mission (e.g., already selected contribution, invited contribution, or proposed contribution); and (2) the status of the host mission within the sponsoring agency (i.e., Pre-Phase A, Phase A, or Phase B), including the level of commitment that the sponsoring agency has made to complete the mission.

In addition to the requirements given in the SALMON AO, all proposed partner MO investigations requiring flight on the ISS must also provide a Letter of Acknowledgement from the NASA Space Station Payload Office. This Letter of Acknowledgement must contain: (1) a description of the formal relationship with the sponsoring agency's host mission for access and accommodation at the space station, (2) identification of known challenges and/or conditional provisions for access or accommodation of the host mission, and (3) a description of the level of technical interchange and negotiation required to mature the host mission's provisions for access and accommodation.

In addition to the requirements given in the SALMON AO, all proposed small complete mission investigations with the exception of investigations requiring flight on the ISS must also provide a Letter of Commitment from the program or agency providing access to space. This Letter of Commitment must contain: (1) a detailed description of the proposed provisions for access to space (e.g., type of high altitude scientific balloon platform, sponsored flight to the ISS, secondary ride on another U.S. sponsored mission, etc.), and (2) the status of those proposed flight provisions within the sponsoring program or agency (i.e., conditional, confirmed, conceptual, etc.) including the level of commitment that the sponsoring program/agency has made to support that flight opportunity.

In addition to the requirements given in the SALMON AO, all small complete mission investigations requiring flight on the ISS must also provide a Letter of Feasibility from the NASA Space Station Payload Office. This Letter of Feasibility must contain: (1) a conceptual description of the feasibility for proposed provisions for access and accommodation at the space station, (2) identification of known challenges and/or conditional provisions for access or accommodation, and (3) a description of the level of technical interchange and negotiation required to mature the proposed provisions for access and accommodation. For any selected investigations, flight commitment to the ISS will be negotiated with NASA's Space Operations Mission Directorate during the Phase A Concept Study time period.

5.5 Launch Vehicle Services and Funding

No launch vehicle will be provided by NASA through this solicitation. In addition, NASA is prohibited by law from purchasing non-U.S. launch vehicles, nor may NASA funds provided to an investigation be used to purchase a launch vehicle from a non-U.S. source.

5.6 Education and Public Outreach

[This section added in its entirety through Amendment 8 on December 3, 2010]

Among NASA's strategic goals is to communicate the results of its efforts to the American public and to enhance the science and technical education of the next generation of Americans. While recognizing the benefits of a robust E/PO program, due to the limited funding envisioned for the Explorer 2011 Science Mission of Opportunities, the SALMON AO and this PEA do not require a core Education and Public Outreach (E/PO) program as outlined in SMD policy (see the *Explanatory Guide to the NASA Science Mission Directorate Educational and Public Outreach Evaluation Factors* document in the Program Library). If an optional E/PO is proposed, the following instructions apply.

The quality of an optional core E/PO plan is not a consideration in the selection of Step 1 proposals for Phase A concept studies. Therefore, E/PO plans are not needed at this time. Proposals shall not designate an E/PO lead and proposals shall not include a plan for an E/PO program.

Plans for an optional core E/PO program will be developed during the Phase A concept study and will be included in the Concept Study Report. The quality of the E/PO plan contained in the Concept Study Report will be evaluated in the downselection for flight following Phase A; see *The Explanatory Guide to the NASA Science Mission Directorate Educational and Public Outreach Evaluation Factors* in the Program Library. The E/PO plan will be compliant with SMD Policy Document SPD-18, *Policy and Requirements for the E/PO Programs of SMD Missions*.

Proposals shall identify the funding set aside for the implementation of the core E/PO program if proposed. There is no minimum or maximum designated cost for the core E/PO program; however, the funding for the core E/PO program must be included in the PI Managed Mission Cost. Core E/PO activities may continue for one year following end-of-prime-mission to allow for the incorporation of the results of the mission investigation into the core E/PO program.

6 Proposal Preparation and Submission

6.1 Proposal Content Requirements

Proposal content must conform to the guidelines set forth in Section 6.2 and Appendix B of the SALMON AO.

[This replacement table added through Amendment 8 on December 3, 2010. Bold indicates changes from the SALMON AO.]

Table B.1 of Appendix B of the SALMON AO is replaced in its entirety by the following restriction and guidance on page count.

TABLE B.1
RESTRICTIONS AND GUIDANCE ON PAGE COUNT

Section	**Reference**	**Page Limits**
Graphic Cover Page **Proposal Summary Information** **Export controlled material statement** **Optional Restriction on Use statement**	App. B (III)	**1** **None** **0.5** **0.5**
Fact Sheet	App. B (V)	2
Table of Contents	App. B (VI)	No page limit
Scientific/Technical Investigation	App. B (VII)	**20 + 2 pages for optional SEO**
Investigation Implementation Management and Schedule	App. B (VIII) App. B (IX)	**20, schedule foldouts do not count against limit**
Cost and Cost Estimating Methodology Cost Tables B.5 and B.6	App. B (X)	**8, cost tables do not count against limit**
Optional: Master Equipment List (MEL); Work Breakdown Structure (WBS); WBS Dictionary; WBS Cost Table; Basis of Estimate Details	App. B (X)	No page limit
Optional: E/PO Acknowledgement and SC	App. B (XI)	**2**
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 between U.S. and International Participation 7. Orbital Debris Generation Acknowledgement 8. Compliance with Procurement Regulations by NASA PI Proposals 9. Heritage 10. Abbreviations and Acronyms List 11. Reference List (optional)	App. B (XII)	No page limit, but small size encouraged

6.2 Exceptions to General SALMON Requirements

The governing Program and Project Management Requirements document NPR 7120.5 is currently represented by NM 7120-81 (NID for NPR 7120.5D).

Appendix B, Table B.1, Restrictions and Guidance on Page Count is replaced by Table B.1 provided in Section 6.1 of this PEA. [Added through Amendment 8 on December 3, 2010.]

Appendix B, Table B.3, Science Traceability Matrix, is replaced by Table B.3 provided at the end of this PEA.

Appendix B, Table B.4, Mission Traceability Matrix, is replaced by Table B.4 provided at the end of this PEA.

Appendix B, Table B.5, NASA Cost Funding Profile Template, is replaced by Table B.5 provided at the end of this PEA.

Appendix B, Table B.7, NASA New Start Inflation Index, is replaced by Table B.7 provided at the end of this PEA.

This PEA contains no other exceptions to the proposal preparation and submission requirements outlined in this SALMON AO.

6.3 Proposal Submission Requirements

Proposals must be submitted according to the guidelines set forth in Section 6.3 of the SALMON AO and in Section 3 of this PEA with the following exceptions.

The original signed proposal and 65 paper copies, each of which contains an attached, clearly labeled CD-ROM that contains electronic proposal files (see Appendix B) shall be delivered to the following address by the proposal submittal deadline specified in Section 3.

NASA Research and Education Support Services (NRESS)
Suite 500
2345 Crystal Drive
Arlington, VA 22202

Phone for commercial delivery: 202-479-9030

7 Proposal Evaluation, Selection, and Implementation

7.1 Evaluation Process

The evaluation of proposals will be conducted as described in Section 7.1.1 of the SALMON AO with the following modification.

Proposers should be aware that, during the evaluation and selection process, NASA may request clarification of specific points in a proposal; if so, such a request from NASA and the proposer's response must be in writing. In particular, before finalizing the evaluation of the feasibility of the mission implementation (see Section 7.2.3 of this PEA), NASA will request clarification on specific, potential major weaknesses in the feasibility of mission implementation that have been identified in the proposal. NASA will request such clarification uniformly from all proposers. The ability of proposers to provide clarification to NASA is extremely limited, as NASA does not intend to enter into discussions with proposers. A typical limited response is to direct NASA's attention to pertinent parts of the proposal without providing further elaboration.

7.2 Evaluation Factors

The evaluation criteria, which are defined more fully in the following sections and will be used to evaluate proposals, are as follows:

- The scientific merit of the proposed investigation;
- The scientific implementation merit and feasibility of the proposed investigation; and
- The technical, management, and cost (TMC) feasibility of the proposed approach for mission implementation, including cost risk.

The proposal categorizations, discussed in Section 7.1 of the SALMON AO, will be based on these criteria. For categorization, scientific merit is weighted approximately 40%, scientific implementation merit and feasibility is weighted approximately 30%, and TMC feasibility, including cost risk, is weighted approximately 30%.

These criteria are defined more fully in the following sections. Evaluation findings for each evaluation criterion will be documented with narrative text in the form of specific major and minor strengths and weaknesses, as well as an adjectival summary score. The adjectival summary scores for the first two criteria (scientific merit and scientific implementation merit) will be reported as Excellent, Very Good, Good, Fair, or Poor, as defined in the table below.

Summary Evaluation	Basis for Summary Evaluation
Excellent	A comprehensive, thorough, and compelling proposal of exceptional merit that fully responds to the objectives of the AO as documented by numerous and/or significant strengths and having no major weaknesses.
Very Good	A fully competent proposal of very high merit that fully responds to the objectives of the AO, whose strengths fully outbalance any weaknesses.
Good	A competent proposal that represents a credible response to the AO, having neither significant strengths nor weakness and/or whose strengths and weaknesses essentially balance.
Fair	A proposal that provides a nominal response to the AO, but whose weaknesses outweigh any perceived strengths.
Poor	A seriously flawed proposal having one or more major weaknesses (*e.g.*, an inadequate or flawed plan of research or lack of focus on the objectives of the AO).

The third criterion, technical merit and feasibility, including cost risk, will be reported as Low Risk, Medium Risk, or High Risk, as defined in the table below.

Summary Evaluation	Basis for Summary Evaluation
Low Risk	There are no problems evident in the proposal that cannot be normally solved within the time and cost proposed. Problems are not of sufficient magnitude to doubt the Proposer's capability to accomplish the investigation well within the available resources.
Medium Risk	Problems have been identified, but are considered within the proposal team's capabilities to correct within available resources with good management and application of effective engineering resources. Mission design may be complex and resources tight.
High Risk	One or more problems are of sufficient magnitude and complexity as to be deemed unsolvable within the available resources.

7.2.1 Scientific Merit of the Proposed Investigation

The information provided in a proposal will be used to assess the intrinsic scientific merit of the proposed investigation. Scientific merit will be evaluated for the Baseline Science Mission and, if defined, the Minimum (or Threshold) Science Mission; science enhancement options beyond the Baseline Science Mission will not contribute to the assessment of the scientific merit of the proposed investigation. The factors for scientific merit include the following:

- Factor A-1. Compelling nature and scientific priority of the proposed investigation's science goals and objectives. This factor includes the clarity of the goals and objectives; how well the goals and objectives reflect program, Agency, and National priorities; the potential scientific impact of the investigation on program, Agency, and National science objectives; and the potential for fundamental progress, as well as filling gaps in our knowledge relative to the current state of the art.
- Factor A-2. Programmatic value of the proposed investigation. This factor includes the unique value of the investigation to make scientific progress in the context of other ongoing and planned missions; the relationship to the other elements of NASA's science programs; how well the investigation may synergistically support ongoing or planned missions by NASA and other agencies; and the necessity for a space mission to realize the goals and objectives.
- Factor A-3. Likelihood of scientific success. This factor includes how well the anticipated measurements support the goals and objectives; the adequacy of the anticipated data to complete the investigation and meet the goals and objectives; and the appropriateness of the mission requirements for guiding development and ensuring scientific success.
- Factor A-4. Scientific value of the Minimum (or Threshold) Science Mission. If a Minimum (or Threshold) Science Mission is defined, then this factor includes the scientific value of the Minimum (or Threshold) Science Mission using the standards in the first factor of this section and whether that value is sufficient to justify the proposed cost of the mission.

Factors A-1 through A-3 are evaluated for the Baseline Science Mission assuming it is implemented as proposed and achieves technical success. Factor A-4 is similarly evaluated for the Minimum (or Threshold) Science Mission, if defined.

This evaluation will result in narrative text, including specific major and minor strengths and weaknesses, as well as an appropriate adjectival rating for the scientific merit of the investigation.

7.2.2 Scientific Implementation Merit and Feasibility of the Investigation

The information provided in a proposal will be used to assess merit of the plan for completing the proposed investigation, including the scientific implementation merit, feasibility, resiliency, and probability of scientific success of the proposed investigation. The factors for scientific implementation merit and feasibility include the following:

- Factor B-1. Merit of the instruments and mission design for addressing the science goals and objectives. This factor includes the degree to which the proposed mission will address the goals and objectives; the appropriateness of the selected instruments and mission design for addressing the goals and objectives; the degree to which the proposed instruments and mission can provide the necessary data; and the sufficiency of the data gathered to complete the scientific investigation.
- Factor B-2. Probability of technical success. This factor includes the maturity and technical readiness of the instruments; the adequacy of the plan to develop the instruments within the proposed cost and schedule; the robustness of those plans,

including recognition of risks and mitigation plans for retiring those risks; the likelihood of success in developing any new technology that represents an untested advance in the state of the art; the ability of the development team - both institutions and individuals - to successfully implement those plans; and the likelihood of success for both the development and the operation of the instruments within the mission design.

- Factor B-3. Merit of the data analysis, data availability, and data archiving plan. This factor includes the merit of plans for data analysis and data archiving to meet the goals and objectives; to result in the publication of science discoveries in the professional literature; and to preserve data and analysis of value to the science community. Considerations in this factor include assessment of planning and budget adequacy and evidence of plans for well-documented, high-level data products and software usable to the entire science community; assessment of adequate resources for physical interpretation of data; reporting scientific results in refereed journals; and assessment of the proposed plan for the timely release of the data to the public domain for enlarging its science impact.
- Factor B-4. Science resiliency. This factor includes both developmental and operational resiliency. Developmental resiliency includes the approach to descoping the Baseline Science Mission to the Minimum (or Threshold) Science Mission in the event that development problems force reductions in scope. Operational resiliency includes the ability to withstand adverse circumstances, the capability to degrade gracefully, and the potential to recover from anomalies in flight.
- Factor B-5. Probability of science team success. This factor will be evaluated by assessing the experience, expertise, and organizational structure of the science team and the mission design in light of any proposed instruments. The role of each Co-Investigator will be evaluated for necessary contributions to the proposed investigation; the inclusion of Co-Is who do not have a well defined and appropriate role may be cause for downgrading of the proposal.
- Factor B-6. Merit of any science/technology enhancement options (STEOs), if proposed. This factor includes assessing the appropriateness of activities selected 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. The peer review panel will inform NASA whether the evaluation of the proposed STEO(s) impacted the overall rating for scientific implementation merit and feasibility. Lack of an STEO will have no impact on the proposal's overall rating for scientific implementation merit and feasibility.

Student Collaboration proposals, if any, will be evaluated only for the impact they have on science implementation feasibility to the extent that they are not separable; student collaboration proposals will not be penalized in Step 1 for any inherent higher cost, schedule, or technical risk, as long as the student collaboration is shown to be clearly separable from the implementation of the Baseline Science Mission. The intrinsic merit of student collaborations will not be evaluated at this time.

This evaluation will result in narrative text, including specific major and minor strengths and weaknesses, as well as an appropriate adjectival rating for the scientific implementation merit and feasibility of the scientific investigation.

7.2.3 Feasibility of the Mission Implementation, Including Cost Risk

The technical and management approaches of all submitted investigations will be evaluated to assess the likelihood that they can be successfully implemented as proposed, including an assessment of the likelihood of their completion within the proposed cost and schedule. The factors for feasibility of mission implementation include the following:

- Factor C-1. Adequacy and robustness of the instrument implementation plan. The maturity and technical readiness of the instrument complement will be assessed, as will the ability of the instruments to meet mission requirements. This factor includes an assessment of the instrument design, accommodation, interface, heritage, and technology readiness. This factor includes an assessment of the instrument hardware and software designs, heritage, and margins. This factor includes an assessment of the proposer's understanding of the processes, products, and activities required to accomplish development and integration of the instrument complement. This factor also includes adequacy of the plans for instrument systems engineering and for dealing with environmental concerns. This factor includes an assessment of plans for the development and use of new instrument technology and the adequacy of backup plans to mature systems within the proposed cost and schedule when technologies having a TRL less than 6 are proposed.
- Factor C-2. Adequacy and robustness of the mission design and plan for mission operations. This factor includes an assessment of the overall mission design and mission architecture, the spacecraft design and design margins (including margins for launch mass, delta-V, and propellant), the concept for mission operations (including communication, navigation/tracking/trajectory analysis, and ground systems and facilities), and the plans for launch services. This factor includes mission resiliency – the flexibility to recover from problems during both development and operations – including the technical resource reserves and margins, system and subsystem redundancy, and reductions and other changes that can be implemented without impact to the Baseline Science Mission.
- Factor C-3. Adequacy and robustness of the flight systems. This factor includes an assessment of the flight hardware and software designs, heritage, and margins. This factor includes an assessment of the proposer's understanding of the processes, products, and activities required to accomplish development and integration of all elements (flight systems, ground and data systems, etc.). This factor includes an assessment of the adequacy of the plans for spacecraft systems engineering, qualification, verification, mission assurance, launch operations, and entry/descent/landing. This factor includes the plans for the development and use of new technology and the adequacy of backup plans to ensure success of the mission when technologies having a TRL less than six are proposed. The maturity and technical readiness of the spacecraft, subsystems, and operations systems will be assessed. The adequacy of the plan to mature systems within the proposed cost and schedule, the robustness of those plans, including recognition of risks and mitigation plans for retiring those risks, and the likelihood of success in developing any new technologies will be assessed.
- Factor C-4. Adequacy and robustness of the management approach and schedule, including the capability of the management team. This factor includes: the adequacy of

the proposed organizational structure and WBS; the management approach, including project level systems engineering; the roles, qualifications, and experience of the PI, PM, other named key management team members, and implementing organization, mission management team, and known partners; the commitment, spaceflight experience, and relevant performance of the PI, PM, other named key management team members, and implementing organization, mission management team, and known partners against the needs of the investigation; the commitments of partners and contributors; and the team's understanding of the scope of work covering all elements of the mission, including contributions. Also evaluated under this factor is the adequacy of the proposed risk management approach, including 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 approach to any proposed descoping of mission capabilities will be assessed against the proposed Baseline Science Mission. The plans for managing the risk of contributed critical goods and services will be assessed, including the plans for any international participation, the commitment of partners and contributors, as documented in Letters of Commitment, and the adequacy of contingency plans for coping with the failure of a proposed cooperative arrangement or contribution. This factor also includes assessment of proposal elements, such as the relationship of the work to the project schedule, the project element interdependencies, the associated schedule margins, and an assessment of the likelihood of launching by the proposed launch date. Also evaluated under this factor are the proposed project and schedule management tools to be used on the project, along with the subcontracting plan, including small and small disadvantaged businesses.

- Factor C-5. Adequacy and robustness of the cost plan, including cost feasibility and cost risk. This factor includes proposal elements such as cost, cost risk, cost realism, and cost completeness, including assessment of the basis of estimate, the adequacy of the approach, the methods and rationale used to develop the estimated cost, the discussion of cost risks, the allocation of cost reserves by phase, and the team's understanding of the scope of work (covering all elements of the mission, including contributions). Proposals will be evaluated for the adequacy of the cost reserves and whether proposals with inadequate cost reserves demonstrate a thorough understanding of the cost risks. This factor also includes an assessment of the proposed cost relative to estimates generated using parametric models and analogies. Also evaluated under this factor are the proposed cost management tools to be used on the project.

Student Collaboration proposals, if any, will be evaluated only for the impact they have on overall mission feasibility to the extent that they are not separable; student collaboration proposals will not be penalized in Step 1 for any inherent higher cost, schedule, or technical risk, as long as the student collaboration is shown to be clearly separable from the implementation of the baseline mission. The intrinsic merit of student collaborations will not be evaluated at this time.

This evaluation will result in narrative text, including specific major and minor strengths and weaknesses, as well as an appropriate risk rating for the feasibility of mission implementation.

7.3 Specific Selection Factors

Proposals will be selected according to the guidelines set forth in Section 7.3 of the SALMON AO. In addition to the factors for selection given in Section 7.3 of the SALMON AO, the level of commitment toward host mission accommodation and/or provision for access to space will be a significant consideration during the selection process.

The Selection Official for this PEA is the Associate Administrator for Science Mission Directorate.

NASA reserves the right to make no selection if there are no proposals of appropriate merit or for any other reason.

7.4 Implementation Activities

Proposal selection and award will be implemented according to the guidelines set forth in Section 7.4 of the SALMON AO and Section 5.3 of this PEA. Explorer MO investigations will be implemented by the Explorer Program Office at the NASA Goddard Space Flight Center.

8 Preproposal Activities

8.1 Preproposal Conference

A Preproposal Conference will be held in Washington, D.C., in accordance with the schedule in Section 3 of this PEA. Further information, including logistics, will be available at the Explorer Acquisition Homepage (see Section 8.2 of this PEA) prior to the Preproposal Conference.

All interested parties may attend. All expenses and arrangements for attending this meeting are the responsibility of the attendees. Note that travel and associated costs of attendance are not allowable as direct costs under another Federal Government award, *e.g.*, a contract, grant, or cooperative agreement. Government employees may attend and be authorized travel and associated costs as a matter of official business.

The purpose of this conference will be to address questions about the proposal process for this AO. Questions should be sent to the Explorer Program Acquisition Scientist at the address given in Section 9 of this PEA. NASA personnel will address all questions that have been received no later than five working days prior to the Conference. Questions submitted after this date may be addressed at the Conference as time permits and as appropriate answers can be generated. Anonymity of the authors of all questions will be preserved. Presentations made at the Preproposal Conference, including answers to all questions addressed at the conference, will be posted on the Explorer Acquisition Homepage at the address given in Section 8.2 of this PEA approximately two weeks after this event. Additional questions and answers subsequent to the conference will also appear in this location, if necessary. Questions may be submitted until 14 days before the proposal due date given in Section 3 of this PEA. It is expected that all questions and answers will be posted on the Explorer Acquisition Homepage at the address given in Section 8.2 of this PEA.

8.2 Program Library and Acquisition Home Page

The Explorer Program Library provides additional regulations, policies, and background information on the Explorer Program. The Program Library is accessible at http://explorers.larc.nasa.gov/EX/ex_Library.html.

An Explorer Acquisition Homepage, available at http://explorers.larc.nasa.gov/EX/, will provide updates and any PEA addenda during the Explorer MO solicitation process. It will provide links to the Program Library, information about the preproposal conference, a list of potential proposers and teaming partners, and questions and answers regarding the PEA.

Updates to the PEA and any amendments will be posted on the NSPIRES website. A link will be provided on the Explorer Acquisition Homepage to the NSPIRES index page for the PEA.

9 Summary of Key Information

Explorer MO Cost Cap	$55M (FY 2011$)
Page limit for proposals	See Section 6.1
Sponsoring organization's latest need date for NASA commitment for U.S. participation (Partner MOs only)	December 31, 2013
Decision date required for New Missions Using Existing Spacecraft (New Missions Using Existing Spacecraft MOs only)	December 31, 2013
Latest MO flight date (Small Complete Mission MOs only)	NLT December 31, 2018
Preproposal Conference	See Section 3
Notice of Intent to Propose Deadline	See Section 3
Proposal Submittal Deadline	4:30 p.m. Eastern Time on the date given in Section 3
Submission medium	Hard and electronic copies; see Section 6.3.1 of the SALMON AO
Web site for submission of electronic cover page via NSPIRES	http://nspires.nasaprs.com/ (help desk available at 202-479-9376 or nspires-help@nasaprs.com)
Web site for additional information, updates, and Program Library	http://explorers.larc.nasa.gov/EX/

NASA points of contact concerning this Program Element:	
For science and other questions associated with this Program Element:	Dr. Barbara Giles Explorer Program Acquisition Scientist Mail Stop 3R15 Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Tel: 202-358-1762 Email: HQ-Explorers@mail.nasa.gov **[email address corrected November 5, 2010]**
For technical questions associated with high altitude scientific balloon missions:	Mr. David Gregory Explorer Balloon Experiment POC NASA Balloon Office Mail Stop 820.0 NASA Wallops Flight Facility 34200 Fulton Street Wallops, VA 23337 Tel: 757-824-2367 Email: david.d.gregory@nasa.gov
For technical questions associated with International Space Station Payloads:	Ms. Marybeth Edeen Explorer ISS Payload POC Space Station Payload Office Mail Stop OZ NASA Johnson Space Center Houston, TX 77058 Tel: 281-483-9122 Email: marybeth.a.edeen@nasa.gov
For technical questions associated with NASA's GEO Quick Ride (GQR) program enabling secondary and hosted payloads:	Mr. Robert Caffrey GEO Quick Ride POC Code 460 NASA Goddard Space Flight Center Greenbelt, MD 20771 Tel: 301-286-0846 Email: robert.t.caffrey@nasa.gov URL: http://gqr.gsfc.nasa.gov/

10 Appendix: Replacement Tables

TABLE B.3: EXAMPLE SCIENCE TRACEABILITY MATRIX

Science Goals	Science Objectives	Scientific Measurement Requirements		Instrument Functional Requirements		Projected Performance	Mission Functional Requirements (Top Level)
		Observables	Physical parameters				
Goal 1	Objective 1	Absorption line	Column density of absorber	Alt. Range	XX km	ZZ km	Observing strategies: requires yaw and elevation maneuvers
Goal 2		Emission line	Density and temperature of emitter				Launch window: to meet nadir and limb overlap requirement. Window applies day to day
Etc.			Size of features	Vert. Resol.	XX km	ZZ km	Need AA seasons to trace evolution of phenomena
		Morphological feature		Horiz. Resol.	XX deg x XX lat x XX long	ZZ deg x ZZ lat x ZZ long	
			Rise time of eruptive phenomenon	Temp. Resol.	XX min	ZZ min.	Need AA months of observation to observe variability of phenomena
				Precision	XX K	ZZ K	
		Rate of change of observable phenomenon		Accuracy	XX K	ZZ K	
	Objective 2 to N			Repeat above categories			

An EXCEL version of this template is available in the Program Library.

TABLE B.4: EXAMPLE MISSION TRACEABILITY MATRIX

Mission Functional Requirements	Mission Design Requirements	Spacecraft Requirements	Ground System Requirements	Operations Requirements
From Table B1	Rocket type Launch date: Mission length Orbit altitude requirement and rationale Geographic coverage and how it drives orbit requirement Orbit local time and rationale for the requirement Type of orbit, e.g. Sun synchronous, precessing, Lagrangian point, other Other	Spinning, stabilized Mass Power Volume: Data Rate Temperature Range for spacecraft systems Pointing Control: Knowledge, Stability, Jitter, Drift , Other Detector radiation shielding requirements and rationale Other	Passes per day and duration Assumed antenna size Data volume per day Real time data transmission requirements Transmit frequency Power available for comm (Watts) Downlink data rate Number of data dumps per day Spacecraft data destination (e.g., mission operations center) Science data destination (e.g., science operations center) Other	General spacecraft maneuver requirements and frequency Special maneuvers requirements Rationale for maneuvers Ephemeris requirements Changes in viewing modes and directions per orbit, per day or over longer time periods. Rationale for these changes Other
Msn Functional Req or Instrument Accommodation (from Table B1)	Mission	Spacecraft	Ground System	Operations
Four different observing strategies: Solar, limb, nadir, zenith; requires yaw and elevation maneuvers		Agility requirements Slew rate = y deg/sec Settle = stability < .001 deg/sec after 30 secs		Target planning on 3 day centers Ephemeris accuracy of x with updates every 2 days
Instrument X precision of 5K		Thermal stability of 1 deg/hr S/C bus stability of .01 deg over 10 secs	Bit error rate < 1e-5 Time correlation to 2 msec over 1 week	Weekly time correlation

An EXCEL version of this template is available in the Program Library.

TABLE B.5: NASA COST FUNDING PROFILE TEMPLATE

Total Mission Cost Funding Profile Template

FY costs in Real Year Dollars (RY$), Totals in Real Year Dollars (RY$) and Fiscal Year 2011 Dollars (FY11$)

WBS#	WBS Element	Phase A			Phase B			Phase C/D				Phase E				RY$	FY11$
		FY2011	FY2012	Total	FY2012	FY2013	Total	FY2013	FY2014	FY2015	Total	FY2015	FY2016	FY2017	Total	Total	Total
01	Project Management																
02	Systems Engineering																
03	Safety & Mission Assurance																
04	Science / Technology																
	Breakout pre-launch science from technology development activities																
05	Payload(s)																
	List each instrument separately																
06	Spacecraft																
	List each major flight system element separately																
07	Mission Operations																
	Breakout separable services, e.g., DSN, etc.																
08	Launch Vehicle / Services																
09	Ground System(s)																
	Breakout non-standard cost, e.g., coordinating ground stations																
10	Systems Integration & Testing																
11	Education and Public Outreach																
	Reserves																
	PI-Managed Mission Cost																
Contributions																	
	Student Collaboration Incentive (if applicable)																
	List by organization and WBS element																
	Total Contributions																
	Total Mission Cost																
Other AO-specific Activities																	
	List by activity and WBS element																
	Enhanced PI-Managed Mission Cost																
	Phase B Bridge Phase Funding (*included above*)																

Label columns with actual fiscal years. Add or remove FY columns as necessary.

An EXCEL version of this template is available in the Program Library.

TABLE B.7:
NASA FY 2010 NEW START INFLATION INDEX
for use in FY 2011

Fiscal Year	2011	2012	2013	2014	2015	2016	2017	2018
Inflation Rate		2.6%	2.7%	2.6%	2.6%	2.6%	2.7%	2.6%
Cumulative Inflation Index	1.000	1.026	1.054	1.081	1.109	1.138	1.169	1.199

Use an inflation rate of 2.6% for years beyond 2018.

Note: Proposers shall use their own forward pricing rates. For organizations that are without forward pricing rates, proposers may use the NASA new start inflation index in Table B.7. This instruction replaces the instruction in Appendix B, Section X of the SALMON AO.

END OF PEA H7

NNH08ZDA009O-SOFIA2G
Program Element Appendix (PEA) H8:
SOFIA SECOND GENERATION INSTRUMENT INVESTIGATIONS

Amended August 10, 2011. Amendment 10 to the SALMON AO, *Corrections and clarifications to PEA H8: SOFIA Second Generation Instrument Investigations*

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Program Element Appendix (PEA) H8:
SOFIA SECOND GENERATION INSTRUMENT INVESTIGATIONS

Foreword

The National Aeronautics and Space Administration (NASA) Science Mission Directorate (SMD) is releasing this Program Element Appendix (PEA) as an amendment to the Stand Alone Mission of Opportunity Notice (SALMON) Announcement of Opportunity (AO) to solicit Principal Investigator (PI)-led instrument science investigations for the SOFIA Program.

This solicitation is a call for science investigations that include the development, delivery, and use of second generation instruments for the SOFIA observatory.

Proposers should be aware of the following major changes in this solicitation from the Draft PEA for SOFIA Second Generation Instruments that was released for community comment on December 15, 2010.

- The description of the three types of instrument investigations that are solicited has been moved from Section 1.2 (*Overview of this Announcement of Opportunity*) to Section 4.4 (*Types of SOFIA Instrument Investigations*).
- The Aerospace Corporation will be contracted to perform evaluation services and, therefore, it is precluded from proposing (Section 4.1.2, *Organizations Precluded from Proposing due to Organizational Conflicts of Interest*).
- The funding available for selections is slightly reduced (from “up to $35M” to “up to $30M”) due to reductions for SOFIA during the years covered by this AO in the President's FY 2012 budget request to Congress. In addition, explicit limits on funding profiles have been specified so that selections will fit within the SOFIA planning budget. (Section 4.6.2, *Cost Requirements and Constraints*)
- New sections, Section 4.7.1 (*Observatory Capabilities*) and Section 4.7.6.8 (*On-Aircraft Vacuum*), have been added.
- Section 4.4 (*Types of SOFIA Instrument Investigations*), Section 4.6.1 *(Schedule Requirements and Constraints*), Section 4.6.2 (*Cost Requirements and Constraints*), Section 4.7.3 (*Other Equipment*), Section 4.7.5 (*Instrument requirements*), Section 4.7.6 (*Instrument Interfaces*), Section 4.8.3 (*Commissioning and Guaranteed Observing Times*), Section 4.10 (*Summary of Policies for Instrument Types*), and Section 4.12 (*Use of SOFIA for Other Purposes*) have been clarified.

In addition to the listed major changes, this solicitation incorporates additional changes from the Draft PEA. All proposers must read this solicitation carefully, and all proposals must comply with the requirements, constraints, and guidelines contained within this AO.

Amendment 10: (a) This amendment removes any limitations on the participation of Aerospace Corporation in any capacity under this AO (Section 4.1.2(iii) *Organizations Precluded from Proposing due to an Organizational Conflict of Inte*rest: The Aerospace Corporation). (b) This amendment clarifies one point (the CM&O rate for NASA Centers)

and corrects an error (the source of civil servant labor funding under the current NASA budget structure) regarding full cost accounting for NASA facilities and personnel (Section 4.6.4 *Full Cost Accounting*). (c) This amendment clarifies that proposals are not required to include small business subcontracting plans (Section 4.11 *Exceptions to General SALMON Requirements*). (d) This amendment clarifies text in the following sections without any change in meaning, policy, or requirements: Section 4.12 *Use of SOFIA for Other Purposes,* Section 4.7.1 *Observatory Capabilities,* Section 5.1.2 *Limit on Format and Size of Electronic Proposals*. Added language is indicated by bold text. Deleted language is indicated by strikethrough text. (Amended August 10, 2011)

NNH08ZDA009O-SOFIA2G
Program Element Appendix (PEA) H8:
SOFIA SECOND GENERATION INSTRUMENTS

1 BACKGROUND

1.1 Programmatic Overview

SOFIA consists of a German-built 2.7-meter (2.5-meter useable aperture) telescope mounted in a Boeing 747-SP aircraft supplied and modified by NASA. Operations costs and observing time are shared by the United States (80%) and Germany (20%). Flying at altitudes up to 45,000-feet, SOFIA observes from above more than 99 percent of Earth's atmospheric water vapor, thereby opening windows to the universe not available from the ground. SOFIA offers international science teams up to 1000 cloud-free, high-altitude science observing hours per year during its two decade design lifetime. More than 50 science proposals per year will be selected through a competitive peer review process. Although the primary impact of SOFIA will be its science return, it will yield other returns as well. Compelling discoveries will follow the development of new technologies that can be demonstrated readily on SOFIA. Young scientists-in-training, educators, and journalists will also fly on SOFIA, making it a valuable training platform and public ambassador.

Seven first-generation science instruments are under development by institutions in both the U.S. and Germany, including both imaging cameras and spectrographs (see http://www.sofia.usra.edu/Science/instruments/). SOFIA observes at wavelengths from 0.3 μm to 1.6 mm. It is capable of high-resolution spectroscopy ($R > 10^4$) at wavelengths between 5 and 600 μm with its first-generation instruments. SOFIA's diffraction-limited imaging longward of 25 μm can produce the sharpest images of any current or planned IR telescope operating in the 30 to 60 μm region.

The SOFIA Observatory concept embodies a number of key advantages that make it a unique tool for astronomy in the coming decades:

- SOFIA is a near-space observatory that comes home after every flight. Its scientific instruments can be exchanged regularly for repairs, to accommodate changing science requirements, and to incorporate new technologies.
- SOFIA has unique capabilities for studying transient events. The observatory can operate on short notice from airbases worldwide, in both the northern and southern hemispheres, to respond to new and transient scientific opportunities.
- SOFIA's diverse range of instrumentation facilitates a coordinated program of analysis of specific targets and science questions. SOFIA's 20-year design lifetime enables long-term studies and follow-up of work initiated by SOFIA itself and by other observatories, such as the Hubble Space Telescope, Chandra X-ray Observatory, Spitzer Space Telescope, Herschel Space Observatory, Submillimeter Array, and Akari (Astro-F), as well as future facilities.
- SOFIA presents an ideal venue in which to educate students, where they can participate in hands-on, cutting-edge space technology developments.
- Because of its accessibility and ability to carry passengers, SOFIA includes a vigorous, highly visible Education and Public Outreach (E/PO) program designed to exploit the unique

and inspirational attributes of airborne astronomy (see http://www.sofia.usra.edu/Edu/edu.html).

SOFIA, with its large suite of science instruments and broad wavelength coverage, is capable of undertaking a huge breadth of different investigations.

Additional information on SOFIA may be found at http://www.sofia.usra.edu/ and in the Program Library associated with this solicitation at http://soma.larc.nasa.gov/SOFIA/sofialib.html.

1.2 Overview of this Announcement of Opportunity

This solicitation is a call for science investigations that include the development, delivery, and use of second generation instruments for the SOFIA observatory. This solicitation permits three different types of science instrument (SI) investigations to be proposed. The types of instrument investigations solicited are described more fully in Section 4.4.

- Facility Science Instrument Investigations: A facility science instrument investigation is a science investigation that includes the development, delivery, and commissioning of a SOFIA facility instrument.

- Science Instrument Upgrade Investigations: A science instrument upgrade investigation is a science investigation that includes the upgrade, delivery, and commissioning of an existing SOFIA instrument.

- Technology Demonstration Science Instrument Investigations: A technology demonstration science instrument investigation is a science investigation that includes the development and operation of a technology demonstration science instrument.

In addition to the solicited instrument science investigations, this solicitation provides an opportunity for potential partners to submit proposals to NASA that make use of SOFIA as a platform for other than astronomical observations. Any such proposal must be on a no-cost and no-interference basis with the SOFIA Program. See Section 4.12 of this program element appendix for further information.

2 SCIENCE AND PROGRAM OBJECTIVES

2.1 NASA Astrophysics Goals

The *2010 Science Plan for NASA's Science Mission Directorate* (http://science.nasa.gov/about-us/science-strategy/) articulates NASA's goal in astrophysics as "Discover how the universe works, explore how the universe began and developed into its present form, and search for Earth-like planets." Three broad scientific questions emanate from this goal:

How do matter, energy, space, and time behave under the extraordinarily diverse conditions of the cosmos?

How did the universe originate and evolve to produce the galaxies, stars, and planets we see today?

What are the characteristics of planetary systems orbiting other stars, and do they harbor life?

The science objectives of NASA's astrophysics research theme are:

- Understand the origin and destiny of the universe, and the nature of black holes, dark energy, dark matter, and gravity;
- Understand the many phenomena and processes associated with galaxy, stellar, and planetary system formation and evolution from the earliest epochs to today; and
- Generate a census of extra-solar planets and measure their properties.

NASA's astrophysics program seeks to be responsive to scientific priorities articulated in reports from the National Academy of Science's National Research Council. The most recent report is the 2010 decadal survey in astronomy and astrophysics, *New Worlds, New Horizons in Astronomy and Astrophysics* (NRC, 2010), available at http://www.nap.edu/catalog.php?record_id=12951.

2.2 SOFIA Science Goals and Objectives

The objective of SOFIA is to make fundamental scientific discoveries that contribute to our understanding of the universe through rigorous collection, analysis, and distribution of unique scientific data. This objective will be accomplished by extending the range of astrophysical observations significantly beyond that of previous infrared airborne observatories through increases in sensitivity and angular resolution. SOFIA will also make contributions in the areas of education and public outreach and in demonstrating new instrument technology.

SOFIA, with its large suite of science instruments and broad wavelength coverage, is capable of undertaking a significant breadth of different investigations. A sample of science programs that might be undertaken with SOFIA is described in *The Science Vision for the Stratospheric Observatory for Infrared Astronomy*, available in the Program Library associated with this solicitation and at http://www.sofia.usra.edu/Science/science_cases/.

A workshop on the science potential for SOFIA was held at Asilomar Conference Grounds in June 2010. Presentations included science opportunities that would be enabled by a new generation of instruments. The proceedings of the *Scientific Opportunities For new Instrumentation, Asilomar 2010*, workshop are available at http://www.sofia.usra.edu/Science/workshops/asilomar.html.

2.3 SOFIA Observatory

2.3.1 The Telescope and Observatory

The SOFIA telescope was supplied by Deutsches Zentrum für Luft und Raumfahrt (DLR), the German Aerospace Center, as a major part of the German contribution to the SOFIA observatory. The telescope is mounted in an open cavity in the aft section of the aircraft and views the sky through a port-side doorway. The telescope is articulated by magnetic torquers around a spherical bearing through which the Nasmyth beam is passed. The telescope has an unvignetted elevation range of 23-58 degrees. Since the cross-elevation travel is only a few

degrees, the airplane must be steered to provide most of the azimuthal telescope movement required for tracking. Hence, the list of targets to be observed determines the flight plan. The focal plane instruments and the observers are on the pressurized side of the 21-foot diameter bulkhead on which the spherical bearing is mounted, allowing a shirt-sleeve working environment for the researchers and crew.

2.3.2 SOFIA's First Generation of Instruments

Seven first generation Science Instruments (SIs) are under development for SOFIA. They cover a much wider range of wavelengths and spectral resolutions than those of any other observatory. These include three Facility Science Instruments (FSIs): the High-resolution Airborne Wideband Camera (HAWC), the Faint Object Infrared Camera for the SOFIA Telescope (FORCAST), and the First Light Infrared Test Experiment Camera (FLITECAM). The U.S. facility instruments will be maintained and operated by the SMO staff. FSI pipeline-reduced and flux calibrated data will be archived for general access by the astronomical community after a one year exclusive access (commonly referred to as "proprietary") period.

In addition, there are four Principal Investigator (PI) instruments maintained and operated by the SI teams: the Echelon-Cross-Echelle Spectrograph (EXES), the Field Imaging Far-Infrared Line Spectrometer (FIFI-LS), the German Receiver for Astronomy at Terahertz Frequencies (GREAT), and the High-speed Imaging Photometer for Occultation (HIPO). These instruments are designed to be less general in their potential applications than are the facility instruments. General investigators can propose to use these latter instruments in collaboration with the SI team that developed the instrument. In the present development plans, pipeline reduced data from the U.S. PI instruments will also be added to the science archive, again after a one year exclusive access period. Two of the PI instruments are being developed in Germany (FIFI-LS, GREAT), although the German PI instrument FIFI-LS will be available as a facility instrument under arrangement with DLR and the FIFI-LS team. The FIFI-LS data will be pipeline-reduced and flux-calibrated before it is placed in the data archive.

Further information about all the first-generation instruments can be found at http://www.sofia.usra.edu/Science/instruments/index.html.

2.4 SOFIA Program Management

SOFIA is a program within the Cosmic Origins theme of the Astrophysics Division of the Science Mission Directorate (SMD). SMD has assigned program management for the SOFIA Program to the NASA Dryden Flight Research Center (DFRC).

The execution of the SOFIA Program is carried out by two projects. The SOFIA Platform Project assigned to DFRC is responsible for completing the development, integration, and testing of the airborne observatory and for conducting mission flight operations of the observatory during the life of the program. The SOFIA Science Project assigned to NASA Ames Research Center (ARC) is responsible for managing all science-related activities for the program, including: support to the science community for the preparation of observation proposals; solicitation of observation proposals; evaluation and selection of observation proposals; planning and sequencing of observations; support of observatory operations (such as support to telescope and

science instrument operations); processing, archiving, and distribution of science data; and management of science instrument development. The Universities Space Research Association (USRA) is NASA's prime contractor for science operation and directs the SMO.

In addition to its role as the site of the SOFIA Science Project, the NASA Ames Research Center is eligible to participate in proposals that are submitted in response to this solicitation. The SOFIA Science Project Office at ARC contributed to the development of this solicitation and will participate in the technical evaluation of proposals. This involvement is necessary because the technical knowledge about the SOFIA observatory and the requirements for SOFIA instruments resides in the SOFIA Science Project. The Science Mission Directorate at NASA Headquarters will manage the evaluation and selection process. In order to manage ARC's two roles, SMD has established functional and organizational firewalls between the SOFIA Science Project Office and those parts of ARC that might participate in proposals. These firewalls ensure that personnel identified as supporting the SOFIA Science Project Office and the AO process will be functionally isolated from proposal teams, will protect all nonpublic information from all proposers, including those at ARC, and will be free of financial and other conflicts of interest with proposers.

3 PROPOSAL OPPORTUNITY PERIOD AND SCHEDULE

This solicitation is an Appendix to the NASA Stand Alone Mission of Opportunity Notice (SALMON) Announcement of Opportunity (AO). The SALMON AO provides the overall structure and guidelines for several types of mission of opportunity solicitations. Each new opportunity is announced with a program element appendix (PEA). This document is such a PEA. In particular, this is a Focused Mission of Opportunity (FMO) solicitation. The SALMON AO (NNH08ZDA009O) can be found in the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at http://nspires.nasaprs.com/.

This Focused Mission of Opportunity PEA solicits science investigations that include the development of U.S. provided instruments for the SOFIA observatory.

This is a single step selection process; no Phase A (Step 2) concept study report or downselection is planned.

The following schedule applies to this Focused Mission of Opportunity program element.

- A Preproposal Teleconference is planned as part of this solicitation. Further information will be available at the SALMON AO SOFIA Instruments website (see Section 7 of this program element appendix) prior to the Preproposal Teleconference.
- Please address questions concerning any portion of this appendix to the Point of Contact given in Section 7 of this program element appendix, as appropriate. The period for questions will close two weeks before the proposal due date.
- A Notice of Intent (NOI) to propose to this announcement is extremely valuable to NASA for purposes of planning the proposal evaluation and peer reviews, and, therefore, is encouraged. NOIs are due no later than 11:59 p.m. Eastern Time on the date given in Section 7 of this program element appendix. Section 6.1.4 of the SALMON Announcement of Opportunity

(AO) provides information on electronic NOI submission through NSPIRES at http://nspires.nasaprs.com/.

- All proposals are due no later than 11:59 p.m. Eastern Time on the date given in Section 7 of this program element appendix. Proposals must be fully electronic and must be submitted through NSPIRES. Proposal submission requirements are outlined in Section 5 of this program element appendix.
- NASA funding for selected proposals will begin as soon as appropriate funding vehicles can be put in place; commonly this is 105 calendar days following selection.

NASA is currently planning to solicit instrument investigations for SOFIA approximately every three years.

4 REQUIREMENTS AND CONSTRAINTS

4.1 Eligibility to Propose

4.1.1 Organizations Welcome to Propose

Proposals from any category of organizations or institutions, U.S or non-U.S. (but non-German), are welcome to respond to this solicitation. Specific categories of organizations and institutions that are welcome to respond include, but are not limited to, educational, industrial, and not-for-profit organizations, Federally Funded Research and Development Centers (FFRDCs), University Affiliated Research Centers (UARCs), NASA Centers, the Jet Propulsion Laboratory (JPL), and other Government agencies.

The Memorandum of Understanding (MOU) between NASA and Deutsches Zentrum für Luft und Raumfahrt (DLR), the German Aerospace Center, gives the authority for selection of German participants in the SOFIA program to DLR. Therefore, German institutions are not eligible to submit proposals in response to this solicitation. This does not preclude co-investigators at German institutions from participating on a no exchange of funds basis in proposals submitted by non-German institutions.

Non-U.S. participation in this solicitation is subject to the requirements in Section 4.8 of the SALMON AO.

4.1.2 Organizations Precluded from Proposing due to an Organizational Conflict of Interest

NASA contracts for the services of outside, non-Governmental organizations for support in evaluating proposals. Organizational conflicts of interest (OCI) between proposing, evaluating, and executing organizations must be avoided. The approach to avoiding organizational conflicts of interest depends on the unique characteristics and roles of each evaluating organization. For non-Governmental organizations, this requires limiting the extent to which the outside evaluating organizations can participate in proposal development and/or execution of the work proposed.

(i) Earth Resources Technology, Inc.

The NASA Evaluations, Assessments, Studies, Services, and Support (EASSS) contract with Earth Resources Technology Inc. (ERT) creates an unmitigatable organizational conflict of interest for ERT in the event that any business unit of ERT has a proposed role as prime contractor, subcontractor, or participating organization. Because of this organizational conflict of interest, ERT is precluded from participating in any capacity in support of a respondent under this AO.

(ii) Universities Space Research Association

The NASA contract with Universities Space Research Association (USRA) for SOFIA science and mission operations includes technical evaluation support under this AO. This AO support creates an unmitigatable organizational conflict of interest for USRA in the event that any business unit of USRA has a proposed role as prime contractor, subcontractor, or participating organization. Because of this organizational conflict of interest, USRA is precluded from participating in any capacity in support of a respondent under this AO.

USRA is a private, nonprofit corporation whose current membership consists of 105 universities in the U.S. and abroad that have graduate programs in space-related sciences and/or engineering. NASA has determined that there is a need for USRA employees to perform technical evaluations of proposals for new science instruments due to their unique qualifications. In order to address any apparent or actual organizational conflict of interest that arises between USRA employees and the 105 member universities of USRA, the NASA Assistant Administrator of Procurement has approved a waiver in accordance with FAR 9.504(e) to permit peer review evaluation by USRA employees for all proposals received, including proposals received from the USRA member universities.

(iii) The Aerospace Corporation

Amendment 10: This amendment removes any limitations on the participation of Aerospace Corporation in any capacity under this AO (Section 4.1.2(iii)). Added language is indicated by bold text. Deleted language is indicated by strikethrough text.

The Aerospace Corporation will not be used for evaluation support. There is no limitation on the participation of Aerospace Corporation in any capacity under this AO. Aerospace may participate fully in proposals and in the work being proposed.

~~The NASA contract with The Aerospace Corporation (Aerospace) for evaluation support under this AO creates an organizational conflict of interest for Aerospace in the event that any business unit of Aerospace has a proposed role as prime contractor, subcontractor, or participating organization. Because of this organizational conflict of interest, Aerospace is precluded from responding to this AO, from participating as a member of any proposal performance team, and from being proposed as the recipient of any work awarded under this AO.~~

~~The Aerospace Corporation is a FFRDC, and it has unique capabilities and skills that are made available to the U.S. Government and other organizations under the terms of its sponsoring agreement with the U.S. Air Force. It is in NASA's best interest that, where appropriate and where it does not create organizational conflicts of interest, respondents to this AO be permitted to take advantage of these same capabilities and skills to improve their proposals. Under appropriate circumstances, respondents to this AO may contract with Aerospace for supporting analysis services, including cost analysis, engineering analysis, and resource analysis, if it is deemed in the best interest of the Government and only under the following conditions.~~

~~(i) Aerospace is precluded from responding to this AO, from participating as a member of any proposal performance team, and from being proposed as the recipient of any work awarded under this AO. Aerospace is precluded from providing or developing hardware, including any elements or components, that will be proposed for any work awarded under this AO. Aerospace should not be referenced in the proposal, nor should the evaluating organization's analysis be identified in the proposal.~~

~~(ii) Aerospace has established firewalls within the Aerospace organization to prevent conflicts of interest between Aerospace organizational units and employees supporting NASA's evaluation of proposals and Aerospace organizational units and employees supporting proposal efforts. Any Aerospace supporting analysis services, including supporting cost analysis and supporting engineering analysis, provided to a proposal team must comply with the firewall that has been established by Aerospace and is described in a NASA approved Organizational Conflict of Interest Avoidance Plan (OCIAP).~~

~~(iii) The proposer shall fully describe in a memorandum submitted to NASA at the same time as the proposal all of the supporting analysis services provided by Aerospace to the proposing team. The memorandum must be signed by the proposing organization and must be concurred on by the evaluating organization. The memorandum shall not be bound into the proposal itself, but must be a separate document. This memorandum must describe all of the work that Aerospace provided, must identify any work products of Aerospace that are included in the proposal or its appendices, and must list all Aerospace employees who participated in the Aerospace work. The memorandum must be emailed or mailed to the NASA Point-of-Contact identified in Section 7 of this program element appendix.~~

4.2 Type of Mission of Opportunity

For NASA, this program element appendix is a Focused Mission of Opportunity (FMO). An FMO is one that addresses a specific, NASA-identified flight opportunity that fulfills the solicited objectives and includes all of the elements specified in this document and in Appendix B of the SALMON AO.

This opportunity solicits proposals for complete science investigations that include provision of an instrument or an instrument upgrade to be flown on the SOFIA observatory. The investigation PI is responsible for conducting the proposed science investigation which includes, but is not limited to, delivering the instrument or upgrade, operating the instrument in order to commission the instrument and carry out the proposed science investigation, preparing and delivering appropriate data analysis software, including required calibration data, analyzing the data, and reporting the results of the science investigation in the science literature. Proposals shall

designate all Co-Is, describe the role of each Co-I in the development of the mission, and justify the necessary nature of the role; see Section 4.6.5 of the SALMON AO.

4.3 Science Requirements and Constraints

Proposals submitted in response to this solicitation shall be for a science investigation that requires provision of an instrument (or instrument upgrade) for use on SOFIA as described in Section 1.2 of this program element appendix. Proposals shall describe a science investigation with goals and objectives that address the NASA and SOFIA science objectives described in Section 2 of this program element appendix. Proposals shall clearly describe the relationship between the objectives of the proposed science investigation and the proposed instrument (or instrument upgrade).

Proposals shall include a plan to calibrate, analyze, publish, and prepare for archiving the data returned (see Section 4.8.2 of this program element appendix).

4.4 Types of SOFIA Instrument Investigations

4.4.1 Facility Science Instrument Investigations

A facility science instrument investigation is a science investigation that includes the development, delivery, and commissioning of a SOFIA facility instrument. A facility instrument is delivered to NASA following commissioning by the SI team. The SOFIA Science Mission Operations (SMO) Center will maintain and operate the instrument and make it available for use by SOFIA general investigators (GIs). Instrument delivery includes acceptance of instrument data reduction pipeline software.

4.4.2 Science Instrument Upgrade Investigations

A science instrument upgrade investigation is a science investigation that includes the upgrade, delivery, and commissioning of an existing SOFIA instrument. After upgrade, the instrument will be a facility instrument regardless of its preupgrade classification. There is no minimum allowable cost or effort for an upgrade, nor is there a maximum allowable cost or effort, as long as the cost is within the funding available for this solicitation (see Section 4.6.2).

Instrument upgrades may be proposed by anyone; it is not required that the original instrument team be a part of the proposing instrument upgrade team. In the case where the original instrument team is not a part of the proposing instrument upgrade team: (a) the proposal shall demonstrate the feasibility of the plan to carry out the proposed upgrade; (b) the proposal shall demonstrate that sufficient knowledge of the instrument design has been/can be transferred to the instrument upgrade team from the original instrument team to enable the upgrade to be carried out with acceptable risk; and (c) where an upgrade from a nonfacility instrument is proposed, the proposal shall detail the arrangement made with the original instrument PI for the transfer of the instrument to the proposing instrument upgrade team, and the proposal shall include a letter of commitment from the original instrument PI relinquishing the equipment.

4.4.3 Technology Demonstration Science Instrument Investigations

A technology demonstration science instrument investigation is a science investigation that includes the development and operation of a technology demonstration science instrument. A technology demonstration science instrument is developed for the purpose of maturing and demonstrating, through a focused science investigation involving a limited number of SOFIA flights, new capabilities and methodologies of value to SOFIA and future NASA missions. SOFIA technology demonstration science instrument investigations are analogous to NASA's sounding rocket and scientific balloon suborbital investigations. Technology demonstration science instrument investigations are allowed to have higher risk and reduced reliability; in exchange they are expected to have a shorter duration and be significantly less costly than a facility instrument.

4.5 Technology Maturity Requirements and Constraints

The SALMON AO, Appendix B, Section VII.F states "All enabling technologies must be identified and the NASA TRL level defined and justified. All enabling technologies are required to be at TRL 5 or higher before a project enters Phase B, and at TRL 6 or higher by the end of Phase B. A plan to meet the required TRLs for each phase must be discussed."

For all proposals submitted in response to this solicitation, all enabling technologies must be identified and the NASA TRL level defined and justified.

For Facility Science Instrument Investigation and Science Instrument Upgrade Investigation proposals, all enabling technologies are required to be at TRL 5 or higher by PDR and at TRL 6 or higher by CDR. A plan to meet the required TRLs for each milestone, including demonstration of adequate cost and schedule, must be discussed.

For Technology Demonstration Science Instrument Investigation proposals, there are no formal TRL gateway requirements. However, all enabling technologies for instrument systems (detector, optics, etc.) must be developed to the stage that they will work before the first use on SOFIA. A plan for technology development that will support the requirements of the proposed use on SOFIA, including demonstration of appropriate cost and schedule, must be discussed.

4.6 Cost and Schedule Requirements and Constraints

4.6.1 Schedule Requirements and Constraints

The SOFIA program has opportunities for commissioning facility science instruments once every 18 months starting in FY 2015. Upgraded instruments and technology demonstration instruments could be flown earlier. The funding for investigations selected through this PEA is allocated in the SOFIA program budget for FY 2012 to FY 2018. The selected investigations will be phased to fit within the FY budget allocation for second generation instruments and to support the commissioning of no more than one new instrument or instrument upgrade per year. It may be necessary for NASA to adjust the commissioning dates of the selected investigations from those proposed to conform to the available SOFIA program budget profile; therefore, the degree of commissioning date flexibility shall also be indicated in the proposal. The selected

investigations may also be asked to perform a delayed or slow start to accommodate the available funding profile or commissioning opportunity constraints.

4.6.2 Cost Requirements and Constraints

In its current SOFIA planning budget, NASA is reserving up to $30M spread over FY 2012-FY 2018 for funding instrument investigations selected from this solicitation. The funding reserved for developing instruments as a result of this AO does not exceed $1M in FY 2012, $3M in FY 2013, or $5M in any of the years FY 2014 through FY 2018.

The availability of these funds, or these amounts of funds, is subject to appropriation by Congress and approval by the President of sufficient funding to permit both the operation of SOFIA and the development of new instrumentation.

Subject to receipt of sufficient meritorious proposals, NASA intends to select one investigation to begin development in mid-FY 2012 and additional investigation(s) to begin development approximately one year later. The number and types of investigations selected will depend on the proposals received. In any case, NASA desires to maximize the science return from SOFIA within the program's funding and schedule constraints.

Proposals shall include a cost plan that is compatible with NASA's funding availability.

Section 4.7.5 of the SALMON AO requires a minimum of 25% unencumbered cost reserve and adequate funded schedule reserve.

4.6.3 Earned Value Management

For Government entities, the earned value management (EVM) requirements are listed in NPR 7120.5D NID. For entities receiving contracts, the EVM requirements are listed in NFS 1852.234-2.

4.6.4 Full Cost Accounting

Amendment 10: This amendment clarifies one point (the CM&O rate for NASA Centers) and corrects an error (the source of civil servant labor funding under the current NASA budget structure) regarding full cost accounting for NASA facilities and personnel (Section 4.6.4). Added language is indicated by bold text. Deleted language is indicated by strikethrough text.

For the purpose of calculating the full cost of NASA provided services for proposals submitted in response to this AO, proposal budgets from NASA Centers, whether as the proposing organization or as a supporting organization, are to include within the PI Mission Cost all costs required for the performance of the research effort. Since the NASA civil servant labor and benefits costs will be covered by the civil servant labor and expenses (CSLE) account within the Agency's Cross-Agency Support Program (CASP), these costs will not be paid from the resulting award but still must be accounted for within the PI Mission Cost.

All NASA civil servant labor costs, including salary and benefit costs, must be clearly identified by year within the budget justification section of the proposal.

Estimated NASA Center Management and Operations (CM&O) costs must be included to enable a level playing field for proposers. For the purpose of calculating the full cost of NASA provided services for proposals submitted in response to this AO, the CM&O burden shall be applied only to NASA provided labor, including Center civil servants and on-site contractors.

Do not include within the cost proposal, nor within the PI Mission Cost, other costs not paid with SOFIA Program funds, such as allocated service pools, Agency Management and Operations (AM&O, a.k.a. NASA Headquarters overhead), and any CM&O burden attributed to off-site contracts (pass-through dollars) and other cost elements.

Proposal budgets from NASA Centers, whether as the proposing organization or as a supporting organization, must include within the PI Mission Cost the following cost elements as appropriate and must separately identify them by element and by year:

- NASA civil servant direct labor, including benefits;
- NASA civil servant travel;
- Other direct costs, including non-civil servant demand service pools and procurements as identified in the NASA N-2 database; and
- The CM&O burden on NASA provided labor, including Center civil servants and on-site contractors.

NASA Centers should use the 16% CM&O rate specified in the Planning, Programming, Budgeting, and Execution (PPBE) FY 2013 Strategic Programming Guidance (SPG) issued by the Office of the Chief Financial Officer (OCFO).

Table 4.6.4-1. Cost Elements for NASA Center Budget Proposals in response to SMD AOs

	Identify in proposal	Include in PI mission cost	Funding source	Comments
Civil Service Labor	Yes	Yes	**SMD Program** ~~CASP~~	includes benefits
Civil Service Travel	Yes	Yes	SOFIA Program	
Other Direct	Yes	Yes	SOFIA Program	includes non-civil servant demand service pools and procurements as identified in the NASA N-2 database
CM&O	Yes	Yes	CASP	applied to NASA provided labor, including Center civil servants and on-site contractors
AM&O	No	No	CASP	includes NASA provided independent technical authority
NASA Contributed Costs	Yes	No	Identify	must be non-SMD

Non-NASA Federal Government (funding requested from NASA)	Yes	Yes	SOFIA Program	if NASA funding is requested for the non-NASA Federal Government agency
Contributions	Yes	No	Identify	includes all non-NASA contributions

If any NASA funded item(s) or services are to be considered as contributed costs, then the contributed item(s) must be separately funded by a non-SMD effort complementary to the proposed investigation, the value of the contribution(s) must be estimated, and the funding source(s) must be identified.

Any non-NASA Federal Government costs must follow the appropriate agency accounting standards for full cost. If no standards are in effect, the proposers must follow the *Managerial Cost Accounting Concepts and Standards for the Federal Government*, as recommended by the Federal Accounting Standards Advisory Board and available at http://www.fasab.gov/pdffiles/sffas-4.pdf.

4.7 Technical Requirements and Constraints

4.7.1 Observatory Capabilities

Amendment 10: This amendment clarifies the caption of Figure 4.7.1-1 to remove an ambiguity in the text without any change in meaning. Added language is indicated by bold text.

At this time of the development of this AO, the SOFIA observatory is preparing a series of detailed observatory characterization flights that will definitively provide essential performance metrics such as the primary contributors to the overall point-spread function, including seeing due to both the shear layer and the telescope cavity, optics distortion, jitter, tracking errors, and image degradation due to the chopper. Plans are to interleave the execution of these flights with science flights during summer 2011. Observatory characterization will be done in parallel with telescope upgrades, including the installation and testing of active mass dampers that will reduce the dominant vibrational modes that have been identified as primary contributors to the net jitter budget. Observatory performance values that are expected following this period of characterization cannot be provided with complete certainty at this time, but will be readily available by the end of CY 2011, in ample time for incorporation into the final designs of selected investigations.

Two values for image size are provided: a conservative number representing the ~95% confidence level for observatory performance, and an observatory goal that may be realized if the planned telescope upgrade activities provide results that exceed expectations. Following the telescope upgrades, the telescope jitter is anticipated to be 0.5 arcsecond (80% encircled energy, or “D80,” a value equivalent to ~1.52 FWHM for a Gaussian profile). Table 4.7.1-1 and Figure 4.7.1-1 provide D80 as a function of wavelength, representing future performance following observatory upgrades. These total image size values include diffraction, jitter, shear layer seeing and a budget for “unknown” sources (such as cavity seeing, optics, etc). The solid

line represents the 95% confidence projected observatory performance values to which proposed instruments should be designed. The dashed line represents the observatory performance goal. Proposers should gear their instrument designs towards the conservative number (solid line), but include a description within the proposal that addresses how their design would be impacted, in either a positive or negative manner, should the observatory performance goal be achieved by the time that the instrument would be commissioned.

Figure 4.7.1-1: Predicted D80 values as a function of wavelength at the 95% confidence level (solid line) and observatory goal (dashed line). The solid line is based on a wavelength-independent size of 2.0 arcseconds (D80)**, a value** that includes jitter but excludes the effects of diffraction, shear layer and cavity seeing. The dashed line is based on a similar wavelength-independent value of 1.60 arcseconds as the observatory goal.

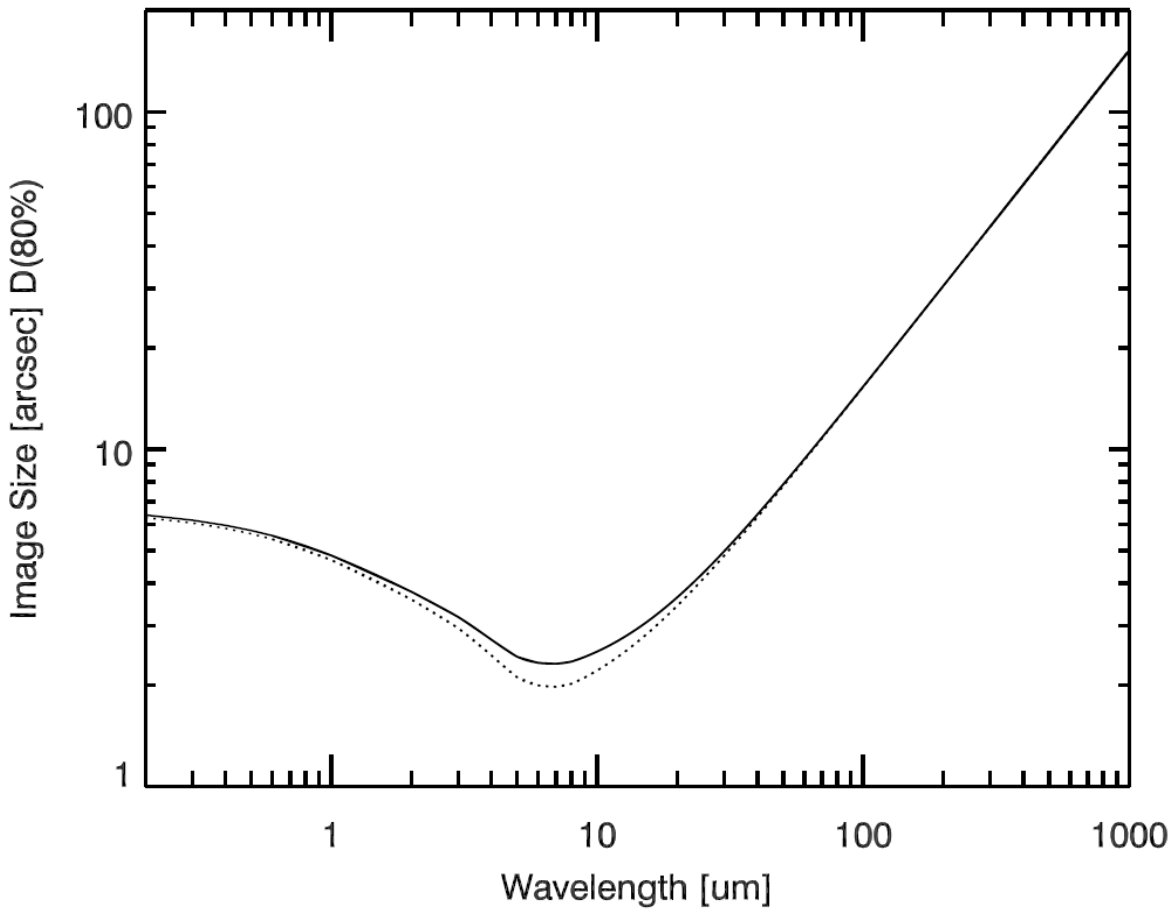

Table 4.7.1-1: Expected future observatory image size (80% encircled energy) in arcseconds for the projected observatory performance at the 95% confidence level and for the observatory performance goal). This data was used to create Figure 4.7.1-1.

λ (μm)	D80 (") solid	D80 (") dashed	λ (μm)	D80 (") solid	D80 (") dashed	λ (μm)	D80 (") solid	D80 (") dashed
	Projected observatory performance	Observatory performance goal		Projected observatory performance	Observatory performance goal		Projected observatory performance	Observatory performance goal
0.6	5.5	5.4	15	3.0	2.8	90	13.8	13.8
1	4.8	4.7	20	3.6	3.4	100	15.3	15.3
2	3.8	3.6	25	4.3	4.1	200	30.5	30.4
3	3.2	2.9	30	5.0	4.8	300	45.6	45.6
4	2.7	2.4	35	5.7	5.6	400	60.8	60.8
5	2.4	2.1	40	6.4	6.3	500	76.0	76.0
6	2.3	2.0	45	7.1	7.0	600	91.2	91.2
7	2.3	2.0	50	7.9	7.8	700	106.4	106.4
8	2.3	2.0	60	9.3	9.3	800	121.6	121.6
9	2.4	2.1	70	10.8	10.8			
10	2.5	2.2	80	12.3	12.3			

4.7.2 Science Instrument System

The "SI System" is generally considered to consist of:

- One to three "PI Rack(s)" of SI equipment, installed over the center wing section of the main deck floor. The dual-bay, short, 19-inch rack frame structures are provided by NASA to the SI developer.
- A "Counterweight Rack," mounted on the Telescope Assembly, which can be populated with SI equipment. The 19-inch rack frame structure is provided by NASA to the SI developer.
- The SI assembly (consisting of a cryostat, optics, and electronics), mounted at the instrument flange of the Telescope Assembly.
- Chopper interface electronics (optional) to drive the Telescope Assembly secondary mirror assembly (SMA) chopper.
- A SI installation cart used to transport the SI through the ground facility, onto the aircraft, and install the instrument on the Telescope Assembly instrument flange.
- Any lab stands or ancillary ground support equipment required for routine maintenance of the instrument.

4.7.3 Other Equipment

Should the proposed investigation require additional equipment (i.e., alternate secondary mirror button, tertiary mirror with alternate coating, instrument rotator, secondary spider baffles, solar filter, etc.) that is neither part of the current observatory nor in the current observatory baseline development plan, the cost for that equipment shall be estimated and included as part of the proposed investigation. Section 4.7.6.1 of this program element appendix and the *Instrument Developer's Handbook* (available in the SOFIA Program Library) contain descriptions of the current observatory features and planned improvements which are in the baseline observatory.

For selected investigations, the SOFIA Program and SI team will determine whether this additional equipment should be incorporated as part of the observatory and developed by the SOFIA Program with input from all the SI teams or whether this equipment should be developed by the SI team under the instrument contract. This determination will be made in coordination with the SI team after selection of the proposal.

4.7.4 Government Furnished Equipment

The SOFIA Program will support selected investigations' integration with the Observatory with equipment, services, and facilities. Government Furnished items include:

- PI rack(s),
- PI rack installation dolly,
- Counterweight rack,
- Counterweight rack installation cart,
- Laboratory space at DAOF for integration activities, and
- Laboratory technicians and supplies to support integration.

A more complete list of Government furnished equipment (GFE) and Government furnished services (GFS) for science instruments is described in the *Instrument Developer's Handbook* (available in the SOFIA Program Library).

4.7.5 Instrument Requirements

Proposals shall include a list of performance requirements the science instrument shall achieve in order to execute the scientific objectives of the proposed investigation. These minimum performance requirements will form the basis of the top-level science and technical performance requirements. The final top-level science and technical performance requirements will be negotiated with the SOFIA Program prior to the SI System Requirements Review (SRR).

To ensure the safety of the personnel onboard the aircraft and of the SOFIA observatory, all equipment onboard the aircraft needs to be deemed airworthy before it can be flown. The airworthiness approval process for science instruments is described in the *Instrument Developer's Handbook*.

The following are topics that pertain to the airworthiness of a science instrument:

- Anything that can cause injury to personnel;
- Anything that can cause a fire;
- Commands by one system to others that result in hazardous conditions;
- Systems that monitor, providing warning of, or prevent hazardous conditions;
- Anything that affects the aircraft pressure boundaries;
- Foreign Object Damage and equipment security;
- Pressure systems;
- Cryogens;
- Toxic substances; and
- Radiation, both ionizing and nonionizing

The *Science Instruments System Specification* document (available in the SOFIA Program Library), contains the requirements for airworthiness, safety, mission assurance, and quality assurance for Science Instruments. The *Instrument Developer's Handbook* also includes a section on instrument mission assurance and an example statement of work. Proposal cost estimates shall include the costs of complying with the airworthiness and mission assurance requirements and processes as described in the *Science Instruments System Specification* and *Instrument Developer's Handbook* documents, as well as the process requirements listed in the example statement of work.

4.7.6 Instrument Interfaces

4.7.6.1 Optical

The SOFIA telescope is a two mirror bent Cassegrain design with a single Nasmyth instrument mount fed by a flat tertiary. The telescope effective aperture is 2.5 meters and provides an f/19.5 beam to the instruments (at nominal focus). The primary and secondary have aluminum coatings. The dichroic tertiary has a gold coating. A fully-reflective tertiary is planned as part of the baseline observatory. The requirements for this alternate tertiary have yet to be defined; it will have either an aluminum coating or a protected silver coating.

The secondary mirror provides a peak-to-peak chop amplitude of 10 arcminutes between 0 and 20 Hz. The visible beam is fed into the Focal Plane Imager (FPI) which is an optical focal plane guiding system. Independent of the FPI there are two other optical imaging and guiding cameras available: a Wide Field Imager (WFI) and Fine Field Imager (FFI). Both of these cameras are attached to the front ring of the telescope.

Focusing is accomplished with an actuated secondary providing adjustment range of ±60 cm referenced to the nominal Nasmyth focal plane location. The telescope unvignetted elevation angles range from 23 to 58 degrees, thus the instrument shall be capable of supporting a rotation of ±20 degrees about the optical axis. The unvignetted field-of-view is a circle with a diameter or 8 arcminutes.

The secondary mirror chopper is triggered from a TTL waveform from the science instrument. This interface is described in the *TA Chopper Processor/Principal Investigator Computer Direct Analog Interface Control Document*.

The secondary mirror can be outfitted with a selection of mirror "buttons" to either attenuate or redirect the optical path of the primary mirror central obscuration in the telescope exit pupil. These buttons are described in the *Instrument Developer's Handbook.*

4.7.6.2 Mechanical

The SI assembly mounts to the telescope assembly on a 41-inch diameter instrument flange. This interface is described in the *Telescope Assembly/Science Instrument Mounting Interface Control Document*. The SI assembly static, dynamic, and installation envelopes are described in the *Science Instrument Envelope Interface Control Document*. Both documents are available in the SOFIA Program Library.

Science Instrument components mounted in the PI and Counterweight 19-inch racks shall be secured to meet airworthiness and crash load requirements to ensure the safety of the SOFIA team operating the observatory in the main cabin. The *Principal Investigator Equipment to PI Rack to Aircraft System Interface Control Document* provides guidelines for the SI teams to populate the PI rack(s), including installation requirements on SI provided hardware, limitations on rack loading, use of support trays, special conditions, and making structural and/or configuration changes to the rack, if deemed necessary.

The *SI Equipment Rack/TA Counterweight Interface Control Document* interface control document provides guidelines for the SI teams to populate the counterweight rack, including installation requirements on SI provided hardware and limitations on rack loading. Requirements on the total mass and mass properties of the loaded counterweight rack are in the *Science Instrument Equipment to Counterweight Rack Interface Control Document*. Access to the counterweight rack is not possible during flight.

4.7.6.3 Pressure

To provide the greatest flexibility in wavelength coverage for the observatory, no window is installed in the optical path of the Nasmyth beam. A gate valve is installed between the instrument flange in the main cabin and the Nasmyth tube in the cavity for safety. This valve is opened when the observatory is operating. Once the gate valve is opened, the SI assembly becomes part of the pressure barrier of the main cabin; the SI assembly defines the interface between the shirt-sleeve laboratory environment in the main cabin and the stratospheric environment in the cavity. The pressure seal interface is defined in the *Telescope Assembly/Science Instrument Mounting Interface Control Document*.

It is up to the SI team to determine whether to install a window in their optical beam. If a highly hygroscopic material is selected, procedures for protecting those windows shall be developed by the SI team and an appropriate window spare complement shall be provided with the instrument.

4.7.6.4 Electrical

Electrical connections to the Mission Controls and Communications System (MCCS) include power, local area network, GPS, and IRIG-B timing. These interfaces are provided at the PI patch panel located near the PI rack mounting points and are described in the *Principal Investigator Patch Panel to Principal Investigator Equipment Rack(s) Interface Control Document*.

The PI racks and the telescope assembly are separated by ~25-feet. The aircraft system provides cables routed from the PI patch panel to the Telescope Assembly patch panel using cables routed under the cabin deck and through the cable load alleviator (telescope cable wrap). The interface between the PI racks and the PI patch panel are described in the *Principal Investigator Patch Panel to Principal Investigator Equipment Rack(s) Interface Control Document*. The interface between the counterweight rack and TA patch panel, and the SI assembly and the TA patch panel are described in the *Cable Load Alleviator Device/Science Instrument Cable Interface Control Document*.

The science instrument electrical interfaces between the counterweight rack and the SI assembly are achieved by direct connection with SI supplied cables.

4.7.6.5 Power

Electrical power to the Science Instrument is supplied by the MCCS at the PI patch panel located near the PI rack mounting points. Power to the counterweight rack and the SI assembly are routed by the SI team via jumper cables or a power distribution system in a PI rack via the PI patch panel to the TA patch panel, as described in the *Principal Investigator Patch Panel to Principal Investigator Equipment Rack(s) Interface Control Document*.

Current documentation indicates a total of 5 KVA is available for use by the Science Instruments. It is our intention to provide up to 20 KVA to science instruments selected by this call.

4.7.6.6 Software

4.7.6.6.1 Mission Command and Control System

The observatory is controlled by the Mission Command and Control System (MCCS) which coordinates the aircraft, telescope, and science instrument. The Science Instrument issues commands to the observatory via the SOFIA Command Language (SCL). These SCL commands are then executed by the MCCS. The MCCS provides, via subscription, the housekeeping data to the science instruments neeedd to reduce their data and populate their FITS headers. The software interface between the SI and the MCCS is described in the *MCCS to Science Instrument Software Interface (Functional) Interface Control Document*.

4.7.6.6.2 Data Cycle System

The SOFIA data cycle system (DCS) provides long-term archival and retrieval functions for raw and reduced science instrument data. The DCS stores the raw and reduced data in FITS files and utilizes the metadata keywords in FITS files to store the necessary parameters required to utilize the data for scientific investigations. The *Data Cycle System to Science Instrument Interface Control Document* describes the DCS and the interface to the Science Instrument data analysis pipeline software.

4.7.6.6.3 Data Reduction Pipeline

Requirements for instrument data reduction pipelines are described in the *Data Processing Plan for SOFIA Science Instruments*.

Technology demonstration instruments are not required to provide a data analysis pipeline to the observatory.

4.7.6.7 Ground Support Equipment

The SI assembly installation cart is an important item of ground support equipment; it is used to load the SI assembly onto the aircraft through the L1 door and install the instrument on the instrument flange. The requirements for the SI installation cart are in the *SI Handling Cart to Aircraft System Interface Control Document* and the *SI Handling Cart to SSMO Facility Interface Control Document*. The science instrument loading ramp is being redesigned to provide

sufficient space on a flat landing to rotate the instrument through the right turn before the ramp down to the aircraft deck.

The SOFIA program supplies carts and dollies for the installation of the PI racks and the counterweight rack.

4.7.6.8 On-Aircraft Vacuum

An on-aircraft vacuum system is planned for the observatory following Early Science. This vacuum system can be used by the mission operations or instrument teams during flight. This vacuum system serves two purposes, to pump out the Nasmyth tub when needed and to support in-flight vacuum requirements of the Science Instruments. Pumping on the Nasmyth tub (volume between the science instrument flange and the gate valve) may be part of normal or off-nominal operations to reduce the pressure in the tub to protect an instrument window or instrument from condensation during decent. Some instruments may use the vacuum system to pump on liquid cryogen baths to reduce their temperature for normal operation. The on-Observatory vacuum system is described in the *Specification for the SOFIA Vacuum Pumping System* document and the *Science Instrument to Aircraft Vacuum Pump Interface Control Document*.

4.8 Data and Observing Requirements and Constraints

4.8.1 Instrument Operations

SOFIA operates out of the Dryden Aircraft Operations Facility (DAOF) located in Palmdale, CA, where the Science Instruments are integrated with the Telescope Assembly. The DAOF includes laboratory space for the storage, preparation, and maintenance of the science instruments. The observatory will fly several nights per week to achieve an average of 3.5 successful science flights per week during a flight campaign, returning to Palmdale each morning except in the case of a deployment.

SOFIA will occasionally be deployed to the southern hemisphere or other locations to accommodate the scientific objectives of the proposed science. All Facility Science Instruments shall be capable of being deployed to remote sites. Technology Demonstration Science Instruments shall be capable of being deployed if the proposed investigation includes observations requiring a deployment.

Facility Science Instruments are prepared for the commissioning flights and operated during the commissioning flights by the instrument team. Facility Science Instruments are owned and operated by the SOFIA Program following the successful completion of the instrument acceptance review. The documentation required for the SOFIA Program to maintain and operate the FSI will be delivered prior to the instrument acceptance review.

Technology Demonstration Science Instruments are prepared and operated by the instrument team for all flights, commissioning and science.

Proposals shall include travel and labor costs for preparing the instrument for flight and operating the instrument during flight in accordance with the instrument type.

The instrument commissioning period will be scheduled by the SOFIA Program based on the instrument availability and Observatory availability. SOFIA science instrument observing time is allotted via the time allocation committee or SMO Director's discretionary time.

While the nominal configuration is for a single instrument to be mounted to the telescope, it is possible to support a dual-instrument configuration, such as the simultaneous operation of HIPO and FLITECAM. To achieve this, HIPO supplies the mechanical and optical interfaces similar to the TA to the FLITECAM instrument. Instruments interested in co-mounting with HIPO would need to collaborate with the HIPO PI to obtain the interface requirements. Instruments wishing to implement a multi-instrument configuration would need to ensure that their configuration meet all the requirements and interfaces described in Section 4.7 of this program element appendix.

Investigations with strict altitude or water vapor depth requirements shall state their requirements in the proposal. While SOFIA has a ceiling of 45,000 feet, it cannot achieve this altitude with a full fuel load. Investigations with strict requirements on water vapor depth shall propose alternate science that can be achieved at lower altitude or should assume shorter duration flights.

The SOFIA science instruments must reliably contribute high quality science observations that maximize the scientific return of flight opportunities and the unique capabilities of SOFIA. Instruments that do not demonstrate sufficient science productivity will be removed from the suite of instruments available to the general observing community as per the instrument retirement section of the *Instrument Developer's Handbook*. The instrument lifecycle is also described in the *Instrument Developer's Handbook* included in the SOFIA Program Library.

Further information on instrument operations can be obtained in the *Synopsis of the SOFIA Concept of Operations* document located in the SOFIA Program Library.

4.8.2 Data Rights and Archiving

All raw science data taken in flight from telescope-mounted science instruments on SOFIA, regardless of the instrument classification (facility science instrument, technology demonstration science instrument, etc.), observing mode, or type of observing program (including science data taken during instrument commissioning flights), are archived at the SMO. Observers acquire their restricted access data (often informally referred to as proprietary data), as well as publically-available datasets, through this data archive system. Pipeline-processed data from supported modes of facility instruments are also archived. The pipeline products involve standard data reductions, including wavelength and flux calibrations. All archived data associated with investigations selected through the U.S. peer review process, as well as through Guaranteed Time granted to science instrument teams, will have a one year restricted access period, during which time only the proposal Principal Investigator and his/her authorized collaborators may access the data.

4.8.3 Commissioning and Guaranteed Observing Times

4.8.3.1 Facility Science Instruments, including Upgrades

For both new Facility Science Instruments and Facility Science Instruments that result from an instrument upgrade, proposers shall estimate the number of flight research hours required to

verify their instrument's performance, commission the instrument for use by general investigators, and obtain any required generic calibration data and provide that estimate in the proposal. Observing time estimates do not need to include observatory overhead values (for telescope set-up and initial source acquisition) but should include observation overheads (time on target, time off-target for background subtraction via chop and/or nod, etc.).

They also shall estimate the number of line operations observing hours, observations with the aircraft parked on the ground, required to commission the instrument and provide that estimate in the proposal. The number of hours proposed for commissioning the instrument and for line operations should be kept as small as practical, and the number of hours proposed shall be justified in the proposal.

In order to conduct the proposed science investigation, the PI of selected new Facility Science Instruments (not upgrades) shall be granted 50-hours of guaranteed observing time.

In order to conduct the proposed science investigation, the PI of a selected instrument upgrade shall be granted guaranteed observing time at a level that is commensurate with the level of effort involved in the upgrade activities. As a general guide, the guaranteed time should not exceed 20 hours unless the associated level of effort is commensurate with development of a new instrument, in which case the proposal may include a request for additional guaranteed observing time. The total amount of requested guaranteed time shall be commensurate with the level of effort to implement the upgrade, and the request shall be fully justified in the proposal.

Guaranteed observing for Facility Science Instruments, both new and upgrades, will be scheduled by the SMO Director within two years following the formal acceptance of the instrument.

4.8.3.2 Technology Demonstration Science Instruments

For Technology Demonstration Science Instruments, proposers shall estimate the number of line operations observing hours, observations with the aircraft parked on the ground, required to prepare the instrument for technology demonstration flights and provide that estimate in the proposal.

In order to conduct the proposed science investigation, the PI of selected Technology Demonstration Science Instruments shall be granted three flights of guaranteed observing time to be scheduled by the SMO Director within two years following the preship review. Any observations required to verify their instrument's performance and obtain any required generic calibration data shall be accommodated within the guaranteed observing time and shall be described in the proposal. Recognizing that the guaranteed observing time flights for Technology Demonstration Science Instruments will incorporate testing, commissioning, and science, flexibility in scheduling these flights will be accommodated to allow instrument "tweaking" between flights.

In addition to Guaranteed Time Observations (GTOs), the Principal Investigator of the Technology Demonstration Science Instrument may compete through the SOFIA General

Investigator program for additional observing time in the period after the last GTO flight and before the instrument is retired.

4.8.4 Instrument Retirement Policy

The retirement of Science Instruments is necessary in order to keep the number of supported instruments available to the SOFIA observer community at a manageable level and to make way for new instrumentation by freeing up resources, including funding, personnel, and flight hours. A "retired" Science Instrument is taken out of the instrument pool and can no longer be used for observations of any kind, by any one, on SOFIA.

As detailed in the *Instrument Developer's Handbook*, Facility Science Instruments shall be retired after a time at which the cost of their maintenance and support is no longer commensurate with their ability to competitively deliver science. As is the case with any facility instrument, retired facility instrumentation that is in storage may be used in instrument upgrade proposals. The availability of such equipment will be indicated in the inventory table given in future solicitations for SOFIA Science Instruments.

Technology Demonstration Science Instruments are retired after two years from the date of the last flight of guaranteed observing time.

4.9 Letters of Commitment for Acquisition of Upgraded Science Instruments

All upgraded non-Facility instruments (e.g., PI instruments) become Facility Instruments following a selected instrument upgrade. Any proposal to upgrade a non-Facility instrument, whether or not the proposal is from the original instrument team, shall include a Letter of Commitment from the Office of Grants and Contracts of the host institution that owns the non-Facility instrument; the Letter shall indicate the institution's agreement to relinquish the instrument.

In cases for which the PI of the upgrade proposal is not the original PI of the science instrument, the proposal shall also include a Letter of Commitment from the original PI of the instrument, agreeing to transfer the PI title and to provide the PI of the selected upgrade proposal all equipment and documentation associated with the instrument if the upgrade proposal is selected.

4.10 Summary of Policies for Instrument Types

Table 4.10-1. Policies for Instrument Types

	Facility Science Instruments	Science Instrument Upgrades	Technology Demonstration Science Instruments
Development	PI responsibility	PI responsibility	PI responsibility
Preliminary design review (PDR)	Yes	Yes	Yes
Critical design review (CDR)	Yes	Yes	Yes
Pre-ship review (PSR)	Yes	Yes	Yes

Acceptance Review (AR)	Yes	Yes	No
SI specification (including airworthiness and mission assurance)	Applies	Applies	Applies
Commissioning time	As proposed	As proposed	Included in guaranteed time
Guaranteed time observer (GTO) time	50 hours	Not to exceed 20 hours (see Section 4.8.3.1)	3 flights
Oversight and approvals	NASA	NASA	NASA
Interface to SOFIA Program	NASA	NASA	NASA
Operations	SMO (after acceptance)	SMO (after acceptance)	PI responsibility
Data analysis	GI responsibility	GI responsibility	PI responsibility
Data analysis pipeline	Delivered by PI and operated by SMO	Delivered by PI and operated by SMO	PI responsibility; not delivered
Data archiving	Raw, reduced, and calibrated	Raw, reduced, and calibrated	Raw
General investigator (GI) access	Yes	Yes	No (except in collaboration with the instrument PI)
Retirement	as per *Instrument Developer's Handbook*	as per *Instrument Developer's Handbook*	2 years following the last GTO flight
Upgrade eligibility	Yes, through AO proposal	N/A	Yes, through AO proposal

Where Table 4.10-1 indicates "YES" for reviews, these reviews shall be conducted with NASA assigned reviewers and a NASA review chair. The content of these reviews is described in the *Instrument Developer's Handbook* and are based on *Criteria for Flight Project Critical Milestone Reviews* (GSFC-STD-1001) and *NASA Systems Engineering Handbook* (SP-2007-6105) tailored appropriately for SOFIA, i.e., content applicable to space flight replaced with SOFIA airworthiness content.

4.11 Exceptions to General SALMON Requirements

Amendment 10: This amendment clarifies that proposals are not required to include small business subcontracting plans (Section 4.11). Added language is indicated by bold text.

This program element appendix contains the following exceptions to the SALMON proposal preparation and submission requirements outlined in the SALMON AO.

- Proposals shall be submitted only electronically and not with hard copy and CD as described in Section 6.3 of the SALMON AO; see Section 5.2 of this program element appendix.

- Proposals or portions of proposals requesting NASA funding shall report proposal costs in Real Year (RY) dollars; there is no requirement to report costs in Fiscal Year (FY) 2008 dollars. This instruction supersedes and cancels the request for costs in FY 2008 dollars described in Appendix B of the SALMON AO, including Table B-5 and Table B-6.
- Section 4.1 of this program element appendix provides eligibility requirements and supersedes Section 4.1 of the SALMON AO.
- Section 4.8.2 of this program element appendix provides data policies and supersedes Section 4.4.3 of the SALMON AO.
- Proposals shall not include a plan or a budget for science/technology enhancement options (STEOs); this supersedes Section 4.4.5 of the SALMON AO.
- Section 4.6.4 of this program element appendix provides instructions for full cost accounting of proposal budgets that include NASA civil servants and supersedes Section 4.7.1 of the SALMON AO.
- **Proposals are not required to include small business subcontracting plans. Small business subcontracting plans will be required only from selected investigations prior to negotiation and award (see Section 4.7.7 of the SALMON AO). Further information may be found in Procurement Information Circular (PIC) 11-01 at http://www.hq.nasa.gov/office/procurement/regs/pic11-01.html.**
- Proposals shall not include a plan or a budget for education and public outreach (E/PO) activities; this supersedes Section 4.10 of the SALMON AO. Selected investigations will be required to coordinate their E/PO, including any student collaboration, with and to complement the overarching SOFIA Program E/PO Plan.
- All inquiries should be addressed to the point-of-contact indentified in Section 7 of this program element appendix; this supersedes Section 6.1.1 of the SALMON AO.
- Rather than identifying the Lead Representative in the NOI, as described in Section 6.1.4(e) of the SALMON AO, the NOI shall include the name of the organizational lead from each organization (industrial, academic, nonprofit, and/or Federal) included in the proposing team, and the organization's role in the proposed investigation, as may be known at the time of the NOI.
- Proposers should note that NPR 7120.5D (referenced in Section 1.3 *et seq.* of the SALMON AO) has been replaced by NPR 7120.5D NID (NASA Interim Directive for NPR 7120.5D, document number NM 7120-81); NASA plans to release NPR 7120.5E before the end of CY 2010. Proposers should refer to the current version of NPR 7120.5, which can always be found in the NASA Online Directives Information System (NODIS) at http://nodis.hq.nasa.gov/.
- The information requested in Appendix B, Section VIII, numbers 1-8 of the SALMON AO is not required as this is not a space mission.
- A commitment from the SOFIA Program to fly the proposed instrument is not required (Appendix B, Section IX of the SALMON AO).
- An Orbital Debris Generation Acknowledgement is not required (Appendix B, Section XII, number 7 of the SALMON AO) as this is not a space mission.

4.12 Use of SOFIA for Other Purposes

Amendment 10: This amendment clarifies the text in Section 4.12 without any change in meaning, policy, or requirements. Added language is indicated by bold text. Deleted language is indicated by strikethrough text.

This solicitation provides an opportunity for **NASA to inform** potential partners **that they are invited** to submit proposals that make use of SOFIA as a platform for other than astronomical observations. It may be possible that SOFIA provides an opportunity for conducting experiments, tests, or other activities that make use of SOFIA other than as an astronomical observatory. Such investigations may address science objectives relevant to science disciplines other than astrophysics (e.g., heliophysics, planetary science, Earth science, life and microgravity science, etc.).

This solicitation provides an opportunity for **NASA to inform** potential users of SOFIA **that they are invited** to discuss concepts with NASA.

Any such proposal is subject to the following constraints and conditions.

- The proposed activity may make use of SOFIA's facilities and operations other than the use of the Telescope Assembly. Some possible SOFIA facilities and operations include, but are not limited to, use of the upper flight deck on the Boeing 747-SP, carrying passive measuring devices in one of SOFIA's cargo or storage areas, etc.
- Any such proposal must be on a no-cost basis with the SOFIA Program. The SOFIA Program has no funding to provide in support of any such proposal. This includes development of the experiment, any needed modifications to SOFIA to accommodate the experiment, operation of the experiment, etc.
- Any such proposal must be on a no-interference basis with the SOFIA Program. The SOFIA Program will not delay or interrupt its science program to accommodate any experiment. Any modifications needed to accommodate the experiment, e.g. installing mounting racks, must be consistent with being accomplished in parallel with regular SOFIA operations. Any operational activities must take place on a noninterference basis with regular SOFIA operations. Experiments will not have access to the SOFIA data systems during flight.
- Any such proposed use must satisfy all SOFIA safety, airworthiness, electrical and magnetic noninterference, and other requirements.

Although this proposal opportunity is being described in this solicitation, any proposals of this kind ~~will not be handled as proposals~~ **should not be** submitted **through NSPIRES** in response to this solicitation (because they do not meet the requirements in Section 4 and elsewhere in this solicitation); rather they ~~will be handled~~ **should be submitted** as unsolicited proposals. The review, selection, and negotiation process will be handled as necessary based on the unique nature of any proposal received. NASA requirements for unsolicited proposals may be found at http://prod.nais.nasa.gov/pub/pub_library/unSol-Prop.html.

Any proposers considering submitting a proposal of this type are strongly encouraged to contact the POC for this solicitation **or the SOFIA Program Office** before submitting a proposal (see Section 7).

5 PROPOSAL PREPARATION AND SUBMISSION

5.1 Proposal Content Requirements

5.1.1 Proposal Content

Proposal content must conform to the guidelines set forth in Appendix B of the SALMON AO.

It is unnecessary to download the NSPIRES-generated Proposal Cover Page and incorporate it into the Proposal Document. NSPIRES will automatically route the two parts of the proposal (Cover Page form, proposal document) to the appropriate peer or NASA reviewers.

5.1.2 Limit on Format and Size of Electronic Proposals

Amendment 1: This amendment clarifies the text in Section 5.1.2 without any change in meaning, policy, or requirements. Added language is indicated by bold text.

Proposals must be submitted electronically as a single**, searchable** PDF file (see Section 5.2.1 of this program element appendix**). NSPIRES will reject any file that is not PDF, and that includes a compressed PDF file.**

There is a 15 Mbyte file size limit for each proposal; this limit applies to the single PDF file that is uploaded. **NSPIRES will reject any file that exceeds the 15Mbyte file size limit.**

All PDF files generated and submitted must meet NASA requirements on creating PDF documents that are compliant with NSPIRES (see http://nspires.nasaprs.com/tutorials/PDF_Guidelines.pdf). This will ensure that proposals can be read by community reviewers and NASA program officers using a wide variety of computers, operating systems, and PDF readers.

It is the responsibility of each applicant to verify the accuracy and completeness of his/her proposal, including all text, figures, tables, foldouts, and required forms. NSPIRES allows applicants to verify, prior to submission, that all information contained in proposal PDF file(s) being provided to NSPIRES is complete and accurate. Well in advance of the proposal due date, the applicant is encouraged to use the “Generate” the “Complete Proposal” (found on the “View Proposal” page within NSPIRES) and to review the file they have generated using NSPIRES to ensure that all text, figures, tables, foldouts, and required forms are complete and accurate. The applicant must immediately call the NSPIRES Help Desk prior to proposal submission for assistance with any proposal if that proposal does not appear to be complete and correct after being “generated” in NSPIRIES. This use of this tool is optional and, if done, should be started well before the submittal deadline to allow adequate time to process the proposal document and to allow time to resolve any problems that might be encountered. Please note that in order to avoid being classified as a “late proposal,” proposals must be submitted prior to the deadline, even if they did not appear to be correct and complete after being “generated” in NSPIRES.

5.1.3 Identification of Export Controlled Material

The key data associated with the electronic submission of proposals (see Section 5.2.1 of this program element appendix) includes questions indicating whether or not a proposal contains

export controlled information (see Section 4.8.4 of the SALMON AO). All proposers must answer these questions YES or NO when completing the electronic submission; these questions shall not be left unanswered.

All proposals shall identify any export controlled material in the proposal as instructed in Section 4.9.1 of the SALMON AO. To the extent possible, export controlled material, including material subject to the International Traffic in Arms Regulations (ITAR; 22 CFR 120- 130, *et seq*. see http://www.pmddtc.state.gov/), shall be organized into separate clearly marked sections.

5.2 Proposal Submission Requirements

5.2.1 Submittal Address: Electronic Submission

Proposals must be submitted electronically via NASA's master proposal data base system, the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at http://nspires.nasaprs.com/. This data site is secure and all information entered is strictly for NASA's use only. This instruction supersedes and cancels the instructions for hard copies and CDs in Section 6.3 of the SALMON AO.

In order to submit a proposal via NSPIRES, this AO requires that (i) the proposing organization be registered in NSPIRES, (ii) the proposer register key data concerning the intended submission by completing an electronic cover page within NSPIRES, (iii) all proposal team members who are named on the proposal's electronic cover page be registered in NSPIRES, (iv) all proposal team members commit to the proposal through NSPIRES, and (v) the proposal is submitted by an Authorized Organizational Representative (AOR) (not the PI) through NSPIRES. This final requirement serves as the proposing organizations "electronic signature" for the proposal.

Potential proposers are urged to access this site well in advance of the NOI and proposal due dates to familiarize themselves with its structure and enter the requested identifier information. The following sections of this program element appendix supplement Section 6.2.2 of the SALMON AO.

5.2.2 Registration of Proposing Organizations in NSPIRES

Every organization that intends to submit a proposal to NASA in response to this solicitation, including educational institutions, industry, not-for-profit institutions, the Jet Propulsion Laboratory, NASA Centers, other U.S. Government agencies, state and local Government agencies, non-U.S. organizations, and other organizations, must be registered in NSPIRES. Registration for NSPIRES must be performed by an organization's electronic business point-of-contact (EBPOC) in the Central Contractor Registry (CCR).

Organizations must obtain a Data Universal Numbering System (DUNS) number (http://fedgov.dnb.com/webform). Note that an organization must also be registered in the Central Contractor Registration (CCR) and obtain a CAGE Code before registration in NSPIRES (http://www.ccr.gov/). The CCR approval process can take several days (at minimum). CCR registration should be performed by an organization's electronic business primary point-of-contact.

Information on registration in NSPIRES is available at https://nspires.nasaprs.com/external/aboutRegistration.do and tutorials are available at http://nspires.nasaprs.com/tutorials/.

5.2.3 Registration of Proposal Team Members in NSPIRES

Every individual named on the proposal's electronic Cover Page form (see below) as a proposing team member in any role, including co-investigators and collaborators,

- must be individually registered in NSPIRES and that such individuals must perform this registration themselves; no one may register a second party, even the PI of a proposal in which that person is committed to participate;
- must be identified with the organization through which they are participating in the proposal, regardless of their place of permanent employment or preferred mailing address; and
- must indicate their commitment to the investigation via NSPIRES.

See Appendix B, Section IV, of the SALMON AO for instructions. Note that this requirement applies to more than just Co-investigators; it applies to all team members named on the proposal's electronic Cover Page form

5.2.4 Deadline

The proposal must be received no later than the time deadline on the proposal due date given in Section 7 of this program element appendix. This time supersedes and cancels the time given in Section 6.3 of the SALMON AO.

5.3 Questions

In order to make sure that all proposers receive the same information, all questions concerning the content provided in this appendix, or in the documents available through the SALMON AO Program Library, should be sent to the E-mail address for questions listed in Section 7 of this program element appendix. When appropriate, responses will be posted on the website also listed in Section 7 of this program element appendix.

The deadline for receipt of questions is two weeks before the proposal due date listed in Section 7 of this program element appendix.

6 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

6.1 Evaluation and Selection Process

The evaluation and selection process described in Section 7.1 of the SALMON AO will be followed.

The evaluation process described in Section 7.1.1 of the SALMON AO is further clarified as follows. Proposers should be aware that, during the evaluation and selection process, NASA may request clarification of specific points in a proposal; if so, such a request from NASA and the proposer's response must be in writing. In particular, before finalizing the evaluation of the feasibility of the mission implementation (Section 7.2.4 of the SALMON AO), NASA will

request clarification on specific, potential major weaknesses in the feasibility of mission implementation that have been identified in the proposal. NASA will request clarification in a uniform manner from all proposers. The ability of proposers to provide clarification to NASA is extremely limited, as NASA does not intend to enter into discussions with proposers. A typical limited response is to direct NASA's attention to pertinent parts of the proposal without providing further elaboration.

6.2 Scientific/Technical Evaluation Factors

Proposals will be evaluated according to the evaluation criteria set forth in Section 7.2 of the SALMON AO.

In addition to the evaluation factors given in Section 7.2 of the SALMON AO, the evaluation of scientific merit also includes the following factors:

- The extent to which the proposed science investigation addresses high priority science objectives, as defined in Section 2 of this program element appendix.
- The extent to which the proposed instrument generally enables high priority science objectives, as defined in Section 2 of this program element appendix, beyond the proposer's science investigation.
- The extent to which the proposed instrument takes advantage of the capabilities of the SOFIA observatory.
- For technology demonstration science instrument investigations, the merit of the science investigations enabled by the matured and demonstrated technology.

In addition to the evaluation factors given in Section 7.2 of the SALMON AO, the evaluation of scientific implementation merit also includes the following factors:

- The extent to which the proposed instrument is compatible with SOFIA interfaces and operations.
- The maturity of the design or the demonstration of a clear path to achieve the necessary maturity.
- The quality of the plans for calibration and data archiving, including development of a data pipeline.
- For technology demonstration science instrument investigations, the value of the matured and demonstrated technology to SOFIA and future NASA missions.

In addition to the evaluation factors given in Section 7.2 of the SALMON AO, the evaluation of technical, management, and cost feasibility also includes the following factors:

- The feasibility of the plans for achieving airworthiness and instrument acceptance.

6.3 Selection Process

After the review by the AO Steering Committee, the final evaluation results will be presented to the Associate Administrator for the Science Mission Directorate, who will make the selection(s).

As the Selection Official, the SMD Associate Administrator may consult with senior members of SMD and the Agency, including the Director of the Astrophysics Division, concerning the selections.

The Selection Official may take into account a variety of programmatic factors in deciding whether or not to select any proposals, including, but not limited to, available funding and maintaining a programmatic and scientific balance. Although SMD develops and evaluates its program strategy in close consultation with the scientific community, each program is an evolving activity that ultimately depends upon the most current Administration policies and budgets, as well as the strategic priorities identified by the 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 solicitation will be to maximize the scientific return and minimize the implementation risk while advancing NASA's astrophysics goals and objectives within the available budget for the SOFIA program. This includes an appropriate balance between the immediate scientific return from facility science instruments and the future scientific return which is enabled through technology demonstration science instruments.

6.4 Implementation Activities

Proposal selection and award will be implemented according to the guidelines set forth in Section 7.4 of the SALMON AO and Section 7 of this program element appendix with the following amendments.

This is a single step selection process; no Phase A (Step 2) concept study report or downselection is planned.

6.4.1 Award Administration and Funding of Investigations

Oversight management responsibilities have been assigned to the SOFIA Science Project Office (SSPO) at the NASA Ames Research Center. The responsibilities of the SSPO will include oversight of science instrument development; coordination of Government-furnished services, equipment and facilities (i.e., the SOFIA Observatory and contributions to the Science Instrument from NASA centers); and contract management for selected investigations.

It is anticipated that the SSPO will provide funding to each selected investigation. It is anticipated that Facility Science Instruments and Science Instrument Upgrades will be funded by contract; and Technology Demonstration Science Instruments will be funded by contract or cooperative agreement. The award of the contract or cooperative agreement is to be initiated as soon as possible after notification of selection. NASA Centers will receive funding via intraagency funding mechanisms. For each selected instrument, revised SOWs and updated cost and pricing data may be requested if the selection does not include the entire proposal as submitted or if additional information is required. If more than one contractual arrangement between NASA and the proposing team is required, a separate SOW and budget breakdown is required for each contractual arrangement.

SOWs will be required for selected investigations, regardless of whether a proposing organization is Governmental or non-Governmental. SOWs will include the following as a minimum: Scope of Work, Deliverables (including science data), and Government Responsibilities (as applicable). For contracts that exceed $700K, the contractor will be required to provide cost and pricing data to support the cost estimate and to certify the cost proposed for the contract in accordance with FAR 15.406-2.

For those investigations that are selected, it will be in the best interest of their PI-led mission management teams to provide updated SOWs and cost and pricing data in as timely a manner as possible. The process of awarding contracts cannot begin until final SOWs and cost and pricing data have been received, and funds cannot be provided to the implementing organizations until this process has been completed.

NASA Centers shall follow their standard operation procedure for selecting teaming partners to facilitate the rapid implementation of their proposal if selected, and this shall be documented in Appendix 8 of the proposal (see Appendix B, Section XII.8, of the SALMON AO).

6.4.2 International Agreements

Should a non-U.S. proposal, or a U.S. proposal with non-U.S. participation, be selected by NASA, NASA's Office of International and Interagency Relations, Science Division, will arrange with the non-U.S. sponsoring agency for the proposed participation to go ahead 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.

7 SUMMARY OF KEY INFORMATION

Funding available	See Section 4.6.2 of this program element appendix
Date for Preproposal Teleconference	August 4, 2011; see the SOFIA PEA additional information page at http://soma.larc.nasa.gov/SOFIA/ for logistical information
Due Date for NOI	August 15, 2011
Due Date for Proposals	11:59 p.m. Eastern Time on October 7, 2011
Web site for additional information for the SALMON PEA for SOFIA Second Generation Instruments	http://soma.larc.nasa.gov/SOFIA/
Program Library for SOFIA Second Generation Instruments AO	http://soma.larc.nasa.gov/SOFIA/sofialib.html
Submission Medium	Electronic copies only; see Section 5.2 of this program element appendix
Web site for submission of electronic proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at 202-479-9376 or nspires-help@nasaprs.com)

NASA point of contact	Dr. Paul Hertz SOFIA Program Scientist Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Tel: 202-358-0986 E-mail: paul.hertz@nasa.gov

8 SUPPLEMENTAL INFORMATION

8.1 Acronym List

AM&O	Agency Management and Operations
AO	Announcement of Opportunity
AOR	Authorized Organizational Representative
AR	Acceptance Review
ARC	Ames Research Center
CASP	Cross Agency Support Program
CCR	Central Contractor Registry
CDR	Critical Design Review
CM&O	Center Management and Operations
CSLE	Civil Servant Labor and Expenses
D80	Diameter at 80% encircled energy
DAOF	Dryden Aircraft Operations Facility
DCS	Data Cycle System
DFRC	Dryden Flight Research Center
DLR	Deutsches Zentrum für Luft und Raumfahrt
DUNS	Data Universal Numbering System
EASS	Evaluations, Assessments, Studies, Services, and Support
EBPOC	Electronic Business Point-of-Contact
E/PO	Education and Public Outreach
ERT	Earth Resources Technology Inc.
EXES	Echelon-Cross-Echelle Spectrograph
FFRDC	Federally Funded Research and Development Center
FFU	Fine Field Imager
FIFI-LS	Field Imaging Far-Infrared Line Spectrometer
FITS	Flexible Image Transport System
FLITECAM	First Light Infrared Test Experiment Camera
FMO	Focused Mission of Opportunity
FORCAST	Faint Object Infrared Camera for the SOFIA Telescope
FPI	Focal Plane Imager
FSI	Facility Science Instrument
FWHM	Full Width at Half Maximum
FY	Fiscal Year
GFE	Government Furnished Equipment
GFS	Government Furnished Services

GI	General Investigator
GPS	Global Positioning System
GREAT	German Receiver for Astronomy at Terahertz Frequencies
GTO	Guaranteed Time Observer/Observation
HAWC	High-resolution Airborne Wideband Camera
HIPO	High-speed Imaging Photometer for Occultation
IR	Infrared
IRIG	Inter-Range Instrumentation Group
ITAR	International Traffic in Arms Regulations
JPL	Jet Propulsion Laboratory
MCCS	Mission Controls and Communications System
MOU	Memorandum of Understanding
NID	NASA Interim Directive
NODIS	NASA Online Directives Information System
NOI	Notice of Intent to propose
NPR	NASA Procedural Requirements
NRC	National Research Council
NSPIRES	NASA Solicitation and Proposal Integrated Review and Evaluation System
OCI	Organizational Conflict of Interest
PDF	Portable Document Format
PDR	Preliminary Design Review
PEA	Program Element Appendix
PI	Principal Investigator
PSF	Point Spread Function
PSR	Pre-Ship Review
RY	Real Year
SALMON	Stand Alone Mission of Opportunity Notice
SCL	SOFIA Command Language
SI	Science Instrument
SMD	Science Mission Directorate
SMO	Science Mission Operations
SOFIA	Stratospheric Observatory for Infrared Astronomy
SOW	Statement of Work
SSPO	SOFIA Science Project Office
STEO	Science/Technology Enhancement Option
TAAS	Telescope Assembly Alignment Simulator
UARC	University Affiliated Research Center
USRA	Universities Space Research Association
WFI	Wide Field Imager

8.2 Documents Referenced in this Program Element Appendix

8.2.1 Documents Available through the SOFIA Program Library

The following documents are available (or will be available) through the Program Library for SOFIA Second Generation Instruments AO available at http://soma.larc.nasa.gov/SOFIA/sofialib.html.

Background Documents
- *The Science Vision for the Stratospheric Observatory for Infrared Astronomy*

Specifications:
- *Science Instrument System Specification*, SOF-AR-SPE-SE01-2028
- *Specification for the SOFIA Vacuum Pumping System*, APP-AR-SPE-SE01-028

Verification Plans:
- *Science Instrument Interface Verification Plan*, SCI-AR-PLA-PM12-2005

Handbooks:
- *Instrument Developer's Handbook*, SCI-AR-HBK-OP03-2000

SI-to-Airborne System ICDs
- *Science Instrument Envelope Interface Control Document*, SOF-DA-ICD-SE03-002A
- *MCCS to Science Instrument Software Interface (Functional) Interface Control Document*, SOF-DA-ICD-SE03-052
- *Principal Investigator Patch Panel to Principal Investigator Equipment Rack(s) Interface Control Document*, SOF-AR-ICD-SE03-2029
- *Principal Investigator Equipment to PI Rack to Aircraft System Interface Control Document*, SOF-DA-ICD-SE03-2015
- *SI Handling Cart to Aircraft System Interface Control Document*, SOF-AR-ICD-SE03-205
- *Cable Load Alleviator Device/Science Instrument Cable Interface Control Document*, SOF-DA-ICD-SE03-036
- *Telescope Assembly/Science Instrument Mounting Interface Control Document*, SOF-DA-ICD-SE03-037
- *TA Chopper Processor/Principal Investigator Computer Direct Analog Interface Control Document*, SOF-DA-ICD-SE03-038
- *SI Equipment Rack/TA Counterweight Interface Control Document*, SOF-DA-ICD-SE03-051

ICDs between SIs and Other Elements of the Science Project
- *Telescope Assembly Alignment Simulator/Science Instrument Interface Control Document*, SCI-AR-ICD-SE03-2020
- *Data Cycle System to Science Instrument Interface Control Document*, SCI-US-ICD-SE03-2023
- *Science Instrument Equipment to Counterweight Rack Interface Control Document*, SCI-US-ICD-SE03-2027
- *SI Handling Cart to SSMO Facility Interface Control Document*, SCI-US-ICD-SE03-2017

- *Vacuum Pump System to Science Instrument Interface Control Document*, SOF-DA-ICD-SE03-2022
- *Data Processing Plan for SOFIA Science Instruments*, SCI-US-PLA-PM17-2010
- *Synopsis of the SOFIA Concept of Operations*, SCI-US-PLA-PM17-2016

8.2.2 Other Documents Referenced in this Program Element Appendix

- 2010 Science Plan for NASA's Science Mission Directorate (*http://science.nasa.gov/about-us/science-strategy/*)
- New Worlds, New Horizons in Astronomy and Astrophysics (*http://www.nap.edu/catalog.php?record_id=12951*)
- The Science Vision for the Stratospheric Observatory for Infrared Astronomy (*http://www.sofia.usra.edu/Science/science_cases/*)
- Scientific Opportunities For new Instrumentation, Asilomar 2010 (*http://www.sofia.usra.edu/Science/workshops/asilomar.html*)
- Managerial Cost Accounting Concepts and Standards for the Federal Government as recommended by the Federal Accounting Standards Advisory Board (*http://www.fasab.gov/pdffiles/sffas-4.pdf*)

END OF PEA H8