National Aeronautics and Space Administration

NNH17ZDA004O **Release Date March 22, 2017**

Announcement of Opportunity

NASA's

Third Stand Alone Missions of Opportunity Notice (SALMON-3)

Notice of Intent to Propose Due Dates: **See program appendices**
Proposal Due Dates: **Through March 18, 2022;**
See program appendices

OMB Approval Number 2700-0085

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ANNOUNCEMENT OF OPPORTUNITY
THIRD STAND ALONE MISSIONS OF OPPORTUNITY NOTICE (SALMON-3)
NNH17ZDA004O
FOREWORD

This National Aeronautics and Space Administration (NASA) Announcement of Opportunity (AO), entitled *Third Stand Alone Missions of Opportunity Notice (SALMON-3)*, provides a solicitation and procurement base for opportunities for modest investigations requiring space flight that advance the high priority science, exploration, and technology objectives of NASA's Science Mission Directorate (SMD), Human Exploration and Operations Mission Directorate (HEOMD), and Space Technology Mission Directorate (STMD).

In 2008, NASA released the first omnibus SALMON AO, which incorporates regular Program Element Appendices (PEAs) for general Mission of Opportunity (MO) proposal opportunities, as well as focused proposal opportunities for specific flight opportunities. The SALMON AO may include U.S. and non-U.S.-led mission opportunities. In 2012, the updated Second SALMON AO was released to continue MO solicitations using this vehicle.

This SALMON-3 continues to accomplish the same purpose with updated policies that govern the solicitation, evaluation, selection, and implementation of modest space investigations; language and policies, to the maximum extent possible, that all mission directorates use in soliciting modest space investigations; requirements that all proposals shall meet in order to represent a compliant response to this AO; and requirements that apply to investigations that have been selected to proceed into formulation.

This SALMON-3 AO does not, in and of itself, solicit proposals. The actual solicitation is enabled by a PEA that is appended to the SALMON-3 AO. The AO provides the standard requirements for all SALMON-3 solicitations and specific requirements that may only apply to particular types of MOs. The PEA will call out the SALMON-3 specific requirements that apply and any additional program requirements for the specific solicitation and proposal opportunity. Program specific requirements spelled out in the PEA include the scope of the solicitation, the available funding, the proposal due date, and other program specific requirements as well as deviations or exceptions from SALMON-3 standard requirements.

Requirements governing proposal content will be found, for the most part, in Section 5 and Appendix B of this AO. The rest of the AO contains NASA policies and practices for implementing space flight projects that may aid the proposer in developing a response to this AO. These policies and practices include requirements that will apply to any proposed investigation that is selected by NASA for further definition and implementation.

PEAs will solicit proposals addressing specific topics of interest from one or more of the NASA participating 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 four MO categories: Partner Missions of Opportunity, New Missions using Existing Spacecraft, Small Complete Missions, and Focused Opportunities.

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

Proposers should be aware that there are major changes in this SALMON-3 AO from the SALMON-2 AO (NNH12ZDA006O) that was released on February 7, 2012. This AO incorporates policy, guidelines, requirements, and constraints updates in addition to clarifications and other changes relative to the SALMON-2 AO. All proposers must read this AO carefully, and all proposals must comply with the requirements, constraints, and guidelines contained within this AO.

This SALMON-3 AO replaces the 2012 release of SALMON-2 (NNH12ZDA006O). As of the release of this SALMON-3 AO, the SALMON-2 AO is closed and no further amendments or Program Element Appendices (PEAs) will be released for the SALMON-2 AO.

Questions or requests for further information about specific proposal opportunities may be addressed to the Point-of-Contact identified in the applicable PEA. General questions regarding this SALMON-3 AO may be addressed to Dr. Jeffrey Newmark, Deputy Associate Administrator for Research (DAAR), Science Mission Directorate, NASA, Washington, DC 20546; Telephone: 202-358- 0684; Email: jeffrey.newmark@nasa.gov.

ANNOUNCEMENT OF OPPORTUNITY
THIRD STAND ALONE MISSIONS OF OPPORTUNITY NOTICE (SALMON-3)
NNH17ZDA004O

TABLE OF CONTENTS

APPENDICES

ANNOUNCEMENT OF OPPORTUNITY
THIRD STAND ALONE MISSIONS OF OPPORTUNITY NOTICE (SALMON-3)
NNH17ZDA004O

1. DESCRIPTION OF OPPORTUNITY

1.1 Introduction

The National Aeronautics and Space Administration (NASA) announces the opportunity to conduct space flight investigations in science, exploration, and technology of modest cost and scope as Missions of Opportunity (MO). Proposed investigations must address one or more of the goals established in the *2014 NASA Strategic Plan* to achieve the national vision to drive advances in science, exploration, and technology to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth. The *2014 NASA Strategic Plan* may be found as NASA Policy Directive (NPD) 1001.0B in the NASA Online Directives Information Service (NODIS) at http://nodis3.gsfc.nasa.gov/.

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

- The Science Mission Directorate (SMD) conducts scientific exploration that is enabled by access to space. SMD projects humankind's vantage point into space with observatories in Earth orbit and deep space, spacecraft visiting the Moon and other planetary bodies, and robotic landers, rovers, and sample return missions. From space, in space, and about space, NASA's science vision encompasses questions as practical as hurricane formation, as enticing as the prospect of lunar resources, and as profound as the origin of the Universe. At every point, we also seek innovative and new ways to do measurements, to gain new knowledge and scientific insights, and for the US to enhance its capability and leadership in Space Science and Applications. See http://science.nasa.gov/ for additional information.

- The Human Exploration and Operations (HEO) Mission Directorate (HEOMD) is charged with expanding human presence into the solar system. HEOMD operates and conducts scientific research aboard the International Space Station, including hosting scientific and technology payloads from SMD and STMD, and acquiring commercial and international transportation services for cargo and crew. HEOMD is preparing to extend its reach to cislunar space via the Space Launch System and Orion crew vehicle. These will include capacity for secondary payloads and cubesats for science and technology research. HEOMD plans to use cislunar space as a practice arena and staging area for crewed missions beyond the Earth-moon system including future missions to Mars. HEOMD and STMD participate as exploration instrument providers on selected SMD missions to the Red Planet. Finally, HEOMD manages NASA's Launch Services and Space Communications and Navigation programs which provide these services to NASA science, technology, and exploration missions. See nasa.gov/directorates/heo for more information.

- The Space Technology Mission Directorate (STMD) is responsible for developing the crosscutting, pioneering, new technologies and capabilities needed by the Agency to achieve its current and future missions. STMD rapidly develops, demonstrates, and infuses revolutionary, high-payoff technologies through transparent, collaborative partnerships,

expanding the boundaries of the aerospace enterprise. STMD employs a merit-based competition model with a portfolio approach, spanning a range of discipline areas and technology readiness levels. By investing an array of transformational, game-changing, and disruptive technologies, STMD seeks to mature the technology required for NASA's future missions in science and exploration while proving the capabilities and lowering the cost for other Government agencies and commercial space activities. See http://www.nasa.gov/directorates/spacetech/home for additional information.

NASA recognizes and supports the benefits of having diverse and inclusive scientific, engineering, and technology communities and fully expects that such values will be reflected in the composition of all proposal teams as well as peer review panels (science, engineering, and technology), science definition teams, and mission and instrument teams.

NASA requires the flexibility to respond to and participate in space flight missions of opportunity that advance high priority science, demonstrate innovative new measurements, meet exploration, and technology 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 a Program Element Appendix (PEA) as an amendment to this standing Announcement of Opportunity (AO) to announcement of selections – is anticipated to take no more than nine months. This short duration solicitation process allows NASA to tailor program requirements to meet national priorities for science, exploration, and technology, and it provides a standard mechanism for rapidly responding to space flight opportunities on non-U.S. as well as U.S. Government and non-Government spacecraft.

1.2 NASA Safety Priorities

Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA's safety priority is to protect: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including NASA employees working under NASA instruments), and (4) high-value equipment and property.

1.3 Online References

All NASA Policy Directives (NPD) and NASA Procedural Requirements (NPR) documents referenced in this AO may be found in the NASA Online Directives Information Service (NODIS) at http://nodis3.gsfc.nasa.gov/.

NASA technical standards documents may be found in the NASA Technical Standards System (NTSS) at https://standards.nasa.gov. NASA technical reports may be found on the NASA Technical Reports Server (NTRS) at http://ntrs.nasa.gov/search.jsp.

The Federal Acquisition Regulations (FAR) are available at https://www.acquisition.gov/?q=browsefar. The Code of Federal Regulations (CFR) and the

United States Code (USC) are available at http://www.gpo.gov/fdsys/. Executive Orders may be accessed at http://www.archives.gov/federal-register/executive-orders/.

The NASA FAR Supplement (NFS) may be accessed at http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm. NASA Procurement Information Circulars (PIC) may be accessed at http://www.hq.nasa.gov/office/procurement/regs/pic.htm.

2. AO OBJECTIVES

2.1 NASA's Strategic Goals

The NASA Vision is "We reach for new heights and reveal the unknown for the benefit of humankind."

The NASA Mission is to "Drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth"

To advance the Vision and Mission, the *2014 NASA Strategic Plan* lays out strategic goals. This AO solicits investigations that advance NASA's strategic goals in science, exploration, and technology.

- Expand the frontiers of knowledge, capability, and opportunity in space.
- Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.
- Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.

2.2 Objectives in Science, Exploration, and Technology

NASA pursues its strategic goals using a wide variety of space flight programs that enable remote sensing, *in situ* investigations, exploration, and technology demonstrations. 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 suborbital flights and ground-based research activities that directly support these space missions.

This AO solicits investigations in science, exploration, and technology.

Science investigations are directed at expanding scientific understanding through basic and applied research in those areas of science that study the space environment, that benefit from performing the research in the space environment, and that take advantage of the view from space. Although a specific PEA might solicit science investigations in any science discipline that contributes to NASA's goals and objectives, most NASA-sponsored science is in the disciplines of astrobiology, astrophysics, Earth science, heliophysics, microgravity science, planetary science and space biology. Our investigations not only perform important science, but can also open up innovative and new opportunities for future missions and investigations.

Exploration investigations are directed at developing the knowledge and capabilities required to extend and sustain human activities across the solar system. Although a specific PEA might solicit exploration investigations in any area that contributes to NASA's goals and objectives, exploration investigations are often directed at lowering the risk for future extended-duration human space missions through research in radiation exposure, behavioral health, and fitness in space and at acquiring strategic knowledge necessary to enable future human space activities through the conduct of critical observations and measurements, the test of operations concepts, the demonstration of technologies, and the identification of specific target destinations.

Technology investigations are directed at developing and demonstrating the innovative new technologies required for our exploration, science, and economic future. Although a specific PEA might solicit technology investigations in any area that contributes to NASA's goals and objectives, technology investigations are often directed at identifying advanced concepts and emerging technologies, at maturing advanced space technologies that may lead to new approaches for the Agency's future space missions and solutions to significant national needs, and at maturing space technology to the point of infusion into the critical path for future missions through relevant environment testing and technology demonstration space flights when necessary.

This solicitation invites the NASA community to participate in conducting science, exploration, and technology investigations with NASA. The NASA community includes the science, exploration, engineering, technology, and other communities within 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, as well as non-U.S. partner organizations.

2.3 Categories of Missions of Opportunity

This Third Stand Alone Mission of Opportunity Notice (SALMON-3) AO invites proposals for Missions of Opportunity. A Mission of Opportunity (MO) is a focused space flight investigation that offers high scientific, exploration, or technical value for a modest cost to NASA.

SALMON-3 MO investigations fall into four categories – Partner Missions of Opportunity (PMOs) (Section 5.1.1), New Missions using Existing Spacecraft (NMESs) (Section 5.1.2), Small Complete Missions (SCMs) (Section 5.1.3), and Focused Missions of Opportunity (FMOs) (Section 5.1.4).

- PMOs are investigations that provide a critical component of a non-NASA or non-U.S. mission. By supporting U.S. participation in PMO investigations, NASA seeks to allow the NASA community the opportunity to conduct an investigation of interest to NASA by providing a critical part of a non-NASA or non-U.S. space mission – such as a complete instrument, or hardware or software components.
- NMESs are investigations that propose a new use of existing NASA spacecraft. The NMES opportunity solicits proposals making use of a NASA spacecraft or other working space asset to conduct an investigation that is not a continuation of the spacecraft's original mission.

- SCMs are scientifically valuable investigations that can be realized within the PEA-specific Cost Cap, including the cost of their access to space if not provided by NASA. The SCM opportunity permits targeted, compelling investigations to be proposed at a much lower cost than Small Explorer (SMEX) or Earth Venture Missions (EVM).
- FMOs are investigations that address a specific, NASA-identified flight opportunity.

2.4 Objectives of Specific Program Element Appendices

MO investigations will be solicited as needed by amending the SALMON-3 AO through "Program Element Appendices" (PEAs). A PEA may provide a general proposal opportunity within a division of a NASA Mission Directorate or a focused solicitation directed at a specific opportunity identified by NASA for conducting 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. PEAs will be released to meet general or specific mission opportunities and will specify the specific goals and objectives of the sponsoring Mission Directorate for that proposal opportunity.

The AO provides the standard requirements for all SALMON-3 solicitations and specific requirements that may only apply to particular types of MOs. A PEA will call out the applicable SALMON-3 specific requirements and any additional program requirements for the specific solicitation and proposal opportunity. Program specific requirements spelled out in a PEA include the scope of the solicitation, the available funding, the proposal due date, and other program specific requirements. A PEA may contain deviations or exceptions from SALMON-3 standard requirements; any such deviations or exceptions will take precedence over their corresponding requirements in the main body or other appendixes of the SALMON-3 AO.

2.5 Single Step Selections

Unless stated otherwise in the applicable PEA, proposed investigations will be evaluated and selected through a single step competitive process. This single step is the solicitation, submission, evaluation, and selection of proposals prepared in response to this AO and the applicable PEA.

3. PROPOSAL OPPORTUNITY PERIOD

Each PEA is a separate and independent solicitation; each PEA will have its own solicitation identifier in the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) and its own funding for selected investigations. Each PEA will specify a due date for proposals, as well as requirement and constraints for that specific solicitation, including the sponsoring NASA Headquarters (HQ) mission directorate and division, the type of MO, the Cost Cap, and any launch-by or commitment-by dates. Specific schedules and due dates will be included in each PEA. NASA anticipates that selections will be announced within nine months of the release of a PEA.

Requirement 1. Proposals submitted in response to a PEA shall be submitted electronically no later than the Electronic Proposal Submittal Deadline stated in the applicable PEA.

Requirement 2. In addition to electronic submission, CD-ROMs containing the proposal and relevant files described in Section 6.2.3 of this AO shall be submitted. Proposals on CD-ROMs submitted in response to this solicitation shall be delivered no later than the Deadline for Receipt of Proposal on CD-ROMs stated in the applicable PEA. Proposals shall be delivered to the Addresses for Submittal of Proposals given in Section 6.2.3.

4. POLICIES APPLICABLE TO THIS AO

4.1 NASA Management Policies

The following policies will impose requirements on selected investigations, for which planning may need to be considered and described as part of the proposal process. These requirements are not levied on proposals.

4.1.1 NASA Space Flight Project Management

Proposals selected in response to this AO will be implemented in accordance with NASA space flight project management processes. NASA space flight project management processes, as defined by NASA Procedural Requirements (NPR) 7120.5E, *NASA Space Flight Program and Project Management Requirements*, are Formulation, Approval, Implementation, and Evaluation. The NASA space flight project management processes are subdivided as follows:

Formulation is divided into:

- Phase A – Mission Concept and Requirements Definition 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 checkout);
- Phase E – Operations and Sustainment; and
- Phase F – Closeout.

Phase E includes analysis and publication of data in the peer reviewed scientific and/or technical literature and delivery of the data to an appropriate NASA data archive (see Section 4.4.3).

Evaluation is the ongoing independent review and assessment of the project's status during both Formulation and Implementation as described in NPR 7120.5E.

A Key Decision Point (KDP) occurs before the project is approved to begin the next phase of development; KDPs are defined in NPR 7120.5E. For missions selected as a result of this AO, KDP-A is the selection of a proposal for formulation, KDP-B is the entry to Phase B following

the System Requirements Review, 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, and KDP-F is the decision to terminate operations after completion of the mission. Scientific and other analyses, including data analysis and preliminary analysis of returned samples, may continue under project funding in Phase F.

4.1.2 NASA Program Management

Owing to the significant expenditure of Government funds on these spaceflight investigations, as well as to their expected complexity, NASA intends to maintain an essential degree of insight into the project. NASA will exercise essential oversight to ensure that the implementation is responsive to NASA requirements and constraints. NASA requirements and constraints are defined in NPR 7120.5E and other NASA requirements documents that are available in NODIS, http://nodis3.gsfc.nasa.gov/. Investigation teams must abide by all applicable NASA and other Federal, state, and local laws and regulations.

Each PEA will designate a Program Office and associated NASA Center (including JPL) that has been assigned responsibility for project oversight. In this role, which is separate from the Center's role as a potential partner in the investigation, the designated Program Office is responsible for NASA's fiduciary responsibility to ensure that selected SALMON-3 investigations are achieved in compliance with the cost, schedule, performance, reliability, and safety requirements to which the Principal Investigator (PI) has committed.

The designated Program Office will be responsible for monitoring the project's progress, and will maintain sufficient insight into the development activities to ensure that cost, schedule, and technical performance of the investigation remain 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.

NPR 7120.5E 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, the NASA Center's project management responsibilities under NPR 7120.5E will be assigned to the implementing project management organization. That organization must be prepared to carry out these responsibilities. In such cases, the Program Office at the designated Center or JPL will retain the Technical Authority (TA) described in NPR 7120.5E, which would otherwise be invested in the designated Center or JPL.

The safety, reliability, and quality assurance requirements document identified in the applicable PEA, will apply to investigations that are selected. Selected investigations that reside at institutions that have NASA-approved safety and mission assurance (SMA) programs may utilize their own institutional practices in lieu of the guidelines and requirements in this document. Although these documents may impose requirements on selected investigations, they do not impose requirements, either implicitly or explicitly, on proposals developed in response to this AO.

In addition to its role as the site of the Program Office, the designated NASA Center is eligible to participate in proposals that are submitted in response to the applicable PEA. The Program Office will have access to the PEA before it is released. This is necessary so that the Program Office can review the PEA and ensure that it correctly describes the post-selection project management processes. The Program Office may contribute to defining the scientific, exploration, and technological scope of the PEA; however, the Program Office does not play a role in evaluating proposals or selecting proposals. The Mission Directorate at NASA Headquarters will manage the solicitation, evaluation, and selection process including sole responsibility for the selection process. In order to manage the designated NASA Center's two roles, the Mission Directorate has established functional and organizational firewalls between the Program Office and those parts of the Center that might participate in proposals. These firewalls ensure that personnel identified as supporting the Program Office and the AO process will protect all nonpublic information from all proposers, including those at the Center, and will be free of financial and other conflicts of interest with proposers.

4.1.3 Roles and Responsibilities in Communications

NASA is required to communicate the discoveries and results of its investigations to the American public. These efforts are intended to promote interest and foster participation in NASA's endeavors and to develop exposure to – and appreciations for - Science, Technology, Engineering, and Mathematics (STEM). Therefore, the PIs of selected investigations are required to work in conjunction with a NASA Center or JPL and with NASA Headquarters to communicate mission updates, science, and new discoveries.

4.1.3.1 NASA Centers or Jet Propulsion Laboratory (JPL)

Each flight mission manages the communications plan and activities utilizing the communications office of a NASA Center or JPL. Missions managed by a NASA Center or JPL will request support of that Center's communications office. For missions not managed by a NASA Center or JPL, the Center where the Program Office resides will fulfill the communications management role.

The communications offices will be responsible for coordinating and executing mission communications activities - along with the mission's Principal Investigator (PI) and Project Office for PI-led missions and Program Office for strategic missions - with the approval of the Headquarters Mission Directorate and the Office of Communications.

4.1.3.2 Principal Investigators

For PI-led missions, the PI fills a challenging, multidisciplinary role, which demands excellent communication, team building, and management skills. The PI is responsible for all aspects of the successful implementation of the mission. The PI is a key spokesperson for the mission - along with NASA officials - and is integral in communicating mission updates, science, and new discoveries.

The PI provides content, analysis, and context for communication campaigns and news stories. In keeping with NASA's communications goals, content should convey an understanding of the

mission and its objectives, and the benefits to target audiences, the public, and other stakeholders.

As part of NASA's review and approval process, the PI, or his or her designee, 1) coordinates, 2) reviews, and 3) approves, with the designated NASA Center communications office, all mission-related communications activities. In case of incompatible views, NASA will have the final decision on release of public products, while ensuring that scientific and technical information remains accurate and unfiltered.

Selected PIs also must work with NASA to ensure their mission website follows NASA requirements for providing content on 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.

4.1.3.3 NASA Headquarters

NASA HQ and the program office personnel provide the necessary oversight and funding for communications in accordance with NASA and Mission Directorate policies for both PI-led and strategic missions.

4.1.4 Remediation, Termination, or Cancellation

Any alteration of an investigation that renders it unable to accomplish one or more of its baseline science, exploration, or technology objectives will be regarded as a descope of the investigation. NASA will review any such descoped set of achievable objectives to ensure that the investigation remains at or above the Threshold Investigation (see Section 5.2.4). A descope made necessary by the PI's inability to remain within budget or schedule, or failure at any time during formulation and implementation to maintain a level of science, exploration, or technology return at or above the Threshold Investigation, can result in investigation cancellation accompanied by appropriate contract action, which may involve termination.

Each investigation is based on the proposal submitted in response to this AO and the applicable PEA. The proposal must include a commitment by the PI for the PI-Managed Mission Cost, schedule, and scientific, exploration, or technology performance of the investigation. If, at any time, the cost, schedule, or performance commitments made in the proposal appear to be in peril, the investigation will be subject to termination or cancellation.

During formulation, each selected PI will work with NASA to develop top-level science, exploration, technology, and technical performance requirements. Each PI will also work with NASA to establish a set of performance metrics for project evaluation with NASA. These will include cost, schedule, and others, as appropriate.

Once an investigation has been confirmed for implementation, failure of the PI to maintain reasonable progress within committed schedule and cost, and/or failure to operate within the cost and other constraints, may provide cause for NASA to convene a termination review. The applicable Associate Administrator may also call for a termination review at any time that an

excursion above the agreed upon investigation cost in Phases C through E occurs, or is projected to occur, by the investigation PI, the implementing organization, or NASA. The objective of such a review is to determine whether remedial actions, including changes in management structure and/or key management team members (including the PI), would better enable the investigation to operate within established cost, schedule, and/or technical constraints. If a termination review determines that no remedy is likely to improve matters, NASA may consider investigation cancellation and/or contract termination. NASA may cancel a mission and/or terminate a contract notwithstanding any international or domestic partnerships established to enable the mission.

Every aspect of a selected investigation must reflect a commitment to overall investigation success while controlling total costs. Consequently, investigations should be designed and planned to emphasize investigation 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 PEA will be considered as candidates for selection.

4.2 Participation Policies

4.2.1 Eligibility to Participate in this AO

Prospective investigators from any category of organizations or institutions, U.S. or non-U.S. with some restrictions (see Section 4.2.2), 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.

There is no restriction on the number of proposals that an organization may submit to this solicitation or on the teaming arrangements for any one proposal, including teaming with NASA Centers and JPL. However, each proposal must be a separate, stand-alone, complete document for evaluation purposes.

NASA contracts for the services of outside, non-governmental organizations for support in evaluating proposals (see Section 7.1). Organizational conflicts of interest 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. NASA has two general classes of limitation for organizations.

Full Limitation: The NASA contract with the outside organization for evaluation support under this AO creates an unmitigable organizational conflict of interest for the evaluating organization in the event that any business unit of the organization has a proposed role as prime contractor, subcontractor, or participating organization. Because of this organizational conflict of interest, the evaluating organization is precluded from participating in any capacity in support of a respondent under this AO.

Partial Limitation: The NASA contract with the outside organization for evaluation support under this AO creates an organizational conflict of interest for the evaluating organization in the event that any business unit of the organization has a proposed role as prime contractor, subcontractor, or participating organization. Because of this organizational conflict of interest, the evaluating organization 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. Under appropriate circumstances, respondents to this AO may contract with the evaluating organization 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) The evaluating organization 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 evaluating organization is precluded from providing or developing hardware, including any elements or components, that will be proposed for any work awarded under this AO. The evaluating organization should not be referenced in the proposal, nor should the evaluating organization's analysis be identified in the proposal.

(ii) The evaluating organization has established firewalls within the organization to prevent conflicts of interest between organizational units and employees supporting NASA's evaluation of proposals and organizational units and employees supporting proposal efforts. Any 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 the evaluating organization and is described in a NASA approved Organizational Conflict of Interest Avoidance Plan.

(iii) The proposer fully describes in a memorandum submitted to NASA at the same time as the proposal all of the supporting analysis services provided by the evaluating organization to the proposing team. The memorandum is not to be bound to the proposal itself, but must be a separate document provided by mail or e-mail to the NASA Point of Contact (POC) identified in the applicable PEA. This memorandum must describe all of the work provided by the evaluating organization, must identify any work products of the evaluating organization that are included in the proposal or its appendices, and must list all employees of the evaluating organization who participated in the work.

For SALMON-3 AO opportunities, two outside evaluating organizations may be used. In this case, their participation in proposed investigations is thus limited, as follows:

- Cornell Technical Services (CTS) is subject to either the "Full Limitation" described above or to no limitation. The NASA Evaluations, Assessments, Studies, Services, and Support (EASSS) contract with CTS creates an unmitigable organizational conflict of interest for CTS in the event that any business unit of CTS has a proposed role as prime contractor, subcontractor, or participating organization. Because of this organizational conflict of interest, when CTS is used for support in evaluating proposals, CTS is precluded from participating in any capacity in support of a respondent under this AO. The decision on whether to contract with CTS for support in evaluating proposals will be made at the time of the release of each PEA, and the PEA will include either a full limitation or no limitation for CTS participation in proposal activities.

- The Aerospace Corporation is subject to either the "Partial Limitation" described above or to no limitation. The Aerospace Corporation, as the Federally Funded Research and Development Center (FFRDC) for space systems acquisition, is available to the U.S. Government and other organizations under the terms of its sponsoring agreement with the U.S. Air Force. The Aerospace Corporation has no limitation and is permitted to participate fully in all proposal activities unless a specific PEA states that Aerospace is under a partial limitation for that PEA. If Aerospace is subject to a partial limitation for a specific PEA, respondents to this AO may contract with The Aerospace Corporation for supporting analysis services, including cost analysis, engineering analysis, and resource analysis, only under the conditions described in paragraphs (i), (ii), and (iii) above.

Any other organizations that are used for evaluation services will be identified in the applicable PEA and the applicable PEA will include either a full limitation, a partial limitation, or no limitation, as appropriate.

4.2.2 Restrictions Involving China

Proposals must not include bilateral participation, collaboration, or coordination with China or any Chinese-owned company or entity, whether funded or performed under a no-exchange-of-funds arrangement.

In accordance with existing laws and regulations , NASA is restricted from funding any NASA contract, grant, or cooperative agreement action that involves bilateral participation, collaboration, or coordination with China or any Chinese-owned company or entity, whether funded or performed under a no-exchange-of-funds arrangement.

Requirement 3. Proposals shall not include bilateral participation, collaboration, or coordination with China or any Chinese-owned company or entity, whether funded or performed under a no-exchange-of-funds arrangement.

4.2.3 Constraints on Investigations that are Candidates for Selection

Only those investigations that propose to meet cost, schedule, and technical requirements that do not exceed the constraints and guidelines identified in this AO and the applicable PEA, and that demonstrate sufficient margins, reserves, and resiliency to ensure mission success within committed cost and schedule will be considered as candidates for selection for flight.

4.2.4 Responsibility of Principal Investigator for Implementation

The primary responsibility for implementing and executing selected investigations rests with the PI, who will have significant latitude to accomplish the proposed objectives within committed schedule and financial constraints. However, this responsibility will be exercised with essential NASA oversight to ensure that the implementation is responsive to the requirements and constraints defined in this AO and the applicable PEA (see Section 4.1.2).

4.2.5 NASA Concurrence for Replacement of Key Management Team Members

Any replacement of Key Management Team members (including but not limited to the Principal Investigator, Project Manager, Project Scientist, and Project Systems Engineer) requires concurrence by NASA.

4.2.6 Small Business Participation

It is the policy of the Government when contracts are issued to emphasize subcontracting opportunities for small businesses. Offerors are advised that NASA is subject to statutory goals to allocate a fair portion of its contract dollars to small businesses, small disadvantaged business (SDB) concerns, Historically Black Colleges and Universities (HBCUs), and Other Minority Institutions (OMIs), as these entities are defined in Federal Acquisition Regulations (FAR) 52.219-8 and 52.226-2. 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.

Offerors are advised that, by law, for NASA prime contracts resulting from this solicitation that offer subcontracting possibilities, exceed the dollar amount stated in the FAR subpart 19.7, and are with organizations other than small business concerns, the clause at FAR 52.219-9 will apply. Offerors other than small businesses submitting a proposal are advised that a small business subcontracting plan is required with goals for subcontracting with small business (SB), small disadvantaged business (SDB), veteran-owned small business (VOSB), service-disabled veteran-owned small business (SDVOSB), Historically Underutilized Business Zone (HUBZone) small business (HBZ), women-owned small business (WOSB), HBCU, and OMI entities to the maximum practicable extent. Failure to submit a subcontracting plan will make the offeror ineligible for selection. The 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.

Proposals are <u>not</u> required to include small business subcontracting plans; however, selected investigations will be required to provide them prior to negotiation and award (Section 7.4.3). Failure to submit a subcontracting plan after selection will make the offeror ineligible for award of a contract. The 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.

4.3 Cost Policies

4.3.1 PI-Managed Mission Cost

PI-Managed Mission Cost is defined as the cost proposed by the PI's investigation team to be funded by the sponsoring Mission Directorate and Program for the development and execution of the proposed investigation during Phases A through F. It includes any reserves applied to the development and operation of the investigation. It also includes any costs that are required to be accounted against the PI-Managed Mission Cost, even though the PI is not responsible for those costs (e.g., NASA-provided telecommunications and network services described in Section 5.3.11). The term does not imply that a contractual relationship between the PI's institution and other proposal team members is required. The PI-Managed Mission Cost may be capped in the applicable PEA.

Examples of costs to be included in the PI-Managed Mission Cost as applicable, unless contributed, are: development activities (e.g., instrument development, spacecraft development, management, software, testing); access to space; education program and/or communications and

outreach program (Section 5.6.1) if required in the applicable PEA; Student Collaborations in excess of any Student Collaboration incentive (if permitted by the applicable PEA; see Section 5.6.2); subcontracting costs, including fees; Co-Investigators (Co-Is) and all other personnel required to conduct the investigation, analyze data, publish results, and deliver data in an acceptable format to an approved archive; insurance; NASA-provided telecommunications, tracking, and/or navigation support; any program/project-specific costs (e.g., curation of returned samples); and all labor, including contractor and Civil Servant (NASA and non-NASA).

4.3.2 Total Mission Cost

Total Mission Cost is defined as the PI-Managed Mission Cost plus any Student Collaboration costs up to the Student Collaboration incentive (if permitted by the applicable PEA; see Section 5.6.2), plus any additional costs that are contributed or provided in any way other than through the sponsoring Mission Directorate and Program as identified in the applicable PEA (see Section 5.7.6). The Total Mission Cost will define the total value of the baseline investigation.

4.3.3 Enhanced PI-Managed Mission Cost

Enhanced PI-Managed Mission Cost is defined as the PI-Managed Mission Cost plus any optional components such as Student Collaborations or Science-Exploration-Technology Enhancement Options (if permitted by the applicable PEA; see Section 5.2.5).

4.3.4 Mission Funding Profile

The planning budget described in the applicable PEA may accommodate one or more selections with a typical funding profile over a nominal development period. Proposers should propose a funding profile that is appropriate for their investigation and is consistent with the selection and launch readiness dates identified in the applicable PEA. Proposers must not assume that NASA can or will accommodate proposals whose requested funding profile differs significantly from the planning budget described in the applicable PEA. While NASA will consider whether a different funding profile can be accommodated, NASA cannot guarantee that the proposed funding profile will be acceptable. The inability of NASA to accommodate the requested funding profile may be a reason for nonselection of a proposal. A final funding profile for the selected investigation will be negotiated.

4.3.5 Availability of Appropriated Funds

Prospective proposers to this AO and any applicable PEA are advised that funds may not be available for awards at the time of its release. The Government's obligation to make awards is contingent upon the availability of sufficient appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this AO and the applicable PEA.

4.4 Data Policies and Intellectual Property

4.4.1 Increasing Access to the Results of Federally Funded Research

As a Federal agency, NASA requires prompt public disclosure of the results of its sponsored research to generate knowledge that benefits the Nation. Thus, it is NASA's intent that all knowledge developed under awards resulting from this solicitation be shared broadly. In keeping with the "*NASA Plan for Increasing Access to the Results of Scientific Research"*

(http://www.nasa.gov/sites/default/files/files/NASA_Data_Plan.pdf), new terms and conditions about making manuscripts and data publically accessible may be attached to awards that derive from this AO. Proposals are required to include a data management plan (DMP) in accordance with terms and conditions stated in the "*NASA Plan for Increasing Access to the Results of Scientific Research"* or to justify that this is not necessary given the nature of the work proposed (see Requirement 17). The kind of data that requires a DMP is described in the "*NASA Plan for Increasing Access to the Results of Scientific Research*."

SMD anticipates that awards deriving from this AO will include terms and conditions requiring that as accepted manuscript versions of peer-reviewed publications (hereinafter "manuscripts") resulting from AO awards be uploaded into NASA's part of the PubMed Central (PMC) repository called NASA PubSpace. This applies only to peer reviewed publications. Patents, publications that contain material governed by personal privacy, export control, proprietary restrictions, or national security law or regulations will not be covered by this requirement. The manuscript will appear in PMC for free public access following a maximum 12 month embargo period after the publication date. PMC will release the manuscript when the embargo has ended. For more details on public access to scientific publications and digital scientific data resulting from NASA-funded research, please see: https://www.nasa.gov/open/researchaccess.

The applicable PEA may include program specific information and requirements concerning data archiving and management.

4.4.2 Data Analysis

The PI will be responsible for analysis of the investigation data (including returned samples) necessary to complete the proposed objectives and for timely publication of initial results in refereed journals or professional publications, as part of their mission operations (Phase E) or post-mission (Phase F) activities. Data analysis may be continued if applicable during Phase F.

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 includes provisions for sharing of flight data necessary for the completion of the selected investigation.

4.4.3 Delivery of Data to Archive

The investigation team will make the mission data fully available to the public through a NASA-approved archive (e.g., the Planetary Data System, the Atmospheric Science Data Center, the High Energy Astrophysics Science Archive Research Center, etc.), in usable form, in the minimum time necessary, but barring exceptional circumstances, within six months following collection. The PI will be responsible for collecting the scientific, engineering, and ancillary information necessary to validate and calibrate the data prior to delivery to the archive.

Archival data products will include low-level (raw) data, high-level (processed) data, and derived data products such as maps, ancillary data, calibration data (ground and in-flight), documentation, and related software and/or other tools necessary to interpret the data. The PI will be responsible for generating data products that are documented, validated, and calibrated in physical units that can be used by the scientific community at large.

NASA data archives have budgets to support core activities, including the basic ingestion and review of new data. Proposed mission data archiving plans and budgets must be consistent with the policies and practices of the appropriate NASA data archive.

4.4.4 Intellectual Property

4.4.4.1 Invention Rights

Recipients that are Small Businesses or nonprofit organizations may elect to retain title to any inventions made under a funding agreement pursuant to the Bayh-Dole Act (35 U.S.C. § 202). Large business recipients are subject to section 20135 of the National Aeronautics and Space Act (51 U.S.C. § 20135) relating to property rights in inventions. Title to inventions made under an agreement by a large business recipient initially vests with NASA. However, these recipients may request a waiver to obtain title to inventions made under the agreement. Such a request may be made in advance of the agreement or within 30 days thereafter. Even if a waiver request is not made, or denied, a large business recipient may request a waiver on individual inventions made during the course of the agreement.

4.4.4.2 Data Rights

All science data returned from investigations led by NASA-funded PIs will be made available to the public as rapidly as possible (see Section 4.4.1). Following a short latency period, all data will be made available to the user community, to the extent consistent with the approved data management plan and the data rights clause incorporated into the award instrument. There is no period of exclusive access permitted. The Principal Investigator proposes and justifies any data product latency period for standard data products listed in the proposal, based primarily on the time required to produce, quality check, and validate the products. Barring exceptional circumstances, data product latency may not exceed six months.

4.5 Project Management Policies

4.5.1 Independent Verification and Validation

The NASA Chief, Safety and Mission Assurance (CSMA) has the authority to select software projects to which Independent Verification and Validation (IV&V) shall be applied, as defined in NASA-STD-8739.8, *Standard for Software Assurance*, and NPR 7150.2B, *NASA Software Engineering Requirements*. At a minimum, all Category 1 and those Category 2 missions with a payload risk classification A or B will require IV&V. If the software assurance classification assessment is expected to determine that IV&V is necessary, proposal teams are encouraged to contact the Office of the Director at the NASA IV&V Program to gain a preliminary understanding of the potential level of safety and software risks. The Office of the Director can be contacted at 304-367-8248. When a project is required to obtain IV&V, exemption will require an assessment of the software project by the NASA Office of Safety and Mission Assurance (OSMA) and approval by the CSMA.

4.5.2 Earned Value Management Plan

For government entities, the earned value management (EVM) requirements are listed in NPR 7120.5E. For entities receiving contracts, the EVM requirements are listed in NFS 1852.234-2.

4.5.3 Cost Analysis Data Requirement

NASA has established a Cost Analysis Data Requirement (CADRe) in NPR 7120.5E, which will apply to investigations selected through this AO. Support contractors funded directly by NASA Headquarters will perform the actual development of the CADRe; the costs for these services need not be included in the proposed PI-Managed Mission Cost. Selected investigations will have to spend project funds only to collect existing documentations and transmit it to the CADRe support contractor at selected major milestones, and then to review the completed CADRe for completeness and accurately.

4.5.4 Conjunction Assessment Risk Analysis

NASA has established conjunction assessment risk analysis requirements in NPR 8715.6B, Chapter 3 that will apply to investigations selected through this AO. Two organizations – the Conjunction Assessment Risk Analysis (CARA) team at NASA Goddard Space Flight Center for Earth-orbiting missions and the MArs (and Moon) Deepspace Collision Avoidance Process (MADCAP) team at the Jet Propulsion Laboratory for Moon and Mars missions – are funded directly by NASA HQ and the Multi-Mission Ground Systems and Services (MGSS), respectively, to perform the actual analysis and risk assessment; the costs for these services need not be included in the mission PI-Managed Mission Cost. An investigation to which NPR 8715.6B, Chapter 3 is applicable will have to budget costs in their proposal PI-Managed Mission Cost to establish a working interface between the Flight Operations Team and the CARA or MADCAP team. This interface will be used to routinely share orbital ephemerides data and covariance data, any maneuvering plans, and to perform any maneuver planning activities required for collision avoidance once on orbit. Additionally, estimates of how many maneuver planning events may be required in a particular Earth orbit regime are available from the CARA team. The interface between the mission and CARA or MADCAP team should be agreed-to and documented one year prior to launch.

5. REQUIREMENTS AND CONSTRAINTS

This section provides general requirements on proposals. Supplemental requirements on standard proposal content and format are provided in Appendix B.

5.1 Missions of Opportunity Categories

Although non-U.S. participation is allowed in SALMON-3 investigations, none is required.

5.1.1 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 participation in a non-NASA space mission, NASA seeks to provide opportunities for the NASA community to conduct science investigations of interest to NASA as part of a non-NASA space mission. Non-U.S. governments, other U.S. Government agencies, or private sector

organizations may sponsor such missions. PMO investigations may be allowed on military satellites or on military space vehicles such as the X-37, provided that the satellites or vehicles are not planned for the purpose of weapons testing.

The PEA will set a cutoff date (the endorsement date) by which NASA endorsement is required by the sponsoring organization. If NASA endorsement is not required by the sponsoring organization by the date listed in the applicable PEA, the proposal should be submitted in response to a future solicitation.

Requirement 4. Proposals for PMOs shall provide a Letter of Commitment from the sponsoring organization stating that the sponsoring organization (i) intends to fund the parent mission, and (ii) that the endorsement of NASA for U.S. PMO participation is required by the sponsoring organization prior to the endorsement date listed in the applicable PEA.

Guidelines and requirements for Letters of Commitment may be found in Section 5.8.2 and Section 5.9.1.

Participation in a non-NASA space mission could take many forms, such as providing a complete instrument, hardware components, technology demonstration, research experiment, 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 U.S. Participating Investigator (USPI) investigations in response to SMD's annual *Research Opportunities in Space and Earth Science* (ROSES) solicitation or another BAA.

NASA will evaluate the proposed investigation content and feasibility, and not the sponsor's entire mission therefore the PI must demonstrate how the proposed PMO is independent or enables or enhances the parent/host mission (see Requirement 15).

Requirement 5. While the investigator is not required to document the entire mission of the sponsor, proposals for PMOs shall meet the following requirements:

(i) The proposal shall fully document the complete PMO investigation and how it will be accomplished within the sponsor's mission.

(ii) The proposal shall identify the mission opportunity or opportunities and shall provide evidence in the proposal that the mission provider agrees to manifest the PMO investigation should the proposal be selected and confirmed for flight by NASA.

(iii) The proposal shall describe the accommodation, including allocations of mass, power, volume, and data (see Requirement B-27 for additional details), demonstrate compatibility with the proposed host mission and show how the host will fulfill the mission requirements. 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.

(iv) The proposer shall identify and obtain appropriate commitments from the sponsor organization(s) that will provide the payload accommodations.

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 investigation integrity, as well as the leadership and management, of the NASA contribution to the mission.

Requirement 6. For PMOs, the PI assumes all risk for delays in the implementation of the parent/host mission and therefore, must propose appropriate reserves for such schedule contingencies.

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 applicable PEA. Unless specified otherwise in the applicable PEA, the launch date itself is not constrained.

PMOs may include flying hardware on a U.S.- or foreign-provided spacecraft launching on a U.S.- or foreign-manufactured launch vehicle. Policies and constraints associated with specific PMO potential partnerships are stated in this AO and the applicable PEA.

NASA investigations are initiated primarily for the conduct and publication of scientific, exploration, and technology 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. research 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 performed. NASA recognizes that PMO investigation teams may justifiably incur additional data analysis responsibilities defined by the policies of the sponsor of the parent mission.

Requirement 7. Proposals for PMOs shall demonstrate that the data obtained and the research conducted will benefit the NASA community.

5.1.2 New Missions using Existing Spacecraft

For the purpose of this AO, a PEA may solicit New Missions using Existing Spacecraft (NMESs), defined as an investigation making use of a NASA spacecraft or other working space asset to conduct an investigation that is not a continuation of the spacecraft's original mission.

Requirement 8. Proposals for NMESs shall meet the following requirements:

(i) The proposal shall make use of a NASA spacecraft or other working space asset once it has completed its prime (and extended) mission(s) or in a complimentary manner that does not interfere with the spacecraft's approved mission.

(ii) The proposed mission shall constitute a new investigation and shall not be an extension, supplement, redirection, augmentation, or follow-up of the spacecraft's original mission or any previously approved mission extensions.

(iii) The new mission shall constitute an investigation addressing the objectives of the research programs identified in the NASA Strategic Plan and in the applicable PEA.

(iv) The proposal shall 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 affect the investigation. In addition, the proposed investigation shall not impose any changes on the requirements of the prime mission

Requirement 9. Proposals for NMESs shall 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 mission operations team with acceptable risk and with adequate capture of engineering and operations knowledge and lessons learned.

Requirement 10. Proposals for NMESs shall provide evidence that a decision by NASA on whether or not to conduct the proposed new mission extension is required by the date listed in the applicable PEA.

New investigations using research instruments or other technical capabilities currently aboard the International Space Station (ISS) will be considered under this proposal category.

5.1.3 Small Complete Missions

For the purpose of this AO, a PEA may solicit Small Complete Missions (SCMs), defined as complete but small space flight investigations in science, exploration, or technology. In such a case, compelling proposals at any cost within the budget allocation listed in the applicable PEA are permitted. The launch date timetable for proposed SCMs will be listed in the applicable PEA.

The term "complete" encompasses all appropriate mission phases from project initiation (Phase A), through all phases of development, mission operations (Phase E), which must include analysis and publication of data in the peer reviewed technical literature, delivery of the data to an appropriate NASA data archive, and closeout (Phase F).

SCMs include access to space. Launch services, if provided, will be described in the applicable PEA. If not provided, proposals must include access to space within the PI-Managed Mission Cost. Proposals for the delivery and use of research instruments or other technical capabilities to the ISS will be considered under the SCM category. SCM investigations may be allowed on military satellites or on military space vehicles such as the X-37, provided that the satellites or vehicles are not planned for the purpose of weapons testing.

Requirement 11. Proposals for SCMs shall meet the following requirements:

(i) Proposals shall encompass all aspects of the investigation, from initial studies to delivery of data to the appropriate NASA archive, including a complete analysis of data sufficient to accomplish the investigation's science or technical objectives.

(ii) Proposals shall describe the development approach for implementing the proposed investigation within schedule and cost constraints, including a project schedule.

If access to space is not provided in the applicable PEA, Class D SCMs may include the provision of non-NASA launch services as primary, secondary, co-manifested, or hosted payloads.

Requirement 12. Proposals for SCMs that include access to space shall be consistent with U.S. space transportation policy and with the policies and requirements in Section 5.3.8 of this AO and the applicable PEA.

5.1.4 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, exploration, or technology investigation that requires the provision of an instrument, an 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. For the purpose of this AO, such opportunities are called Focused Missions of Opportunity and may be solicited by a specific PEA.

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

5.2 Research Requirements

5.2.1 Scope of Proposed Investigations

A goal is understood to have a broad scope (e.g., discover whether life exists elsewhere in the Universe; discover how and why the Earth's climate and the environment are changing), while an objective is understood as a more narrowly focused part of a strategy to achieve a goal (e.g., identify specific chemical, mineralogical, or morphological features on Mars that provide evidence of past or present life there; understand and improve predictive capability for changes in the ozone layer, climate forcing, and air quality associated with changes in atmospheric composition). Proposed investigations must achieve their proposed objectives; however, the investigation might only make progress toward a goal without fully achieving it.

Requirement 13. Proposals shall describe a science, exploration, or technology investigation with goals and objectives that address the program research objectives identified in the applicable PEA.

Requirement 14. Proposals shall demonstrate how the proposed investigation will fully achieve the proposed objectives.

For PMOs, NASA will evaluate the goals and objectives of proposed investigation within the parent/host mission and not the sponsor's entire mission, therefore the PI must clearly demonstrate how the proposed PMO is independent of or enables or enhances the parent/host mission.

Requirement 15. For PMOs, proposals shall demonstrate how the proposed PMO goals and objectives are independent of or enables or enhances the parent/host mission.

5.2.2 Traceability of Proposed Investigations

The purpose of the SALMON-3 AO is to provide opportunities for the NASA community to perform focused science, exploration, or technology investigations that advance knowledge and conclude with papers published in peer-reviewed archival journals or appropriate professional publications, as well as deposition of appropriately reduced and calibrated data in designated data archives (see Section 4.4.3). Examples of a Science Traceability Matrix and a Mission Traceability Matrix are given in Tables B1 and B2, along with examples for elements in such matrixes. Analogous traceability matrices for exploration and technology proposals are also required.

Requirement 16. Proposals shall clearly state the relationship between the science, exploration, or technology objectives, the data to be returned, and the instrument or experiment complement to be used in obtaining the required data (see Appendix B, Section D, for additional detail).

Requirement 17. Proposals shall include a plan to calibrate (both preflight and inflight), analyze, publish, and archive the data returned, and shall demonstrate, analytically or otherwise, that sufficient resources have been allocated to carry out that plan within the proposed investigation cost. The data plan shall discuss and justify any data latency period (see Appendix B, Section E, for further detail). The data plan shall be in compliance with terms and conditions stated in the *NASA Plan: Increasing Access to the Results of Scientific Research* or a justification shall be provided that this is not necessary given the nature of the work proposed (see Section 4.4.1).

5.2.3 Investigation Objectives and Requirements

The ability to determine whether a proposed project or experiment can successfully carry out the proposed investigation depends on a well-formulated articulation of the proposed objectives, the information and steps needed to bring closure to the objectives, and the measurements that must be obtained while conducting the investigation. The proposed investigation is evaluated against the standard of successfully delivering the required measurements.

Requirement 18. Proposals shall state the specific objectives and their required measurements at a level of detail sufficient to allow an assessment of the capability of the proposed investigation to make those specific measurements and whether the resulting data is necessary and sufficient to achieve these objectives.

Requirement 19. Proposals shall describe the proposed instrumentation or experimental setup, including a discussion of the rationale for its selection.

5.2.4 Baseline and Threshold Investigations

The Baseline Investigation and Threshold Investigation are defined to be consistent with NPR 7120.5E as follows:

> The "Baseline Investigation" is the investigation that, if fully implemented, would fulfill the Baseline Science/Exploration/Technology Requirements, which are the performance requirements necessary to achieve the full science, exploration, or technology objectives of the investigation.
>
> The "Threshold Investigation" is a descoped Baseline Investigation that would fulfill the Threshold Science/Exploration/Technology Requirements, which are the performance requirements necessary to achieve the minimum science, exploration, or technology acceptable for the investment.

The differences between the Baseline Investigation and the Threshold Investigation provide resiliency to potential cost and schedule growth in the proposed formulation and implementation plan. Any alteration of an investigation that renders it unable to accomplish one or more of the Baseline Investigation objectives, but allows accomplishment of all Threshold Investigation objectives may be an acceptable descope.

NASA recognizes that, in some circumstances, the Threshold Investigation may be identical to the Baseline Investigation.

Requirement 20. Proposals shall specify only one Baseline Investigation and only one Threshold Investigation.

Requirement 21. Proposals shall not identify any descopes or other risk mitigation actions that result in the mission being unable to achieve the Threshold Investigation objectives.

5.2.5 Science-Exploration-Technology Enhancement Options

Activities such as extended missions, guest investigator programs, general observer programs, participating scientist programs, interdisciplinary scientist programs, and/or archival data analysis programs, where appropriate, have the potential to broaden the scientific impact of investigations. These and other optional activities may be proposed as Science-Exploration-Technology Enhancement Options (SEOs) for investigations proposed in response to a PEA when permitted.

NASA considers any proposed SEO activities as optional. Inclusion of such optional activities in a proposal does not imply a commitment from NASA to fund them, even if the baseline investigation is selected. The applicable PEA will describe SEO requirements. NASA reserves the right to accept or decline proposed SEO activities at any time during the investigation; in particular, the decision may not be made at the time the baseline investigation is selected for flight. The process for deciding on SEO activities may involve further reviews (e.g., a "Senior Review" for extended missions). NASA reserves the right to solicit and select all participants (e.g., guest investigators, archival data analysts, and participating scientists) in such programs.

Costs for proposed SEO activities must be defined, but will not count against the PI-Managed Mission Cost. Funding requested for SEO activities prior to Phase E should be minimized. As these proposed activities are optional and are not included within the cost capped baseline investigation, the science/exploration/technology enabled by SEO activities is not considered as part of the scientific/exploration/technology merit of the proposed investigation.

Requirement 22. If SEO activities are proposed, the proposal shall define and describe the proposed activities and their costs.

Requirement 23. If SEO activities are proposed, they shall be clearly separable from the Baseline Investigation and Threshold Investigation.

Requirement 24. If an extended mission SEO is proposed for SMD-sponsored solicitations, it shall conform to the guidelines provided in the *SMD Mission Extension Paradigm* document found in the PEA-specific Library.

See Appendix B, Section E, for additional detail.

5.3 Technical Requirements

5.3.1 Commitment for a Single Step Selection

Unless stated otherwise in the applicable PEA, proposed investigations will be evaluated and selected through a single step competitive process.

Requirement 25. Each proposal shall include a commitment by the PI for the cost, schedule, and scientific, exploration, and technical performance of the investigation.

5.3.2 Complete Investigations

Proposals must encompass all aspects of the type of investigation solicited in the applicable PEA, 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, exploration, or technology objectives. NPR 7120.5E defines the activities, milestones, and products typically associated with each mission phase, and is used as a guideline when defining an investigation approach. Note that NPR 7120.5E levies requirements on projects, not proposals. The baseline investigation proposed in response to this AO and the applicable PEA must be complete from project initiation through closeout. This baseline investigation must contain, within the PI-Managed Mission Cost, all mission activities required to accomplish the proposed goals and objectives.

Requirement 26. Proposals submitted in response to this AO and the applicable PEA shall be for complete research investigations that require a spaceflight mission.

Although the SALMON-3 AO is intended for investigations that require a spaceflight mission, the applicable PEA might broaden the allowable platforms to include others such as suborbital platforms.

Requirement 27. Proposals shall encompass all aspects of the investigation, from initial studies to delivery of data to the appropriate NASA archive, including a complete analysis of data sufficiency to accomplish the investigation's research or technical objectives

This AO solicits investigations that can be executed within the scope of the PEA-specific Cost Cap and/or other cost constraints given in the applicable PEA.

Requirement 28. Proposals shall describe the development approach for implementing the proposed investigation within schedule and cost constraints, including a project schedule.

For MOs in which the flight systems development and operations are the responsibility of the PI (e.g., SCMs), see Appendix B, Section F (Version B), for details. For MOs in which the flight systems development and operations are not the responsibility of the PI (e.g., instrument only MOs), see Appendix B, Section F (Version A).

Observations from space often have natural synergies with other observations. Some proposed observations may either require or desire additional observations in order to better address the questions as proposed for the investigation. Some of these observations may be within the MO host mission, from currently existing or planned NASA missions, or from missions by other U.S. or non-U.S. agencies. Proposers are expected to clearly state any dependencies on other data sets, what assumptions are made on the likelihood that these observations will exist during potential time frames for operation of their proposed investigations, and the implications if those observations do not exist.

Requirement 29. Each proposal shall clearly outline which additional ongoing or planned observations, if any, are required for the proposed investigation to achieve its baseline investigation. The proposal shall describe how the high-level requirements will be impacted if such observations do not exist when the proposed investigation is in operation.

Most NASA observations from space require stringent and well-defined calibration and validation plans. NASA expects each proposal to fully describe the requirements for calibration and validation. If some required validation data are not to be funded directly by the selected PI-led investigation, the proposal should provide information about the commitment to funding for those data in the time frame of five to ten years after selection of the investigation and describe the implications to meeting the requirements if such data do not become available.

Requirement 30. Each proposal shall fully describe the requirements for calibration and validation. If some required validation data are not to be funded directly by the selected PI-led investigation, the proposal shall provide information about the expectations for available calibration and validation instruments and/or data in the time frame of five to ten years after selection of the investigation and describe the implications to meeting the requirements if such activities do not become available.

5.3.3 Accepted Management Processes and Practices

The document NPR 7120.5E, *NASA Space Flight Program and Project Management Processes and Requirements*, delineates activities, milestones, and products typically associated with

Formulation and Implementation of projects; it should be used as a reference in defining an Investigation Team's management approach. The implementing organizations are free to propose their own processes, procedures, and methods for managing their missions; however, they must be consistent with the principles of NPR 7120.5E. Processes, procedures, and methods should be proposed that are appropriate for the scope and scale of the proposed investigation. Any deviations from NPR 7120.5E will require a waiver during formulation.

Requirement 31. Proposals shall describe the investigation's proposed management approach, including the management organization and decision-making process, the teaming arrangement, the responsibilities of the PI and other team members, and the risk management and risk mitigation plans (see Appendix B, Section G, for additional detail).

The document NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*, clearly articulates and establishes the requirements on the implementing organization for performing, supporting, and evaluating systems engineering. This systems approach is applied to all elements of a system and all hierarchical levels of a system over the complete project life cycle. NPR 7123.1B should be used in defining the Investigation Team's systems engineering approach. The implementing organizations are free to propose their own processes, procedures, and methods for systems engineering; however, they must be consistent with NPR 7123.1B.

Requirement 32. Proposals shall describe the investigation's proposed systems engineering approach, including plans, tools, and processes for requirements, interfaces, and configuration management (see Appendix B, Section F, for additional detail).

Requirement 33. Proposals shall describe any deviations from NPR 7120.5E, NPR 7123.1B, and any other NASA procedural requirements that will require a waiver during formulation.

See Appendix B, Section F, for additional details.

5.3.4 Mission Category and Payload Risk Classification

NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*, establishes guidelines for categorizing NASA missions based on the estimated life-cycle cost and mission priority level.

NPR 8705.4, *Risk Classification for NASA Payloads,* establishes baseline criteria that enable a definition of the risk classification level for NASA payloads. It defines four payload risk levels or classes, A thru D, and provides guidance for programmatic options during development based on this class.

The Mission Category (per NPR 7120.5E) or the Payload Risk Classification (per NPR 8705.4) of an investigation selected from this AO and the applicable PEA may have been designated by NASA and therefore stated in the PEA. Otherwise, proposers must propose a mission categorization and risk classification appropriate for their proposed mission.

Requirement 34. Based on the criteria for the Mission Category in NPR 7120.5E and the Payload Risk Classification in NPR 8705.4, proposals shall define a mission categorization and risk classification for their proposed investigation, whether it is designated by NASA or proposed. Proposers shall incorporate appropriate work effort and support in their proposals accordingly.

Mission Category and Payload Risk Classification will be confirmed or modified by the NASA Decision Authority at selection points KDP-A and KDP-B.

5.3.5 New Technologies/Advanced Engineering Developments

The PEA may specify that it solicits science or exploration investigations, not technology or advanced engineering development projects. Proposed science or exploration investigations are generally expected to have mature technologies, with systems at a Technology Readiness Level (TRL) of 6 or higher when proposed. For the purpose of TRL assessment, systems are defined as level 3 WBS payload developments (i.e., individual instruments) and level 3 WBS spacecraft elements (e.g., electrical power system); see Figure 3-7 of the *NASA WBS Handbook*, NASA/SP-2010-3404, which can be found in the applicable PEA-specific Library. TRLs are defined in NPR 7123.1B *NASA Systems Engineering Processes and Requirements*, Appendix E, which can be found in the applicable PEA-specific Library as well.

Proposals with a limited number of less mature technologies and/or advanced engineering developments when proposed are permitted as long as they contain a plan for maturing these systems to TRL 6 (see NASA/SP-2007-6105 Rev 1, *NASA Systems Engineering Handbook*) by no later than Preliminary Design Review (PDR) and adequate backup plans that will provide mitigation in the event that the systems cannot be matured as planned. The TRL state of systems will be validated by an independent team at PDR.

PEAs issued by NASA STMD, including those that solicit a technology demonstration investigation as opposed to a science or exploration investigation, will require technologies with systems to be matured to TRL 5, not TRL 6, no later than PDR. Requirement 35 is not applicable to such PEAs.

Requirement 35. Unless otherwise specified in the applicable PEA, proposals that use systems currently at less than TRL 6 when proposed shall include a plan for system maturation to TRL 6 by no later than PDR and a backup plan in the event that the proposed system cannot be matured as planned.

See Appendix B, Section F, for additional details.

5.3.6 Technology Demonstration Opportunity

As part of a new emphasis on innovation, NASA is encouraging the introduction of new technologies for select mission opportunities. The goal of this effort is to provide a pathway for new capabilities to be introduced such that new investigations with enhanced scientific return may be realized. A *Technology Demonstration Opportunity (TDO)* consists of either NASA-developed or PI-developed technologies that may have a TRL of less than 6 when proposed, and must *not* be required by either the Baseline or the Threshold mission. If the technology is PI-

developed, then the Intrinsic Merit (Factor A-6), Experiment Merit (Factor B-7), and the TMC Feasibility (Criterion C) will be evaluated, particularly for separability from and impact to the mission. If the technology is NASA-developed, then only the TMC feasibility (Criterion C) will be evaluated. Incentives, such as an increase to the PEA-specific Cost Cap may be offered.

Specific PEAs may encourage proposers to define a PI-developed and/or NASA-developed Technology Demonstration Opportunity (TDO). A TDO may be an instrument, investigation, new technology, hardware, or software demonstrated on either the flight system or ground system. Constraints on any proposed TDO are that it may not include the demonstration of a radioisotope power system, and it must be clearly separable from the proposed Baseline and Threshold Investigations to the extent that it will not impact either if the TDO development has technical, schedule, or cost problems and is deleted from the mission, or if the TDO fails in flight. The cost of any TDO accommodation that directly affects the Baseline or Threshold Investigation resources (e.g., increased launch mass, increase power) must be included in the PI-Managed Mission Cost.

Any PI-developed TDO will be considered outside of the PI-Managed Mission Cost. It must use innovative technological approaches that may have continuing applicability to future NASA missions.

The proposer must clearly identify the proposed TDO and describe the innovative technology and/or the enhanced investigation return. The proposer must clearly identify the development schedule of the TDO and describe how it can be developed so as to be separable from the proposed Baseline Investigation and Threshold Investigation.

Review and decision points for determining the PI-developed TDO readiness for flight must be identified. Plans for TDO failure or cancellation must be included. Backup plans for the TDO technology, if any, should be explained. There will be no penalty assessed for the potential higher technical risk of the TDO itself.

If any NASA-developed TDOs are specified in a PEA, they will only be subject to a TMC evaluation, which will address satisfaction of requirements specified by the NASA-developed technology, as well as the impact to and separability from the mission.

TDOs will be evaluated as described above using the criteria described in Section 7.2. If NASA selects the proposed mission, NASA may or may not choose to select the TDO.

Requirement 36. If TDO activities are proposed, the proposal shall define and describe the proposed activities and their costs.

Requirement 37. If TDO activities are proposed, they shall be clearly separable from the Baseline Investigation and the Threshold Investigation.

The applicable PEA will state whether a PI-developed and/or NASA-developed TDO is encouraged and will specify other requirements and constraints.

5.3.7 Technology Infusion Opportunity

NASA recognizes that technology and continued technological progress is essential to ensure continued success for future missions. NASA is implementing processes to better infuse technology into new missions. A *Technology Infusion Opportunity (TIO)* consists of NASA-developed technologies which are for use as part of a Baseline investigation, where NASA will have completed development to at least TRL 6 before PDR. The TRL risk of each technology will not be evaluated, as long as the technology is used as specified per its readiness assessment (e.g., performance and environment). Examples include identification of key transformational technology areas and development of new flight opportunities for maturation of technologies as part of the mission solicitation process.

Specific PEAs may encourage investigations to propose the infusion of technologies developed by NASA for use as part of Baseline Investigations; any NASA-developed technology infusion is strictly optional. Some technologies will be offered as Government Furnished Equipment (in whole or part) and some will carry incentives for use (to be considered an increase in the PEA-specific Cost Cap). NASA assumes the responsibility for maturing these technologies to TRL 6. Therefore, proposals that include utilization of one of these NASA-developed technologies will not be required to include a maturation plan for them, as long as the technology is used as specified (e.g., performance and environment). Consequently, proposals will be required to include a plan for the infusion of these technologies (see Appendix B, Section J.12).

5.3.8 Access to Space

NASA may offer access to space options through this AO and the applicable PEA. Examples of platforms that may be provided by NASA for access to space, or near space, include:

- Access to space for missions on the International Space Station (ISS).
- Balloon vehicles and balloon launch services for missions on high-altitude scientific balloons.
- Access to space for hosted payloads on suborbital Reusable Launch Vehicles.
- Access to space for Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA)-class missions

Proposers must pursue alternative access to space when applicable (applicable to Class D missions only). Alternative access to space may include non-NASA launch services as primary, secondary (e.g., on a secondary payload adapter), or co-manifested payloads. Alternative access to space may include payload accommodations as a hosted payload (e.g., instrument package).

The desired use of a U.S. Government furnished or U.S. excess ballistic missile launch vehicle will be formally coordinated with NASA per NPD 8610.12H, *Orbital Space Transportation Services*, in order to evaluate if the appropriate determination can be made to allow use of a non-commercial U.S. launch vehicle. (Note: Given the state of the U.S. commercial launch industry, approval for use of an excess ballistic missile launch vehicle would be unlikely, and use of Space Launch System (SLS) would need to be determined). The planned use of a foreign launch vehicle will also be formally coordinated with NASA per NPD 8610.12H so the appropriate interagency coordination and/or approval actions can be conducted in a timely manner. (Note:

Given the state of the U.S. commercial launch industry, an in-kind foreign contribution to NASA's mission would need to occur in order to launch on a foreign launch vehicle).

Non-NASA launch services will be handled by NASA consistent with existing policy and regulations. The demonstrated reliability and the resultant probability of mission success for non-NASA launch services will be evaluated by NASA consistent with current U.S. space transportation policy and NASA's policies. The proposed launch service will be assessed in conjunction with NASA stakeholders as part of the selection process. A charge to the PI-Managed Mission Cost may be levied for the expected NASA launch vehicle monitoring functions and advisory services; this cost will be specified in the applicable PEA. The functions, operating structure, and policies of NASA Launch Services Program (LSP) with regards to defining and executing advisory services or consulting for government or commercial entities are defined in the *Launch Services Program (LSP) Advisory Services Plan* that can be found in the PEA-specific Library. For non-NASA launch services, the NASA Flight Planning Board will approve final mission assignment assuring consistency with Agency risk strategy. Information on the reliability of ELVs may be obtained from the point of contact listed in the PEA-specific *ELV Launch Services Program Information Summary* document that can be found in the PEA-specific Library.

Proposers considering the use of non-NASA launch services as a secondary or co-manifested payload should contact the NASA LSP for potential rideshare opportunities and details associated with LSP providing advisory services for launch mission assurance for missions flying as primary or secondary payloads per NPD 8610.7D and NPD 8610.23C, *Launch Vehicle Technical Oversight Policy*.

Hosted payloads will be handled by NASA consistent with existing policy and procedures. The proposed hosted accommodation will be assessed in conjunction with NASA stakeholders as part of the selection process.

Requirement 38. Proposed access to space shall be consistent with current U.S. space transportation policy, NASA policies, and with any policies or requirements specified in this AO and the applicable PEA. Current U.S. space transportation policy and applicable NASA policy documents can be found in the PEA-specific Library.

5.3.8.1 Non-NASA Launch Services

Alternative access to space options involves several complex issues at this stage of project maturity. It is in the proposer's best interest to clearly support the maturity of their plan and access to space possibilities. The minimum expectations for access to space arrangements must be included in the proposal to the level of detail outlined in Requirement 39 (iii). Any additional evidence of maturity or commitment provided will be used to support risk posture.

Requirement 39. Proposals that include non-NASA launch services (purchased or contributed) obtained from a U.S. or non-U.S. partner shall meet the following requirements:

(i) When flying as a primary, the proposer shall demonstrate a commitment from the launch services provider.

(ii) When flying as a co-manifested or secondary payload, the proposer shall demonstrate a commitment from the proposed co-manifested or primary mission organization(s) to accommodate the proposed payload or demonstrate that the launch services provider has an appropriate process to provide specific launch services; these commitments must be documented in a Letter from the appropriate organization(s).

(iii) The proposal shall identify the launch opportunity and shall provide evidence in the proposal that the launch service provider agrees to manifest the mission should the proposal be selected and confirmed for flight by NASA. This evidence shall include a Letter from the launch services provider containing, at a minimum, the following information:

a. Evidence that the launch services provider will provide the services described in the proposal under the conditions (cost, schedule) described in the proposal;
b. A description of the opportunity (or opportunities, if more than one under consideration) that the launch service provider can offer for consideration by the PI; and
c. A description of the process that the launch service provider will use in order to commit to the PI to provide specific launch services for the proposed investigation, should NASA select the proposed investigation; this process description shall include a notional schedule for identifying the specific launch opportunity and definitizing the cost.

(iv) The proposal shall describe the launch services, demonstrate compatibility with the proposed launch vehicle, and show how the provider will fulfill the mission requirements.

(v) The proposal shall describe the arrangement between the PI and the non-NASA launch service provider to enable the PI's insight for launch services, consistent with NASA Procedural Documents (NPD) 8610.7D and 8610.23C. Note that these NPDs allow unique arrangements for payloads able to tolerate more risk. NASA will develop an advisory approach based on the insight the PI is provided from the non-NASA launch service provider. The proposal budget shall include the cost of the NASA launch vehicle monitoring functions and advisory services, which would enable NASA to review and advise the PI on launch vehicle information from the non-NASA launch service provider; this cost will be specified in the applicable PEA.

(vi) The proposal shall demonstrate that the proposed launch services are consistent with current U.S. space transportation policy, NASA policies and the policies and requirements of this AO and the applicable PEA. These policies may levy additional requirements and constrains.

See Appendix B, Section F, for additional details.

Launch delay costs, for whatever reason, represent a cost threat to the PI-Managed Mission Cost and are considered a risk.

Requirement 40. Launch delay costs shall be considered as a risk and the appropriate reserves shall be planned and funded out of the PI-Managed Mission Cost.

5.3.8.2 Hosted Payloads

Alternative access to space may include purchased or contributed payload accommodations as a hosted payload (e.g., instrument package).

Requirement 41. Proposals that include payload accommodation as a hosted payload shall meet the following requirements:

(i) The proposer shall secure the organization(s) that will provide the payload accommodations.

(ii) The proposal shall identify the mission opportunity or opportunities and shall provide evidence in the proposal that the mission provider agrees to manifest the investigation should the proposal be selected and confirmed for flight by NASA.

(iii) The proposal shall describe the accommodation, demonstrate compatibility with the proposed spacecraft and show how the host will fulfill the mission requirements.

(iv) The proposed investigation shall be self-sufficient (with exception of any critical resources provided by the host platform) and the success of the investigation shall not depend on the other science payloads accommodated on the host platform. The NASA PI is responsible for the entire investigation including mission assurance. The proposal shall describe how mission assurance will be met for those areas that are not under the PI's control.

(v) The proposal shall demonstrate that the proposed hosted-payload accommodations are consistent with current U.S. space transportation policy, NASA policies and the policies and requirements of this AO and the applicable PEA. These policies may levy additional requirements and constrains.

A NASA hosted payload on a non-U.S. Government-provided spacecraft is subject to certain U.S. Government review and approval processes. Selection of any proposal that includes hosted payload accommodations on a non- U.S. Government spacecraft is conditional until approval has been obtained.

Launching a NASA hosted payload on a foreign-provided spacecraft and/or foreign-provided launch services will require a formal agreement between NASA and the foreign entity providing the accommodation and launch services, as well as coordination within the U.S. Government.

Requirement 42. For hosted payloads, the PI assumes all risk for delays in the implementation of the host mission and therefore, shall propose appropriate reserves for such schedule contingencies.

5.3.9 Environmental Compliance

The *National Environmental Policy Act* (NEPA) *of 1969*, as amended (42 USC 4321 *et seq*.), is the Nation's policy for the protection, maintenance and enhancement of the environment. It requires NASA to integrate environmental considerations into Agency decisions before taking action. NASA actions include all programs or projects that are financed (even partially), assisted, conducted, regulated, approved or permitted by NASA.

NASA complies with the NEPA by following the Council on Environmental Quality (CEQ) and internal Agency regulations. NASA policy requires the preparation of an Environmental

Management Plan to ensure the NEPA process is completed during the preliminary design and technology development phase of a mission. When responding to an announcement, proposers must include NEPA cost and schedule needs into their estimates. Please also note that proposers of missions conducted outside the U.S. must comply with Executive Order 12114 (*Environmental Effects Abroad of Major Federal Actions*).

Depending on the complexity of a proposal, the NEPA process will require preparation of one of three levels of NEPA documentation:

(i) Record of Environmental Consideration (REC) Routine Payloads;
(ii) Environmental Assessment (EA); or
(iii) Environmental Impact Statement (EIS).

As of 2011, NASA updated the NASA Routine Payloads EA that provides NEPA coverage for commonly used launch locations and expendable launch vehicles. The EA provides a checklist (available at http://www.nasa.gov/agency/nepa/NRPchecklist) that enables NASA to determine if a proposed mission can be considered "routine" based on the planned launch location, launch vehicle and envelope payload characteristics. If so, then a REC is prepared that describes the planned mission and includes the completed checklist to provide NEPA compliance. If the checklist reveals that the planned mission does not constitute a "routine" payload, then a mission-specific EA or EIS will be required. An EIS is typically required for payloads that use radioisotope power systems (RPS) and may be required for payloads that use radioisotope heater units (RHUs).

Depending upon the complexity of analysis required, NEPA documentation requiring an EA or EIS can be resource intensive. Contractor costs for an EA are often in the $150K-$200K range and can require one year to complete. Typical cost estimates to prepare an EIS involving a RPS or RHUs can reach $1M+ and can take more than one year to complete. NEPA compliance costs must be included in the PI-Managed Mission Cost and major NEPA milestones must be included in the proposed schedule. The Table with key milestones and cost for the launch approval processes in FY## (where ## is the year) is found in the PEA-specific Library.

Requirement 43. The costs of environmental review and launch approval shall be included in the PI-Managed Mission Cost. The key milestones for environmental review and launch approval shall be accounted for in the proposed schedule.

Please contact the NASA NEPA Manager, by phone or email if you have questions concerning NASA environmental compliance requirements. The NASA NEPA Manager contact information may be found at http://www.nasa.gov/agency/nepa/NEPATeam.html .

5.3.10 Use of Radioactive Material

The PEA may state that the proposed use of radioactive materials of any quantity and any isotope, including radioisotope power sources, radioisotope heater units, or radioactive calibration sources for science instruments, is not permitted.

Alternatively, a PEA may allow for investigations to baseline use of small amounts of radioactive material for uses such as radiological calibration sources for science instrumentation; however no radioactive material may be used for supplemental power.

The proposed use of radioactive materials of any quantity and any isotope, including radioactive sources for science instruments, will require review for environmental impact and Nuclear Launch Safety Approval (NLSA). The environmental review requirements flow from NEPA and are specified in NPR 8580.1, *Implementing the National Environmental Policy Act and Executive Order* 12114. The NLSA requirements are specified in NPR 8715.3C, *NASA General Safety Program Requirements*, Chapter 6: "Nuclear Safety for Launching of Radioactive Materials." The effort required for NLSA consists of concurrence from the NASA Office of Safety and Mission Assurance for low-level radioactive sources (i.e., with an A2 mission multiple less than 10, as defined in NPR 8715.3C, Chapter 6 and Appendix D).

Requirement 44. If use of radioactive materials is proposed (e.g., for radiological sources or other operational purposes), the proposal shall include a listing of the estimated radioactive materials to be used (isotope, form, quantity). The proposal shall provide a rationale for the use of radioactive materials and reasonable, nonradiative alternatives if possible.

Requirement 45. For NASA launches involving the use of radioactive materials, the costs of environmental review and launch approval shall be included in the PI-Managed Mission Cost. The key milestones for environmental review and launch approval shall be accounted for in the proposed schedule.

A Table with key milestones and cost for the launch approval processes are found in the applicable PEA Library.

Questions concerning the NLSA process may be addressed to the Nuclear Flight Safety Assurance Manager, NASA Office of Safety and Mission Assurance, by phone or email. The Nuclear Flight Safety Assurance Manager, NASA Office of Safety and Mission Assurance contact information may be found at https://sma.nasa.gov/sma-disciplines/nuclear-flight-safety.

5.3.11 Telecommunications, Tracking, and Navigation

Use of NASA's Near-Earth Network (NEN), Space Network (SN), or Deep Space Network (DSN) may be proposed, as appropriate. Points of contact and cost information for these services may be found in the *NASA's Mission Operations and Communications Services* document in the PEA-specific Library.

A cost estimation algorithm for the DSN and persons to contact to obtain costs for other networks and various Government-operated facilities are contained in the *NASA's Mission Operations and Communications Services* document or at the DSN Future Missions Planning Office website at http://deepspace.jpl.nasa.gov/advmiss/. For assistance with the cost calculation, contact the persons named on the website. Proposers to this AO should compute the estimated DSN Aperture Fees and report this in their proposal as a means of assessing the reasonableness of the proposed DSN use. DSN Aperture Fees should not be included in the PI-Managed Mission Cost nor should they appear in any cost table.

When the use of non-NASA communication services is proposed, NASA reserves the option of contracting for those services directly through its Space Communication and Navigation (SCaN) office. Further information can be obtained from the point of contact in the *NASA's Mission Operations and Communications Services* document. NASA funds may not be used for the construction of new facilities for non-NASA communications services.

Requirement 46. Proposals shall include mission requirements for telecommunications, tracking, and navigation; proposals shall also include a plan for meeting those requirements. If non-NASA networks are used, a cost plan for the use of services must also be included in the PI-Managed Mission Cost. For PMOs and hosted payloads, where the PI is not responsible for the host mission, proposals shall describe the investigation's requirements for telecommunications, tracking, and navigation, and the proposal shall describe how the host mission will meet those requirements.

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

Where the use of NASA's network services may not be within the capabilities and capacities described in the *NASA's Mission Operations and Communications Services* document, discussions should be initiated with the Point of Contact (POC) named in that document. In this case, a Letter of Commitment is required from the NASA network provider describing the network's ability to deliver the required capabilities and capacities and the cost for doing so.

It is policy that only one DSN 34 meter antenna will be scheduled at the same time during normal operations of the selected mission. It is policy that none of the DSN 70 meter antennas may be proposed to support normal operations of the selected mission. These restrictions do not apply to station hand-offs, critical event coverage, emergency services, radio science measurements, or navigation observations (e.g., delta differential one-way ranging or delta-DOR).

NASA intends to transition all space missions to the use of Ka-band for science data return (telemetry, tracking, and commanding (TT&C) data may still be transmitted using X-band or S-Band). In order to better manage the Agency's transition to Ka-band service, proposed investigations are required to baseline the use of Ka-band for science data return, unless it is inappropriate.

Radio frequency spectrum for telecommunications is allocated by service (e.g., Earth Exploration-Satellite, Space Research, and Space Research (Deep Space)) and may be further constrained by maximum channel bandwidth limits (see the *Available Spectrum and Channel Limits by Allocated Service* document in the Program Library). Proposals are required to address conformance to applicable maximum channel bandwidth limit(s).

Requirement 47. If use of NASA's network services is proposed, costs for services, as described in the *NASA's Mission Operations and Communications Services* document, including

the cost of any development but excluding DSN Aperture Fees, must be included in the PI-Managed Mission Cost and the proposal's cost plan. Cost estimates for DSN Aperture Fees shall be included in the proposal but not in any cost table.

Requirement 48. If use of NASA's network services beyond the capabilities and capacities described in the *NASA's Mission Operations and Communications Services* document is proposed, the proposal shall include a Letter of Commitment from the NASA network provider; the Letter shall confirm the ability of the network to provide the required capabilities and capacities and shall include an estimate of the additional costs for these capabilities and capacities.

Requirement 49. Proposals shall baseline the use of Ka-band for science data return, unless it is inappropriate for the proposed investigation; proposal of an alternative communications approach shall be justified.

Requirement 50. Proposals shall address conformance to the applicable maximum channel bandwidth limit(s).

Requirement 51. Proposals that propose the use of the DSN shall baseline the use of only one DSN 34 meter at any time for normal operations (not including periods of station hand-off emergencies, delta differential one-way range (DDOR) determination, etc.).

5.3.12 Critical Event Coverage

Critical events in the operation of a spacecraft are defined as those that must be executed successfully, usually in a single opportunity, as failure could lead to early loss or significant degradation of the mission if not executed successfully or recovered from quickly in the event of a problem.

NPR 8705.4, *Risk Classification for NASA Payloads,* requires that critical event telemetry be recovered for reconstruction of an anomaly, should one occur. Telemetry coverage is required during all mission critical events to assure data is available for critical anomaly investigations to prevent future recurrence. NPR 8705.4 provides examples of critical events. Critical event coverage may be provided in any fashion that is deemed appropriate for the proposed investigation.

Requirement 52. Proposals shall specify all critical events for the proposed mission and shall discuss the technical approach, required resources, and implementation concepts for providing critical event telemetry. This requirement does not apply to PMOs and hosted payloads, where the PI is not responsible for the host mission.

5.3.13 Orbital Debris Assessment and End-of-Mission Spacecraft Disposal

NPR 8715.6B, *NASA Procedural Requirements for Limiting Orbital Debris*, specifies that spacecraft are to limit the generation of orbital debris during operations and spacecraft disposal requirements for all Earth- and Moon-orbiting spacecraft. Earth-orbiting spacecraft must be passivated at the end of the mission prior to disposal and be deorbited within 25 years of end-of-mission (or 30 years after launch, whichever comes first), or be placed in a disposal orbit above

2000 km but not within 300 km of geosynchronous orbit (GEO). Lunar missions must address disposal to avoid increasing the hazard to other spacecraft.

For PMOs, hosted payloads, and FMOs where applicable, where the PI is not responsible for the host mission, information must be included regarding the instrument's contribution to orbital debris and the plan for passivation at the end of operations or in preparation for end-of-mission disposal. In addition, information must be provided identifying system components expected to survive Earth reentry during the post-mission disposal. This will allow NASA to remain in compliance with NPR 8715.6B, *NASA Procedural Requirements for Limiting Orbital Debris,* and NASA-STD-8719.14, *Process for Limiting Orbital Debris*

Requirement 53. As applicable for Earth and Moon orbiters, proposals shall demonstrate satisfaction of requirements to limit the generation of orbital debris during mission operations and the disposal per NPR 8715.6 and NASA-STD-8719.14 (see Appendix B, Section J.7, for additional detail). For PMOs, hosted payloads, and FMOs where applicable; where the PI is not responsible for the host mission; proposals shall describe the instrument's contribution to orbital debris, the plan for passivation at the end of operations or in preparation for end-of-mission disposal, and the system components expected to survive Earth reentry.

5.3.14 Mission Operations Tools and Services

NASA's Advanced Multi-Mission Operating System (AMMOS) comprises a set of tools and services that support the operations of robotic flight missions (see the AMMOS catalog at http://ammos.jpl.nasa.gov/). AMMOS may be proposed, as appropriate. AMMOS tools and services and their long-term sustaining engineering are fully funded by NASA and are provided by NASA free of charge to all missions. Only mission-unique adaptations to the AMMOS must be funded by missions. Use of applicable AMMOS tools is expected, although not required. Points of contact and cost information for these services may be found on the AMMOS website specified above.

It is expected that any mission operations tools or services to be developed by the investigation, and their sustaining engineering, will be described and budgeted in the proposal.

Requirement 54. If a ground/operations system solution other than the AMMOS or mission-unique adaptations to the AMMOS is proposed, it shall be described and budgeted for in the proposal.

5.4 Management Requirements

5.4.1 Principal Investigator

The Principal Investigator (PI) is accountable to NASA for the success of the scientific, exploration, or technology investigation, with full responsibility for its scientific, exploration, or technology and technical integrity, and for its execution within committed cost and schedule. Designation of a Deputy PI is recommended, however is not required.

The PI must be prepared to recommend termination of the investigation when, in her/his judgment, the minimum subset of objectives identified in the proposal as the Threshold Investigation is not likely to be achievable within the committed cost and schedule.

Requirement 55. A proposal shall identify and designate one, and only one, PI as the individual in charge of the proposed investigation.

5.4.2 Project Manager

The Project Manager (PM) oversees the technical and programmatic implementation of the project. The PM works closely with the PI in order to ensure that the mission meets its objectives within the resources outlined in the proposal.

Proposals may designate a Project Manager Alternate. At selection and subject to approval by NASA, the Alternate may be named as the PM. The qualifications of both the PM and the PM Alternate will be evaluated.

NASA will approve the PM at each transition to the next Phase of implementation as part of the KDP approval process.

Requirement 56. A proposal shall identify and designate one, and only one, PM as the individual charged with the responsibility for overseeing the technical and programmatic implementation of the proposed project. Proposals may optionally name a single Project Manager Alternate.

Requirement 57. Proposals shall clearly define the respective roles of the PI and PM.

5.4.3 Management and Organization Experience and Expertise

The qualifications and experience of the PI, PM, Project Systems Engineer (PSE) (if named), Project Scientist (PS) (if named), Project Manager Alternate (if named), and other key members of the PI-led investigation team must be commensurate with the technical and managerial needs of the proposed investigation.

The implementing institutions, selected and overseen by the PI, have the responsibility to ensure that the mission meets schedule and cost constraints. It is the PM and the implementing institutions' responsibility to provide the quality personnel and resources necessary to meet the technical and managerial needs of the mission. The commitment, spaceflight experience, prior experience, and time commitment of the key members of the PI-led investigation team and of the implementing institutions will be assessed against the needs of the investigation.

Requirement 58. Proposals shall identify the management positions that will be filled by key management members. These positions shall include, at minimum, the PI, PM, PSE (if named), Project Manager Alternate (if named) and, where appropriate, the PS and partner leads for substantial efforts. For management positions for which Key Management Team members are named (including the PI and PM), proposals shall describe the qualifications and experience of those team members who occupy those positions. For key management positions for which Key Management Team members are not named, proposals shall describe the qualifications and

experience required of any candidate to occupy those positions. For all positions that will be filled by Key Management Team members, proposals shall demonstrate that the described qualifications and experience are commensurate with the technical and managerial needs of the proposed investigation. The time commitment of each Key Management Team member shall be provided by mission phase.

Requirement 59. Proposals shall describe the qualifications and experience of the primary implementing institutions and demonstrate that they are commensurate with the technical and managerial needs of the proposed investigation.

See Appendix B, Section G, for additional detail.

5.4.4 Risk Management

Proposers must demonstrate clear understanding of specific risks inherent in the formulation and implementation of their proposed investigation and must discuss their approaches to mitigating these risks. Examples of such risks that must be discussed in the proposal are: any new technologies/advanced engineering developments; any nontrivial modifications or upgrades of existing technologies; any validation of heritage technology for the mission context; any manufacturing, test, or other facilities needed to ensure successful completion of the proposed investigation; any need for long-lead items that must be placed on contract before the beginning of Phase C to ensure timely delivery; and any contributions that are critical to the success of the mission.

Requirement 60. Proposals shall define and discuss the major risks to the formulation and implementation of the proposed investigation.

Requirement 61. Proposals shall discuss management approaches to mitigate risks to ensure successful achievement of the investigation objectives within the committed cost and schedule.

The differences between the Baseline Investigation and the Threshold Investigation (see Section 5.2.4) may provide some resiliency to potential cost and/or schedule growth in the proposed formulation and implementation of the investigation. One method of responding to such growth is to descope the mission. Any set of descopes, which still allows the investigation to satisfy the objectives of the Threshold Investigation, may be proposed.

Requirement 62. If the proposed risk management approach includes potential descoping of mission capabilities, the proposal shall include a discussion of the approach to such descopes, including savings of resources (e.g., mass, power, schedule, funding, etc.) by implementing descopes, the decision milestone(s) for implementing descopes and the impact of individual as well as combined descopes to the objectives of the investigation.

Requirement 63. Proposals that include international participation shall address the risk resulting from any international contributions to the proposed mission (see Section 5.7.6 and Section 5.8).

5.4.5 Schedule

Requirement 64. Proposals shall conform to the schedule requirements provided in the applicable PEA.

5.4.6 Compliance with Procurement Regulations by NASA PI Proposals

Proposals submitted by NASA Centers are required to comply with regulations governing proposals submitted by NASA PIs (NASA FAR Supplement (NFS) 1872.308).

Requirement 65. Proposals submitted by NASA Centers shall contain any descriptions, justifications, representations, indications, statements, and/or explanations that are required by the regulations in NFS 1872.308.

See Appendix B, Section J.6, for additional details.

5.5 Investigation Team, Co-Investigators, and Collaborators

5.5.1 Investigation Team

Requirement 66. Proposals shall clearly define the team necessary to successfully conduct the investigation.

5.5.2 Co-Investigators

A Co-Investigator (Co-I) is defined as an investigator who plays a necessary role in the proposed investigation and whose services are either funded by NASA or are contributed by his/her employer.

Every Co-I must have a role that is required for the successful implementation of the investigation, and the necessity of that role must be justified. The identification of any unjustified Co-Is may result in the downgrading of an investigation and/or the offer of only a partial selection by NASA.

Requirement 67. Proposals shall designate all Co-Is, describe the role of each Co-I in the development of the investigation, and justify the necessary nature of the role.

Requirement 68. Proposals shall identify the funding source for each Co-I. If funded by the sponsoring Mission Directorate and Program, costs shall be included in the PI-Managed Mission Cost. If contributed, the costs shall be included in the Total Mission Cost.

5.5.3 Collaborators

A collaborator is an individual who is less critical to the successful development of the investigation than a Co-I. A collaborator must not be funded through the proposal. A collaborator may be committed to provide a focused contribution to the project for a specific task, such as data analysis. If funding support is requested in the proposal for an individual, that individual must not be identified as a collaborator, but must be identified as a Co-I or another category of team member.

Requirement 69. Proposals shall identify and designate all collaborators and describe the role of each collaborator in the development of the mission.

Requirement 70. Proposals shall identify the funding source for each collaborator; the costs shall be included in the Total Mission Cost.

5.6 Education Program Plan, Communications and Outreach Program Plan, and Student Collaborations

5.6.1 Education Program Plan and Communications and Outreach Program Plan

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.

The applicable PEA will state whether an Education Program Plan or Communications and Outreach Program Plan is required and the requirements associated with these plans.

5.6.2 Student Collaborations (optional)

PI-led missions potentially provide active research opportunities for aspiring undergraduate (as well as advanced high school and, on an exceptional basis, graduate) students. The applicable PEA may state that proposals may define a Student Collaboration (SC) that is a separate part of the proposed investigation. SCs may involve students in multiple phases of a mission spanning scientific formulation; mission planning; systems engineering; design and development of flight hardware; qualification, test and integration; and mission operations and data analysis.

An ideal SC provides a hands-on experience for students that focuses on the unique demands of instrument development, flight systems, environments, and operations, and on the opportunity to acquire early knowledge of systems engineering techniques. SC provides the opportunity for authentic, real-world experiences that span development through the operational phases of a mission. Undergraduate SC is a priority because it is at this critical junction that individuals, including from groups traditionally underrepresented or underserved in STEM, make decisions to pursue and persist in degrees that will provide the skills required by the future space science workforce.

As part of the SC, funds may be requested to purchase special equipment, modify equipment, or provide services required specifically for the work to be undertaken. For example, funds may be requested to provide prosthetic devices to manipulate a particular apparatus; equipment to convert sound to visual signals, or vice versa, for a particular experiment; access to a special site or to a mode of transportation (rental services only – no vehicle purchases permitted); a reader or interpreter with special technical competence related to the project; or other special-purpose equipment or assistance needed to conduct a particular project.

SC enhances, but does not reform or redesign individual undergraduate or graduate courses or degree requirements. SC is not a form of teaching or research assistantship. SC must not be proposed to provide whole year or multi-year tuition and stipends normally provided by scholarships or fellowships. SC may be proposed to include the cost of incentives, stipends, travel, equipment or services, etc. designed to enable a student to successfully participate in

Research and Development (R&D). Students supported on SC are not *interns*; they are *associates* who work jointly on the proposed real R&D while receiving appropriate mentoring and other support.

If a proposed investigation is selected, NASA retains the option to fund or not to fund the proposed SC in full or in part. There is no minimum and no maximum allowable cost for a SC. NASA is providing a SC option that is defined to be 1% of the PI-Managed Mission Cost. Contributions to the SC are permitted. The proposed NASA cost of the SC, up to the SC incentive, will be outside of the PI-Managed Mission Cost. If the SC costs NASA more than the SC incentive, then the balance of the NASA cost of the SC must be within the PI-Managed Mission Cost. SC resources, as an addition to a mission's implementation, are not available to solve mission cost overrun issues. SC provides no cost-savings to a NASA mission.

A proposed SC will be evaluated only for its impact on mission feasibility. The merit of the proposed SC will be evaluated later, as part of the reviews leading to KDP-B; see SMD Student Collaboration document in the PEA-specific Library. The three SC merit review criteria that will be evaluated are:

- *Quality, Scope, Realism, and Appropriateness*. Student level and the project's SC research objectives are both clearly defined. SC mentors and supervisors are identified and have clear lines of responsibilities. A description of what constitutes, to the proposer, a successful SC effort.
- *Diversity.* SC participant recruitment and retention (R&R) practices or proposed inclusion strategies are described. Proposed R&R likely to reach disadvantaged individuals and/or those from groups underrepresented in STEM.
- *Evaluation*. The SC has proposed evaluation methodology based on techniques appropriate to the SC activities proposed. The evaluative processes will document outputs and intended outcomes and use metrics to demonstrate progress or explain the lack of achievement by the SC component.

To address the merit evaluation, SC proposals will be required to include appropriate plans and budgets for evaluation, participant recruitment and retention, mentoring, and oversight of students to maximize their learning and describe R&D conduct, particularly design and development of flight systems; assembly, integration and test; and mission operations and data analysis that enhances without interference the mission's success. Provision of analogous information in the proposal to the applicable PEA is recommended but not required.

Requirement 71. If a proposal contains a SC, the proposal shall demonstrate that the proposed SC is clearly separable from the proposed Baseline and Threshold Investigations; will not increase the mission development risk; and will not impact the investigation in the event that the SC is not funded, fails during flight operations, or that the SC encounters technical, schedule, or cost problems during development (see Appendix B, Section I.3, for additional details).

Requirement 72. If a proposal contains a SC, the proposal shall identify the funding set aside for the SC. This funding may be outside the PI-Managed Mission Cost up to the student collaboration incentive or as specified in the applicable PEA, and any SC costs beyond the student collaboration incentive shall be within the PI-Managed Mission Cost.

5.7 Cost Requirements

5.7.1 PI-Managed Mission Cost and Total Mission Cost

The applicable PEA states the PEA-specific Cost Cap or other cost constraints for the PI-Managed Mission Cost, including all mission phases as applicable (see Section 4.3).

For each selection, and unless otherwise stated in the selection letter, the selected investigation's Cost Cap will be set at the proposed PI-Managed Mission Cost.

Requirement 73. Proposals shall include the proposed PI-Managed Mission Cost and the proposed Total Mission Cost in all required AO cost tables (see Appendix B, Section H, for required AO cost tables).

Requirement 74. The proposed costs shall comply with the PEA-specific Cost Cap or other cost constraints stated in the applicable PEA.

Requirement 75. No more than 25% of the PI-Managed Mission Cost shall be spent prior to KDP-C (Confirmation).

For Partner Missions of Opportunity or hosted payloads, the PI assumes all risk for delays in the implementation of the parent/host mission and, therefore, must propose appropriate reserves for such schedule contingencies. Following the completion of Phase A, but prior to final selection by the parent mission's sponsoring organization, and unless specified otherwise in the PEA, NASA funding for additional work will be limited to $250K/year.

5.7.2 Cost Estimating Methodologies and Cost Reserve Management

As the provision of cost details is not anticipated until later in formulation, proposals may use estimates derived from models or cost estimating relationships from analogous missions (see Appendix B, Section H, for additional details). However, the credibility of proposed costs is likely to be enhanced by the application of methodologies that are typically employed for mature projects.

Requirement 76. Proposals shall identify the methodologies (e.g., cost models, cost estimating relationships of analogous missions, etc.) and rationale used to develop the proposed cost.

Requirement 77. Proposals shall include a discussion of sources of estimate error and uncertainty in the proposed cost and management approaches for controlling cost growth.

Proposals that are unable to show adequate unencumbered cost reserves are likely to be judged a high cost risk and not selected. For the purpose of this AO, the Phases A/B/C/D unencumbered cost reserves percentage on the PI-Managed Mission Cost is measured against the cost to complete through Phases A/B/C/D. The numerator is the amount of unencumbered cost reserves for Phases A/B/C/D, not including funded schedule reserve. The denominator is the PI-Managed Mission Cost to complete Phases A/B/C/D including the cost of technical design margins, funded schedule reserves, and encumbered cost reserves, but not including unencumbered cost reserves.

The required minimum Phases A/B/C/D unencumbered cost reserves percentage will be specified in the applicable PEA.

Adequate unencumbered cost reserves must be demonstrated at each of the following milestones: KDP-A (demonstrated in the proposal), KDP-B, KDP-C (the independent cost estimate for Confirmation), and KDP-D (at the end of Phase C).

Requirement 78. Proposals shall identify and justify the adequacy of the proposed Phases A/B/C/D unencumbered cost reserves. Proposals shall demonstrate at least the PEA-specific minimum Phases A/B/C/D unencumbered cost reserves percentage and shall demonstrate an approach to maintaining required unencumbered cost reserves through subsequent development phases.

The required minimum Phases E and F unencumbered cost reserves percentage measured against the Phases E and F cost (if any) will be specified in the applicable PEA.

Requirement 79. Proposals shall identify and justify the adequacy of the proposed Phases E and F unencumbered cost reserves. Proposals shall demonstrate at least the PEA-specific minimum Phases E and F unencumbered cost reserves percentage measured against the Phases E and F cost (if any).

5.7.3 Work Breakdown Structure

Requirement 80. Proposals shall provide a Work Breakdown Structure (WBS) that conforms to the standard prescribed in Appendix G of NPR 7120.5E. Costs for most elements shall be specified to WBS Level 2. Exceptions are the costs of elements that explicitly appear only at a level below WBS Level 2; these exceptions include individual instruments, unique flight system elements, the use of NASA or NASA-procured tracking and communications, and data analysis/archiving (see Appendix B, Section H, for additional details).

5.7.4 Master Equipment List

Requirement 81. Proposals shall include a Master Equipment List (MEL) summarizing all spacecraft system element components and individual instrument element components to support validation of proposed mass estimates, power estimates, contingencies, design heritage, and cost (see Appendix B, Section J.8, for additional details).

5.7.5 Full Cost Accounting for NASA Facilities and Personnel

For the purpose of calculating the full cost of NASA provided services, proposal budgets from NASA Centers, whether as the proposing organization or as a supporting organization, are to include within the PI-Managed Mission Cost all costs normally funded by a Project under NASA's full cost accounting practices, including civil servant labor (salaries and benefits), civil service travel, and procurements. All of these costs must be clearly identified by year within the budget justification section of the proposal.

Estimated NASA Center Management and Operations (CM&O) overhead costs must also be included within the PI-Managed Mission Cost to enable a level playing field for all proposers. Per NASA HQ policy guidance signed in June 2010 by the Associate Administrator for Mission

Support Directorate and by the Agency Chief Financial Officer, all NASA Centers are to use an identical CM&O burden rate per "equivalent head"; this CM&O burden rate is specified in the applicable PEA. For years after FY specified in the PEA, this number must be inflated. As per Agency policy, this rate must be applied as a "cost per equivalent head" to all Civil Servant Full Time Equivalents (FTEs) plus on or near-site contractor Work-Year Equivalents (WYEs) associated with the proposal. The estimated FTEs and WYEs per fiscal year, and the resulting CM&O burden, must be identified in a separate table within the budget justification section of the proposal. The CM&O rate will not change from year to year in Fiscal Year (FY) dollars, though in Real Year (RY) terms, it will adjust for inflation.

The applicable CM&O burden rate will be provided in the applicable PEA.

The CM&O burden costs must be clearly denoted in all budget tables. These costs may not be included or rolled into any other budget lines in such a way that they become unidentifiable.

Do not include within the cost proposal, or within the PI-Managed Mission Cost, any estimate for Agency Management and Operations (AM&O, a.k.a. NASA HQ overhead).

A table stating the cost elements for NASA Center Budget Proposals in response to the SALMON-3 AO and the applicable PEA is found at the PEA-specific Library.

Requirement 82. Proposals including costs for NASA Centers shall conform to the full cost policy stated in this section. Each element of the NASA Center costs (direct labor, travel, procurements) shall be separately identified by year.

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 an effort complementary to the proposed investigation, the value of the contribution(s) must be estimated, and the funding source(s) must be identified. For SMD-sponsored solicitations, the complementary effort must not be within SMD.

Requirement 83. If any NASA funded item(s) or services are considered as contributed costs, then the proposal shall estimate the value of the contribution(s) and shall identify the funding source(s).

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 (FASAB) and available in the PEA-specific Library.

Requirement 84. Proposals including costs for non-NASA Federal Government agencies shall follow the applicable accounting standards.

5.7.6 Contributions

Contributions from sources other than those provided in the PEA, U.S. or non-U.S., are welcome. These may include, but are not limited to, labor, services, contributions to the instruments or the spacecraft(s), and/or alternative access to space (e.g., host spacecraft, launch vehicle, and/or launch services). Such contributions will not be counted against the PI-Managed Mission Cost, but they must be included in the calculation and discussion of the Total Mission Cost (Section 4.3.2).

The applicable PEA may specify any limits to the amount of contributions and unallowable sources of contributions. PEAs sponsored by SMD do not permit contributions of funding from SMD programs other than the funding offered through the applicable PEA.

Values for all contributions of property and services must be established in accordance with applicable cost principles. The cost of contributed hardware must be estimated as either: (i) 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 (ii) the cost associated with the reproduction and modification of the item (i.e., any recurring and mission-unique costs), if this is not a first-time development. If an item is being developed primarily for an application other than the one in which it will be used in the proposed investigation, then it may be considered as falling into the second category (with the estimated cost calculated as that associated with the reproduction and modification alone). If Government Furnished Equipment (GFE) is being contributed, then permission must be obtained from the appropriate Agency or Program; the permission must be included in the Letter of Commitment.

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

Requirement 85. If a proposal includes one or more contributions, the proposal shall separately identify all contributions, the organizations providing the contributions, and the organizations providing the funding for the contributions; the costs for the contributions shall be separately identified within the Total Mission Cost.

Requirement 86. If a proposal includes one or more contributions, the total value of the contributions shall be established in accordance with the applicable and stated cost principles and shall comply with any applicable PEA-specified cap on the sum of all contributions.

Letters of Commitment are required from each organization responsible for a contribution (for U.S. organizations, see Section 5.9.1.1; for non-U.S. contributing organizations, see Section 5.8.2).

The requirement for institutional Letters of Commitment for contributions does not apply to contributed support for collaborators; no institutional Letters of Commitment are required with

the proposal for collaborator support. The requirement for personal statements of commitment from collaborators is given in Section 5.9.2 and Requirement 98.

A contributed item that is essential for the success of the proposed investigation and/or is in the critical path of mission development is a risk factor. Risks include 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. When no mitigation is possible, this should be explicitly acknowledged and the rationale for accepting the unmitigated or residual risk should be explicitly stated.

Requirement 87. If a proposal includes contributions that are essential to the success of the proposed investigation or in the critical path, the proposal shall include: (i) demonstrations of clear and simple technical and management interfaces in the proposed cooperative arrangements, (ii) explicit evidence that the proposed contributions are within the contributors' scientific and technical capabilities, and (iii) contingency plans for dealing with potential failures of proposed cooperative arrangements or, where no mitigation is possible, an explicit acknowledgement to that effect and an explicit rationale for accepting the risk.

For proposals with contributed access to space (Section 5.3.8), all requirements in Appendix B must be met. Where a resource is being contributed (e.g., launch services, host spacecraft), all of the information required might not be available to the proposer (e.g., Appendix B, Section F.2). Nevertheless, the proposal must provide sufficient information on the availability of that resource for NASA to assess whether the mission's resource requirements can be met and how the PI will assure the mission's success.

Requirement 88. If a proposal includes contributed access to space, it shall provide sufficient information for NASA to assess whether the mission's resource requirements can be met and how the PI will assure the mission's success.

5.8 Non-U.S. Participation Requirements

5.8.1 Overview of Non-U.S. Participation

NASA solicits research proposals from both U.S. and non-U.S. sources (see NFS 1835.016-70) with some restrictions (see Section 4.2.2).

NASA's policies for international cooperation in space research projects may be found in NPD 1360.2B, *Initiation and Development of International Cooperation in Space and Aeronautics Programs*. The characteristics of successful international cooperation include mutual benefits, clearly defined division of responsibilities, responsibilities for each participant within known capabilities, recognition of export control laws prohibiting the unwarranted transfer of technology abroad, and no-exchange-of-funds. Because space research projects generally involve major investments of resources, and because NASA is a Government agency, NASA's counterparts will generally be non-U.S. Government agencies rather than non-U.S. universities or private organizations.

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 appropriate non-U.S. entity. Non-U.S. proposers, whether as primary proposers or as participants in U.S. research efforts, must arrange for non-U.S. financing for their portion of the research.

The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted.

5.8.2 General Guidelines Applicable to Non-U.S. Proposals and Proposals that include 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, U.S. and non-U.S., must be typewritten in English and must comply with all submission requirements stated in the applicable PEA, this AO and Appendix B of this AO.

Requirement 89. Unless otherwise noted, proposals from non-U.S. entities shall not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan that covers only the participation of the U.S. entity shall be included. Proposals from U.S. institutions with non-U.S. participation shall include a cost plan that only covers U.S. entities.

Requirement 90. Proposals from non-U.S. entities and proposals from U.S. entities that include non-U.S. participation shall be formally endorsed, through Letters of Commitment, by the responsible funding agency in the country of origin. The required elements in a Letter of Commitment for a contribution are given in Section 5.9.1.1. In addition to these required elements, endorsements from foreign entities shall indicate that the proposal merits careful consideration by NASA and that, if the proposal is selected, sufficient funds will be made available to undertake the proposed activity. Officials who are authorized to commit the resources of the non-U.S. funding agencies shall sign these Letters of Commitment.

Contributions from non-U.S. sources offer benefits but also represent complexity and risk to a project. The benefits of proposed contributions will be assessed as they contribute to scientific and technical merit and feasibility. The stability and reliability of proposed partners and the appropriateness of any proposed contribution will be assessed outside of the evaluation process as a programmatic risk element in the proposal.

Requirement 91. Proposals from U.S. proposers shall include a discussion of mitigation plans, where possible, for the failure of funding or contributions to materialize when they are outside the control of the PI. When no mitigation is possible, this shall be explicitly acknowledged and the rationale for accepting the unmitigated or residual risk shall be explicitly stated.

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 should be weighted by likelihood and will be considered by NASA to be encumbered. When no mitigation is possible, this must be explicitly acknowledged and the rationale for accepting the unmitigated or residual risk must be explicitly stated. In addition to budget and technical risk, non-U.S. contributions introduce schedule risk for implementing 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. NASA will not normally initiate development of any international agreements until after the selection decision.

Any proposed non-U.S. participation must be described at the same level of technical, schedule, and management detail as that of U.S. partners. A cost plan for the non-U.S. participation should not be included. Failure to document technical 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.

Requirement 92. To the maximum extent practical, and allowing for any PEA-specific exemptions, any proposed non-U.S. contribution essential to the success of the proposed investigation shall be described at the same level of detail as those of U.S. partners.

Requirement 93. 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 any non U.S. participation and method for estimating value (detailed budget not required), and (v) cross-reference to any Letters of Commitment in the proposal appendix. Proposals with non-U.S. participation shall clearly describe the flow of design requirements (potentially export controlled information) and hardware between U.S. and non-U.S. participants. This description shall take the form of an "exploded diagram" (see Appendix B, Section J.4).

5.8.3 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 International and Interagency Relations will arrange with the non-U.S. sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsor will each bear the cost of discharging its respective responsibilities.

It is the policy of NASA to establish formal agreements with non-U.S. partners in cooperation on flight missions. Owing to the short duration of the period between selection and the end Phase A, it is not possible for NASA to conclude an international agreement prior to the end of Phase A. In some cases, interim agreements may be put in place, after the conclusion of Phase A, until a more permanent arrangement is reached.

Requirement 94. If applicable, proposals shall demonstrate that Phase A can be completed in the absence of an international agreement.

5.8.4 Export Control Guidelines Applicable to Non-U.S. Proposals and Proposals that include Non-U.S. Participation

Requirement 95. Non-U.S. proposals and U.S. proposals that include non-U.S. participation shall describe plans for compliance with U.S. export laws and regulations, *e.g.,* 22 CFR parts120-130 and 15 CFR parts 730-774, as applicable to the circumstances surrounding the particular non-U.S. participation (see Appendix B, Section J.5, for additional details).

5.9 Additional Proposal Requirements

5.9.1 Institutional Letters of Commitment

Institutional Letters of Commitment signed by an institutional official must be provided from (i) all organizations offering contributions of goods and/or services (both U.S. and non-U.S.) on a no-exchange-of-funds basis and (ii) all major organizational partners in the proposal regardless of source of funding. See Appendix B, Section J.2, for additional details.

5.9.1.1 Institutional Letters of Commitment for Contributions

The required elements in an Institutional Letter of Commitment for a contribution are: (i) evidence that the institution and/or appropriate Government officials are aware and supportive of the proposed investigation; (ii) a precise description of what is being contributed by the partner and what assumptions are being made about NASA's role; (iii) a statement that the organization intends to provide the contribution or required funding for the investigation, if it is selected by NASA; (iv) the strongest possible statement of financial commitment from the responsible organization to assure NASA that all contributions will be provided as proposed, including whether the contribution and/or funding has been approved and/or what further decisions must be made before the funding is committed by the partner; and (v) a signature by an official authorized to commit the resources of the organization for participation in the investigation (if it is not clear from the signer's title that the signer has the necessary authority, then the signer's authority should be explicitly stated in the Letter).

Requirement 96. For all U.S. organizations offering contributions, proposals shall include appropriate Letters of Commitment from both the organization(s) providing any contributed property or service and from the organization(s) providing any required funding.

Additional requirements for Institutional Letters of Commitment from non-U.S. organizations offering contributions are given in Section 5.8.2.

5.9.1.2 Institutional Letters of Commitment for Major Partners

Major partners are the organizations, other than the proposing organization, responsible for providing research leadership, project management, system engineering, major hardware elements, science instruments, integration and test, mission operations, and other major products or services as defined by the proposer. All other participants are regarded as not major. Major partners are listed in Section (i) of the Table of Proposal Partners (see Appendix B, Section J.1, for additional details).

The required elements in an Institutional Letter of Commitment for a major partner are: (i) a statement of commitment for the effort that is assigned to that participant in the proposal, (ii) a description of what is being provided, and (iii) a signature by an official authorized to commit the organization.

Requirement 97. Unless otherwise explicitly exempted elsewhere in the applicable PEA, proposals shall include a Letter of Commitment from each major partner in the proposal, regardless of source of funding. For major partners providing one or more contributions, only a single Letter of Commitment is required.

5.9.2 Personal Letters of Commitment

No Personal Letters of Commitment are required in the proposal. No Institutional Letters of Commitment are required for individuals in the proposal, unless the individual's effort is contributed, the individual is part of the Proposal Team, and the individual is not a collaborator. The Proposal Team is defined to include, but not be limited to, all members of the Key Management Team, any Co-I who is not part of the Key Management Team, and any collaborator who is not part of the Key Management Team. Proposal Team members are identified on the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) proposal cover page. Proposal team members indicate their commitment to the proposed investigation through NSPIRES.

Requirement 98. Every proposal team member shall indicate his/her commitment to the proposed investigation and specifically to the role, responsibilities, and participating organization proposed for him/her, through NSPIRES. By committing, Proposal Team members are certifying that their linked organization in NSPIRES is correct, for the purposes of the proposal.

5.9.3 Export Controlled Material in Proposals

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 are, therefore, subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR parts 120-130. Consideration must also be given to the Export Administration Regulations (EAR), 15 CFR parts 730-774, issued by the United States Department of Commerce, Bureau of Industry and Security (BIS) under laws relating to the control of certain exports, reexports, and activities.

While inclusion of export controlled material in proposals is not prohibited, proposers are advised that the inclusion of such material in proposals may complicate NASA's ability to evaluate proposals, as NASA may employ the services of non-U.S. persons (e.g., individuals who are neither U.S. citizens nor lawful permanent residents of the U.S.) to review proposals submitted in response to this AO and the applicable PEA. In order to enable proper evaluation of proposals, any export-controlled information subject to ITAR or EAR must be marked with a notice to that effect.

Requirement 99. If the proposal contains export controlled material, the following statement shall be prominently displayed in Section A of the proposal (following the Proposal Summary Information):

> "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. The identified information (data) is (are) printed in a red font and figure(s) and table(s) containing the identified information (data) is (are) placed in a red-bordered box"

Note that it is the proposer's responsibility to determine whether any proposal information is subject to the provisions of ITAR or EAR. Information about U.S. export regulations is available at http://www.pmddtc.state.gov/ and at http://www.bis.doc.gov/.

5.9.4 Classified Materials

Requirement 100. Proposals submitted in response to this AO, as well as the proposed investigations and all proposed technologies, shall be unclassified. The proposal shall be complete including an unclassified appendix regarding heritage (see Appendix B, Section J.9, for further details).

In order to increase the capabilities of investigations proposed in response to this AO and the applicable PEA while minimizing the development and operations risks within the PI-Managed Mission Cost, proposers may choose to leverage technology that was developed by other institutions and agencies as well as technology developed by NASA and NASA-funded partners. It is recognized that some technology relevant to proposed missions may have classified heritage.

Proposals that propose the use of hardware with classified heritage may provide a classified proposal appendix to NASA to allow validation of classified heritage claims. The classified appendix regarding heritage may include Letters of Validation for classified heritage claims from technology development sponsors. The proposer is responsible for determining what information is classified and what information is unclassified; any classified information provided to NASA must be handled appropriately to include marking, declassification information and according to the applicable Security Classification Guide (SCG) or similar document.

When a proposer submits a classified appendix regarding heritage in addition to a complete proposal, the evaluation process (Section 7.1.1) will be supplemented. At least one evaluator with appropriate clearance and relevant expertise will review the classified appendix regarding heritage; this evaluator may be a member of the evaluation panel or this evaluator may be a specialist reviewer. All findings generated during the review of the classified appendix regarding heritage will be unclassified, and these findings will be provided as input for assessing the *Technical, Management, and Cost (TMC) Feasibility of the Investigation Implementation*. No clarifications will be requested concerning findings from evaluation of the classified appendix regarding heritage.

The entire proposal including the unclassified appendix regarding heritage will be read and evaluated by the entire evaluation panel. The evaluation panel will not have access to the classified appendix regarding heritage. Proposers are strongly encouraged to provide as much information and detail as possible on their technology heritage in the unclassified appendix regarding heritage.

NASA will endeavor to use the information in the classified appendix regarding heritage to better understand the proposed investigation. However, NASA cannot guarantee that this process will be fully successful in informing the review panel of the impact of a classified appendix regarding heritage that they have not read.

If the proposer wishes to send a classified appendix regarding heritage to NASA, it must be provided to NASA HQ separately from the proposal A single copy of the classified appendix regarding heritage must be submitted along with a cover letter referencing the submitted proposal by name, PI, and proposing organization. The proposer is responsible for obtaining any "need to know" permission for at least one reviewer with appropriate clearance and relevant expertise to evaluate the classified appendix regarding heritage; that permission should be discussed in the cover letter. The proposer assumes all responsibility for determining the appropriate security clearance and method of delivery to NASA HQ of the classified appendix regarding heritage. The classified appendix regarding heritage must be handled and delivered to NASA HQ in compliance with NPR 1600.1A, *NASA Security Program Procedural Requirements*.

Requirement 101. Proposers that choose to submit a classified appendix regarding heritage shall submit the appendix and a cover letter to NASA HQ no later than the Deadline for Receipt of Proposal on CD-ROMs stated in the applicable PEA. The proposer shall determine the appropriate security classification for the classified appendix, the proposer shall obtain any permission required for a reviewer to read the classified appendix, and the proposer shall ensure that all appropriate security requirements are followed in delivering the classified appendix to NASAHQ.

The point-of-contact for the applicable PEA must be notified of the intent to submit a classified appendix regarding heritage, the level of classification to aid in receipt of the information, and any interest in submittal via a classified email system in lieu of physical delivery.

The requirements on content, format and length of the classified appendix regarding heritage are the same as those for the unclassified appendix regarding heritage included in the proposal (see Appendix B, Section J.9, for further details) with the exceptions that Letters of Validation may be included in the classified appendix regarding heritage.

The address for delivery of the package containing the classified appendix will be provided in the applicable PEA. The package containing the classified appendix should be sent to NASA HQ by whatever means is appropriate (e.g., courier, U.S. Registered Mail, etc.) with coordination in advance with the receiving Facility. The Heritage Appendix should indicate that a classified appendix has been submitted.

6. Proposal Submission Information

6.1 Preproposal Activities

6.1.1 Preproposal Conference

Each PEA will state whether a Preproposal Conference will be held and whether it will be held in person or via web/teleconference. If a preproposal conference is to be held, information including date and logistics will be made available no later than 2 to 4 weeks after the PEA release on the PEA-specific Acquisition Homepage.

All interested parties may participate. Any expenses and arrangements for participating is this meeting are the responsibility of the attendees. Note that travel and associated costs of

participation 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 and the applicable PEA. Questions should be sent to the NASA POC identified in the applicable 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 PEA-specific Acquisition Homepage no later than 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 the applicable PEA. Answers will be provided no later than 10 days before the proposal due date.

6.1.2 Notice of Intent to Propose

Each PEA will state whether a Notice of Intent (NOI) to propose is required. NOIs are utilized to facilitate planning of the proposal evaluation. When not required, NASA strongly encourages all prospective proposers to submit a Notice of Intent (NOI). NOIs are due by 11:59 pm Eastern Time on the date specified in the applicable PEA. Material in a NOI is deemed confidential and will be used for NASA planning purposes only.

An NOI is submitted electronically by entering the requested information at http://nspires.nasaprs.com/. Registration on the NSPIRES website is required to submit NOIs and proposals. Proposers who experience difficulty in using the NSPIRES site should contact the Help Desk by email at nspires-help@nasaprs.com for assistance. Proposers should subscribe to the SMD/STMD/HEOMD general distribution lists in NSPIRES in order to receive notices of any SMD/STMD/HEOMD amendments. In addition, proposers are encouraged to frequently check the SALMON-3 NSPIRES webpage, the SALMON-3 Acquisition Homepage (http://soma.larc.nasa.gov/salmon-3), the PEA-specific NSPIRES webpage, and PEA-specific Acquisition Homepage for updates.

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, email address, and institutional affiliation of the PI.

(b) Full names and institutional affiliations of each known Proposal Team member. If any Proposal Team members are from non-U.S. institutions, the vehicle by which these people expect to be funded should be identified in the comments box on the NOI form.

(c) Answers to PEA-specific questions, such as Type of MO. For a given PEA, each NOI and proposal can only be submitted as a single Type of MO.

(d) Use the NSPIRES NOI "Summary" Section to provide a brief statement (4000 characters or fewer) covering the following:
   (i) Science, exploration, or technology objectives of the proposed investigation;
   (ii) General design or architecture of the investigation;

(iii) Instruments that may be included in the payload; and
(iv) Identification of any new technologies that may be employed as part of the investigation.

(e) 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 communicate any changes to the investigation team, between NOI and proposal submission, to the point of contact identified in the applicable PEA. Submitting an NOI does not commit the team to submitting a proposal.

6.1.3 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 Teaming Interest page accessible from the SALMON-3 AO Acquisition Homepage (see address given in Section 6.1.4) have expressed an interest in teaming with other organizations on SALMON-3 AO proposals. This is not a comprehensive list of organizations that are capable of teaming; it 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.

6.1.4 The SALMON-3 Acquisition Homepage

The SALMON-3 Acquisition Homepage, available at http://soma.larc.nasa.gov/salmon-3 provides information and updates during the SALMON-3 AO solicitation process. It provides links to the SALMON-3 AO and PEA solicitations, any pertinent announcements, SALMON-3 AO specific questions and answers, the teaming interest list, and PEA-specific Acquisition Homepages.

Clarifications and amendments to the SALMON-3 AO and any individual PEA will be posted on the NSPIRES website. A link will be provided on the SALMON-3 Acquisition Homepage to the NSPIRES index page for the PEA.

6.1.5 PEA-Specific Acquisition Homepage and PEA-Specific Library

A PEA-specific Acquisition Homepage will provide updates and any PEA addenda during the applicable PEA solicitation process. It will provide links to the applicable PEA, any pertinent announcements, the Preproposal Conference, PEA-specific Library, PEA-specific questions and answers, and the list of potential teaming partners.

Any clarifications or amendments to the PEA will be posted on the NSPIRES website. A link will be provided on the PEA-specific Acquisition Homepage to the NSPIRES index page for the PEA.

The PEA-specific Library will provide additional regulations, policies, and background information related to the applicable PEA.

6.1.6 Point of Contact for Further Information

Inquiries specific to a PEA should be addressed to the PEA-specific Point of Contact (POC) identified in each PEA. All inquiries regarding this AO should be directed to the SALMON-3 AO POC as designated in this section. Inquiries may be sent by email; the character string "SALMON-3 AO" (without quotes) should be included in the subject line of all transmissions.

General AO inquiries may be addressed to the SALMON-3 AO POC**:**

Dr. Jeffrey Newmark
Science Mission Directorate
NASA Headquarters
Washington, DC 20546-0001
Tel: 202-358-0684
Email: jeffrey.newmark@nasa.gov

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

6.2 Proposal Preparation and Submission

6.2.1 Structure of Proposals

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

Requirement 102. Proposals shall conform to the uniform proposal format outlined in Appendix B.

6.2.2 Certifications

The authorizing institutional signature on the proposal certifies that the proposing institution has read and is in compliance with the required certifications printed in full in Appendix H. Therefore, it is not necessary to separately submit these certifications with the proposal.

If the certifications need to be amended, they may be submitted as an additional proposal appendix.

6.2.3 Submission of Proposals

Requirement 103. Proposals shall be submitted no later than the proposal submittal deadline specified in the applicable PEA.

Requirement 104. Electronic proposal files (see Appendix B) shall be submitted electronically via NASA's master proposal database 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.

Requirement 105. In addition to electronic submission, two identical, clearly labeled CD-ROMs that contain electronic proposal file(s) and Microsoft Excel files of tables (see Appendix B), shall be delivered to the following address by the Deadline for Receipt of Proposal on CD-ROMs specified in the applicable PEA.

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

Telephone for commercial delivery: 202-479-9030

NSPIRES will notify proposers virtually immediately upon successful submission of the electronic proposal. NASA will notify proposers that their CD-ROMs have been received within two weeks of the submittal. Proposers who have not received this confirmation within two weeks after submittal of their proposals should contact the POC of the applicable PEA.

Proposals received after the submittal deadline will be treated in accordance with Appendix A, Section VII.

6.2.4 Electronic Submission of Proposal Summary Information

This AO requires that proposal summary information, referred to as the Electronic Cover Page, must be submitted electronically through NSPIRES, NASA's master proposal database system located at http://nspires.nasaprs.com/. This data site is secure and all information entered is strictly for NASA's use.

Potential proposers should access this site well in advance of the proposal due date to familiarize themselves with its structure and to enter the requested identifier information. Every individual named as a Proposal Team member on the proposal's Electronic Cover Page must be registered in NSPIRES. Such individuals must register themselves; that is, no one may register a second party, even the PI of a proposal in which that person is committed to participate. The proposal's Electronic Cover Page must be submitted electronically by one of the officials at the proposing 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 NSPIRES. Such registration must be performed by the organization's Electronic Business Point-of-Contact (EBPOC) in the System for Award Management (SAM).

Requirement 106. The proposing organization and all individuals named as Proposal Team members on the Electronic Cover Page shall be registered in NSPIRES.

All Proposal Team members must indicate their commitment to the proposed investigation through NSPIRES (see Requirement 98).

Frequently Asked Questions (FAQs) on the use of NSPIRES can be accessed through the NSPIRES Proposal Online Help site at http://nspires.nasaprs.com/external/help.do.

Additional instructions for creating the Electronic Cover Page are given in Appendix B, Section A.2.

7. Proposal Evaluation, Selection, and Implementation

7.1 Overview of the Proposal 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 and the applicable PEA. Additional compliance checks occur during the evaluation process. Proposals that do not comply may be declared noncompliant and returned to the proposer 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 that these be submitted as part of a proposal.

Compliant proposals will be evaluated against the criteria specified in Section 7.2 and the applicable PEA by panels of individuals who are peers of the proposers. Proposals will be evaluated by more than one panel (e.g., a science/exploration/technology panel and a technical/management/cost panel). Panel members will be instructed to evaluate every proposal independently without comparison to other proposals. These panels may be augmented through the solicitation of nonpanel (mail-in) reviews, which the panels have the option to accept in whole or in part, or to reject. PEA-specific Proposal Evaluation Plans will generally be posted on the PEA-specific Acquisition Homepage upon the release of the final version of the PEA.

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 TMC Feasibility of the Proposed Investigation Implementation (see Section 7.2.4), NASA will request clarification on specific, potential major weaknesses 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 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. The applicable PEA will state whether NASA is requesting clarifications on potential major weaknesses on one of the *Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation or the Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation* criteria or both.

7.1.2 Categorization and Steering Process

NASA will convene a Categorization Committee, composed wholly of Civil Servants and Intergovernmental Personnel Act appointees (some of whom may be from Government agencies other than NASA) and appointed by the Associate Administrator(s) for the appropriate Mission

Directorate(s). The Categorization Committee will consider the *Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation*, the *Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation* and the *TMC Feasibility of the Proposed Investigation Implementation* evaluation results and, based on the evaluations, categorize the proposals in accordance with procedures required by NFS 1872.403-1(e). The categories are defined as follows:

Category I. Well-conceived and scientifically and technically sound investigations pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and data that 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. 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 that are recommended for rejection for the particular opportunity under consideration, whatever the reason.

NASA will convene a Steering Committee, composed wholly of Civil Servants and Intergovernmental Personnel Act appointees (some of whom may be from Government agencies other than NASA) and appointed by the Associate Administrator(s) for the appropriate Mission Directorate(s). The Steering Committee will then review the results of the evaluations and categorizations. The 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 supporting materials.

7.1.3 Selection Process

After the review by the Steering Committee, the final evaluation results will be presented to the appropriate Mission Directorate Associate Administrator(s), who will make the final selection(s). The Selection Official(s) may consult with senior members of the mission directorate(s) and the Agency concerning the selections.

As part of the selection process, a decision will be made as to whether or not any Category III proposals will receive funding for further development.

7.2 Evaluation Criteria

7.2.1 Overview of Evaluation Criteria

The evaluation criteria below will be used to evaluate proposals as described in Section 7.1. For a PMO 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:

- Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation;
- Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation; and
- Technical, Management, and Cost (TMC) Feasibility of the Proposed Investigation Implementation.

The proposal categorizations, discussed in Section 7.1.2, will be based on these criteria. Unless the PEA specifies otherwise, for categorization, Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation is weighted approximately 40%, Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation is weighted approximately 30%, and TMC Feasibility of the Proposed Investigation Implementation 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 rating. The adjectival summary rating for the first two criteria (Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation and Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation) will be reported as Excellent, Very Good, Good, Fair, or Poor, as defined in the table below. The specific PEA will clarify whether or not half-step ratings are utilized.

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, TMC Feasibility of the Proposed Investigation Implementation 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. Investigation 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.

7.2.2 Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation

The information provided in a proposal will be used to assess the intrinsic science, exploration, or technology merit of the proposed investigation. Scientific, exploration, or technology merit will be evaluated for the Baseline Investigation and the Threshold Investigation; Science-Exploration-Technology Enhancement Options beyond the Baseline Investigation will not contribute to the assessment of the intrinsic merit of the proposed investigation. The factors for intrinsic merit include the following:

- Factor A-1. Compelling nature and priority of the proposed investigation's science, exploration, or technology 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 impact of the investigation on program, Agency, and national science, exploration, or technology 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 science, exploration, or technology progress in the context of other ongoing and planned missions; the relationship to the other elements of NASA's 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 science, exploration, or technology 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 success.
- Factor A-4. Science, exploration, or technology value of the Threshold Investigation. This factor includes the intrinsic value of the Threshold Investigation using the standards in the first factor of this section and whether that value is sufficient to justify the proposed cost of the investigation.
- Factor A-5. Merit of any Science-Exploration-Technology Enhancement Options (SEOs), if proposed. This factor includes assessing the potential of the selected activities to enlarge the impact of the investigation. Although evaluated by the same panel as the balance of Intrinsic Merit factors, this factor will not be considered in the overall criterion rating.
- Factor A-6. Merit of any PI-developed Technology Demonstration Opportunities (TDOs), if proposed. This factor includes assessing the potential of the TDO(s) to enlarge the impact of the investigation and/or the value to future investigations of demonstrating the selected technology. Although evaluated by the same panel as the balance of Intrinsic Merit factors, this factor will not be considered in the overall criterion rating.

Factors A-1 through A-3 are evaluated for the Baseline Investigation assuming it is implemented as proposed and achieves technical success. Factor A-4 is similarly evaluated for the Threshold Investigation.

This evaluation will result in narrative text, including specific major and minor strengths and weaknesses, as well as an appropriate adjectival rating for the Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation.

7.2.3 Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation

The information provided in a proposal will be used to assess the merit of the plan for completing the proposed investigation, including the experiment implementation merit, feasibility, resiliency, and probability of science, exploration, or technology success of the

proposed investigation. The factors for experiment implementation merit and feasibility include the following, as applicable for the investigation being proposed:

- Factor B-1. Merit of the instruments and investigation design for addressing the science, exploration, or technology goals and objectives. This factor includes the degree to which the proposed investigation will address the goals and objectives; the appropriateness of the selected instruments and investigation design for addressing the goals and objectives; the degree to which the proposed instruments and investigation can provide the necessary data; and the sufficiency of the data gathered to complete the science, exploration, or technology investigation.
- Factor B-2. Probability of technical success. This factor includes the maturity and technical readiness of the instruments or demonstration of a clear path to achieve necessary maturity; 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 investigation design.
- Factor B-3. Merit of the data analysis, data availability, and data archiving plan and/or sample analysis plan. This factor includes the merit of plans for data and/or sample analysis, data archiving, and/or sample curation to meet the goals and objectives of the investigation; to result in the publication of discoveries in the professional literature; and to preserve data and samples of value to the research and development 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 research and development community; assessment of adequate resources for physical interpretation of data; an assessment of the planning and budget adequacy and evidence of plans for the preliminary evaluation and curation of any returned samples; reporting science, exploration, or technology results in the professional literature (e.g., refereed journals); and assessment of the proposed plan for the timely release of the data to the public domain for enlarging its impact.
- Factor B-4. Science, exploration, or technology resiliency. This factor includes both developmental and operational resiliency. Developmental resiliency includes the approach to descoping the Baseline Investigation to the Threshold Investigation 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 investigation team success. This factor will be evaluated by assessing the experience, expertise, and organizational structure of the investigation team and the experiment design in light of any proposed instruments. The role of each Co-Investigator and collaborator will be evaluated for necessary contributions to the proposed investigation; the inclusion of Co-Is or collaborators who do not have a well-defined and appropriate role may be cause for downgrading of the proposal during the evaluation.

- Factor B-6. Merit of any Science-Exploration-Technology Enhancement Options (SEOs), if proposed. This factor includes assessing the appropriateness of the selected activities to enlarge the impact of the mission and the costing of the selected activities. Although evaluated by the same panel as the balance of Implementation Merit factors, this factor will not be considered in the overall criterion rating.
- Factor B-7. Merit of any PI-developed Technology Demonstration Opportunities (TDOs), if proposed. This factor includes assessing the appropriateness of the TDO to enlarge the impact of the investigation, and/or add value to future investigations, and the potential risk to the investigation objectives posed by the TDO. There will be no penalty for the potential higher technical risk of the TDO itself. Although evaluated by the same panel as the balance of Implementation Merit factors, this factor will not be considered in the overall criterion rating.

Student Collaboration proposals, if any, will be evaluated only for the impact they have on the Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation to the extent that they are not separable; student collaboration proposals will not be penalized 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 Investigation.

This evaluation will result in narrative text, including specific major and minor strengths and weaknesses, as well as an appropriate adjectival rating for the Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation.

7.2.4 TMC Feasibility of the Proposed Investigation Implementation

The technical and management approaches of all submitted investigations, including any TDOs proposed, 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 investigation implementation include the following, as applicable for the investigation being proposed:

- 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 investigation 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, plans for advanced engineering developments, 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 investigation design and plan for operations. This factor includes an assessment of the overall investigation design and investigation

architecture, the spacecraft design and design margins (including margins for launch mass, delta-V, and propellant), the concept for operations (including communication, navigation/tracking/trajectory analysis, and ground systems and facilities), and the plans for launch services. This factor includes investigation 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 Investigation. This factor will be applied only to the extent that it is appropriate for the proposals solicited by the applicable PEA.

- 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, plans for advanced engineering developments, and the adequacy of backup plans to ensure success of the investigation when systems having a TRL less than 6 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. This factor will be applied only to the extent that it is appropriate for the proposals solicited by the applicable PEA.
- 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, investigation 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, investigation 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 investigation, 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 investigation capabilities will be assessed against the potential impact to the proposed Baseline Investigation. 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 technical adequacy of contingency plans, where they exist, for coping with the failure of a proposed cooperative arrangement or contribution. This factor also includes assessment of 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.

- Factor C-5. Adequacy and robustness of the cost plan, including cost feasibility and cost risk. This factor includes 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 investigation, including contributions). The adequacy of the cost reserves and understanding of the cost risks will be assessed. This factor also includes an assessment of the proposed cost relative to estimates generated by the evaluation team 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 the TMC Feasibility of the Proposed Investigation Implementation to the extent that they are not separable; Student Collaboration proposals will not be penalized 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 Investigation.

The application and scope of any proposed use of NASA-developed technology will be evaluated for appropriateness and conformance to the guidelines in Sections 5.3.6. and 5.3.7 and/or the applicable PEA. Any development or flight readiness risk for these NASA-developed technologies will not impact the evaluation of the development risk of proposed investigations. The implementation feasibility and risk of the proposed use of NASA-developed technology will be evaluated against the factors in this section. All proposers will receive feedback, if applicable, on their proposed use of NASA-developed technology.

Programmatic risks may be assessed but are not considered in the TMC risk rating. Examples include but not limited to; Stability and reliability of proposed partners and their contributions, environmental assessment approvals, and late/non-delivery of NASA provided project elements.

This evaluation will result in narrative text, including specific major and minor strengths and weaknesses, as well as an appropriate risk rating for the TMC Feasibility of the Proposed Investigation Implementation.

7.3 Selection Factors

As described in Section 7.1.3, the results of the proposal evaluations based on the criteria above and the categorizations will be considered in the selection process.

Considering the critical role of the PI, PM, and their institutions, prior experience (especially in meeting cost and schedule constraints) will be an important factor in the selection of an investigation under this AO.

The Selection Official(s) may take into account a wide range of programmatic factors in deciding whether or not to select any proposals and in selecting among top-rated proposals, including, but

not limited to, planning and policy considerations, available funding, programmatic merit and risk of any proposed partnerships, and maintaining a programmatic balance across the mission directorate(s). While NASA develops and evaluates its program strategy in close consultation with the NASA community through a wide variety of advisory groups, NASA programs are evolving activities that ultimately depend upon the most current Administration policies and budgets, as well as programs' objectives and priorities that can change quickly based on, among other things, new discoveries from ongoing missions.

The overriding consideration for the selection of proposals submitted in response to this AO will be to maximize science, exploration, or technology return and minimize implementation risk while advancing NASA's science, exploration, or technology goals and objectives within the available budget for the program. Therefore, the proposed PI-Managed Mission Cost will be considered in the final selection of investigations through this AO. Depending on the availability of proposals of appropriate merit, this objective may be achieved by the selection of investigation(s) at the PEA-specific Cost Cap, one or more investigations significantly below the PEA-specific Cost Cap that would allow a more rapid release of the next PEA, or a combination of investigations of various costs. Proposers are encouraged to propose well below the PEA-specific Cost Cap, as that permits greater flexibility and robustness in the program and in NASA.

7.4 Implementation of Selected Proposals

7.4.1 Notification of Selection

Following selection, the PIs of the selected investigations will be notified by telephone, followed by formal written notification which may include any special conditions or terms of the offer of selection (e.g., partial selections, see Section II of Appendix A) and any special instructions for formulation. The formal notification will also include instructions for scheduling a debriefing at which any issues noted during the evaluation that may require attention during formulation will be discussed, as well as instructions for initiating the project.

The Selection Statement for this solicitation, which is signed by the Selection Official(s), may include information from the Proposal Summary for any proposal, whether or not it is selected. Since the Selection Statement is a releasable document, the Proposal Summary must not contain proprietary or confidential information that the submitters wish to protect from public disclosure.

7.4.2 Principal Investigator-Led Team Masters Forum

One step toward successful execution of PI-led investigation is to ensure that PI-led investigation management teams receive the instruction necessary to enable them to better execute their investigations for NASA. The PI-led Team Masters Forum is intended for newly selected PI-led mission management teams to facilitate knowledge sharing in areas that are deemed necessary to successfully execute PI-led missions. Course attendance by the leaders of newly selected PI-led mission management teams (PI, Project Manager, Project Scientist, Project Systems Engineer, and Project Resource Control Manager) and the NASA HQ personnel associated with the selected investigation would be required as soon as practical after proposal selection. Funds to attend the PI-led Team Masters Forum must be budgeted for in the PI-Managed Mission Cost.

The applicable PEA will state whether a PI-led Team Masters Forum is planned.

7.4.3 Award Administration and Funding

Oversight management responsibilities are assigned to the Program Office at the Center designated in the applicable PEA. The responsibilities of the Program Office will include oversight of investigation implementation; coordination of Government-furnished services, equipment, and facilities; and contract management for selected investigations.

It is anticipated that the Program Office will provide funding to each selected investigation.

For investigations selected under this AO that do not deliver flight hardware or software (e.g., New Missions using Existing Spacecraft), grants or cooperative agreements may be awarded.

For investigations selected under this AO that deliver flight hardware or software (e.g., Partner Missions of Opportunity, Small Complete Missions, and Focused Missions of Opportunity), it is anticipated that contracts will be awarded to begin formulation, to be initiated as soon as possible after notification of selection. NASA Centers will receive funding via intra-agency funding mechanisms. Statements of Work (SOWs), certified cost and pricing data (as applicable), and small business subcontracting plans (as applicable) will be required in order to put awards in place.

Proposals are *not* required to include SOWs and certified cost and pricing data for formulation and subsequent phases (as applicable), or small business subcontracting plans (as applicable). These will be required *only* for investigations that are selected at the outcome of the competition. If more than one contractual arrangement between NASA and the proposing team is required, a separate SOW is required for each organization.
For those investigations that are selected, it will be in the best interest of their PI-led investigation management teams to provide SOWs, certified cost and pricing data (as applicable), and small business subcontracting plans (as applicable) in as timely a manner as possible. The process of awarding contracts cannot begin until SOWs, cost and pricing data, and small business subcontracting plans have been received, and funds cannot be provided to the implementing organizations until this process has been completed.

SOWs will be required for selected investigations regardless of whether a proposing organization is Governmental or non-Governmental. SOWs will include the requirements for Phase A, as well as general task statements for Phases B through F. SOWs will include the following as a minimum: Scope of Work, Deliverables (including science and/or engineering data), and Government responsibilities (as applicable). SOWs need not be more than a few pages in length.

For contracts that exceed the dollar threshold stated in the FAR subpart 15.4, the contractor will be required to provide certified cost and pricing data to support the cost estimate, in the format specified in 48 CFR 15.408, Table 15-2, and to certify the costs proposed for the contract in accordance with FAR subpart 15.4.

Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of International and Interagency 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 memorandum of understanding.

7.4.4 Confirmation of Investigations

Per NPR 7120.5E, at the end of Phase B, NASA will conduct an independent review of the investigation's readiness to proceed. This review must be completed before the project will be authorized to spend more than 25% of the proposed PI-Managed Mission Cost. The results of the independent review and the project status will be presented to the Mission Directorate Program Management Council (PMC) at the Confirmation Review (KDP C) for Confirmation to enter Phase C. If the project is classified Category 1 according to NPR 7120.5E, the Confirmation results will need subsequent approval from the Agency PMC. Following Confirmation, no rephasing between Phase E costs to Phase C/D will be permitted.

7.5 Opportunity for Debriefing of Nonselected Proposers

Proposers of investigations that are not selected will be notified in writing and offered oral debriefings for themselves and a representative from each of their main partners (if any). Written debriefing materials will be provided at the time of the oral debriefing. Such debriefings may be in person at NASA HQ or by telephone if the proposal PI 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.

7.6 Process for Appeals

7.6.1 Agency Procurement Ombudsman

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

Director of the Contract and Grant Policy Division
Office of Procurement
NASA Headquarters
Washington, DC 20546
USA

7.6.2 Protests

Only prospective offerors seeking contract awards under this AO have the right to file a protest, either at the Government Accountability Office (GAO) or with the Agency, as defined in

FAR 33.101. The provisions at FAR 52.233-2 ("Service of Protest") and NFS 1852.233-70 ("Protests to NASA") are incorporated into this AO. Under both of these provisions, the designated official for receipt of protests to the Agency and copies of protests filed with the GAO is:

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

8. CONCLUSION

This SALMON-3 AO offers NASA and its partners an avenue to participate in accomplishing national science, exploration, and technology goals, while generating opportunities to enhance education and engage the public in the excitement of space discoveries. NASA invites both the U.S. and international communities to submit proposals for investigations in response to this AO and its PEAs.

/signed/

Thomas Zurbuchen
Associate Administrator for Science Mission Directorate

/signed/

William H. Gerstenmaier
Associate Administrator for Human Exploration and Operations Mission Directorate

/signed/

Steve Jurczyk
Associate Administrator for the Space Technology Mission Directorate

APPENDIX A

GENERAL INSTRUCTIONS AND PROVISIONS
See NASA FAR Supplement, Part 1872.705-1

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 AO Section 5.8 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

The investigator's institution agrees that the cost proposal submitted in response to the AO 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 cost information in accordance with FAR 15.403-5. Submission of certified cost or pricing data, as defined in FAR 15.403-4, is required if the proposal exceeds the dollar threshold stated in the FAR 15.403-4. Certified cost or pricing data will also be required for proposals for subsequent mission phases.

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 1815.208).

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. INTELLECTUAL PROPERTY

a. Patent Rights

For any NASA contract resulting from this solicitation awarded to other than a small business firm or nonprofit organization, the clause at NFS 1852.227-70, New Technology, shall apply. Such contractors may, in advance of a contract, request waiver of rights as set forth in the provision at NFS 1852.227-71, Requests for Waiver of Rights to Inventions.

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 1852.227-11) shall apply.

b. Rights in Data

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

XII. 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 the dollar threshold stated on the FAR subpart 19.7, and are with organizations other than small business concerns, the clause at FAR 52.219-9 shall apply. Accordingly, offerors awarded contracts that exceed the dollar threshold stated on the FAR subpart 19.7, other than small business concerns, are required to submit small business subcontracting plans consistent with the FAR. Failure to do so will make the offeror ineligible for award. 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.

XIII. WITHDRAWAL OF PROPOSALS

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

APPENDIX B

REQUIREMENTS FOR PROPOSAL PREPARATION

INTRODUCTION

The following requirements apply to preparation of proposals in response to a Program Element Appendix (PEA) of the Third Stand Alone Mission of Opportunity Notice (SALMON-3) Announcement of Opportunity (AO). While the body of the AO and the applicable PEA specify the general policies and requirements for preparing proposals, as well as for implementing investigations proposed in response to this opportunity, Appendix B provides further definition of the proposal requirements in the AO and contains the specific requirements for the format and content of the proposals. Some AO requirements do not require further definition by an Appendix B requirement; however they must be addressed in the proposal. Failure to follow Appendix B and proposal format and content requirements on the applicable PEA may result in reduced ratings during the evaluation process or, in some cases, could lead to rejection of the proposal without review. In the event of apparent conflicts between this Appendix and the policies and requirements specified within the body of the SALMON-3 AO and a PEA, the order of precedence is: the PEA, then the SALMON-3 AO, then Appendix B.

GENERAL REQUIREMENTS

The following expands requirements in the AO, in particular Requirement 102 through Requirement 105.

Requirement B-1. A proposal shall consist of one volume divided into readily identifiable sections that correspond and conform to Sections A through J of this appendix. It shall be typewritten in English and shall employ metric (SI) and/or standard astronomical units, as applicable. It shall contain all data and other information that will be necessary for scientific and technical evaluations; provision by reference to external sources, such as Internet websites, of additional material that is required for evaluation of the proposal is prohibited.

Requirement B-2. Proposal page size shall be either American standard 8.5 x 11 inches or European standard A4. Foldout pages (11 x 17 inches or A3) may also be employed at the proposers' discretion (see below for assessment of foldout pages against the page limit).

Requirement B-3. Text shall not exceed 55 lines per 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 formatted for A4 paper. Single-column or double-column formats are acceptable for text pages. Type fonts for text and figure captions shall be no smaller than 12-point (i.e., no more than 15 characters per inch; six characters per centimeter). There is no minimum requirement for fonts used within figures and tables but all text in figures and tables shall be legible; fonts smaller than 8-point are often illegible.

Proposal Structure and Page Limits		
Section	**Contents**	**Page Limits**
A	Graphic Cover Page Export Controlled Material statement (Section 5.9.3) Optional Restriction on Use statement (see Appendix A, Section V)	1 0.5 0.5
	PI Commitment (Section 5.3.1)	1
B	Fact Sheet	2
C	Table of Contents	None
D E	Science, Exploration, or Technology Investigation Experiment Implementation, including optional SEO and/or TDO	20 + 2 pages for SEO (if applicable) + 3 pages for TDO (if applicable)
F G	Investigation or Mission Implementation Schedule Foldout (s) Management	15 (3 Schedule Foldouts do not count against limit)
H	Cost and Cost Estimating Methodology Cost Table B3	8 (Cost Table Foldout(s) do(es) not count against limit)
I	Optional Student Collaboration Plan	2
J J.1 J.2 J.3 J.4 J.5 J.6 J.7 J.8 J.9 J.10 J.11 J.12	Proposal Appendices (no others permitted): Table of Proposal Participants Letters of Commitment Resumes Summary of Proposed Program Cooperative Contributions Draft International Participation Plan Discussion on Compliance with U.S. Export Laws and Regulations Compliance with Procurement Regulations by NASA PI Proposals Discussion of End-of-Mission Spacecraft Disposal Requirements Master Equipment List (MEL) Heritage List of Abbreviations and Acronyms List of References (optional) Infusion Plan for TIO (if applicable)	 None None None None None None None None 30 None None 5

Requirement B-4. Proposals shall conform to the page limits specified in the *Proposal Structure and Page Limits* table. Every side of a page upon which printing appears will count against the page limits and, unless specifically exempted (e.g., Requirement B-34 and Requirement B-58), each foldout page will count as two or more pages against the page limits as appropriate for its area (*e.g.,* a fold-out with the total area of two standard pages counts as two pages, *etc.*).

Requirement B-5. Electronic proposals shall be a single, searchable and unlocked (e.g., without digital signatures) Adobe Portable Document Format (PDF) file, comprised of the main proposal, all tables (e.g., Requirement B-58 and Requirement B-77), and all applicable proposal appendices (see Section J of this appendix). Images (e.g., figures and scans) shall be converted into machine-encoded text using optical character recognition. Electronic proposals shall be limited to 25 MB in size. Links to other parts of the proposal are permitted, but links to materials outside of the proposal are not. Once submitted, the document uploaded to NSPIRES will be considered the official submission.

Requirement B-6. CD-ROMs of proposals shall include electronic proposals specified in Requirement B-5 and shall additionally include Microsoft Excel files of tables (see Requirement B-59 and Requirement B-79). CD-ROMs of proposals may additionally include up to 100 MB, higher resolution but otherwise identical, versions of electronic proposals. In the event of a conflict between versions of electronic proposals, the version specified in Requirement B-5 shall take precedence.

A. PROPOSAL SUMMARY INFORMATION AND GRAPHIC COVER PAGE

A.1. Electronic Proposal.

The following expands requirements in the AO, in particular Requirement 102.

Requirement B-7. Proposal Summary Information and the Graphic Cover Page, prepared as directed below, shall preface every proposal. The Proposal Summary Information will not be counted against the page limits. The Proposal Summary shall not contain proprietary or confidential information that the submitters wish to protect from public disclosure. Note that the Graphic Cover Page should be the first page of the electronic proposal document specified in Requirement B-5; when combined by NSPIRES with the Proposal Summary Information, the Graphic Cover page will follow that information.

Requirement B-8. The Graphic Cover Page shall contain, at a minimum, the following information and elements displayed on the cover page of the proposal:

- The proposal title;
- The name of the proposing organization;
- The name of the PI;
- The name and title of an official who is authorized to commit the proposing organization through the submission of the proposal;
- The signature of the PI and the authorizing official, and

Optionally, the Graphic Cover Page may also contain:

- Any illustrations or graphic elements of the proposer's choice (or none); and
- Any additional information of the proposer's choice that is nonproprietary and that does not provide additional content beyond what is in the proposal (or none).

A.2. Electronic Cover Page (NSPIRES Submission).

The following expands requirements in the AO, in particular Requirement 106.

Electronic submission must be through the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at http://nspires.nasaprs.com/.

Requirement B-9. This AO requires that proposal summary information, referred to as the Electronic Cover Page, shall be submitted electronically. The forms for the Electronic Cover Page are found in NSPIRES at http://nspires.nasaprs.com/.

The NSPIRES electronic cover page includes the response to the following instruction: "List all participants in this investigation, both requesting funding and not requesting funding, who do not appear on the proposal's cover page as a Co-Investigator, collaborator, or any other category of participant. Include name, institution, city, state or country, and a description of the role in five words or less *(*e.g., data analyst, facility provider, support technician)." It is recognized that individuals may be affiliated with the proposed investigation without being listed as team members on the proposal cover page. The information provided is used to ensure that the evaluation panels do not include individuals as reviewers who have participated in one or more proposals as they have the appearance of being biased.

Requirement B-10. Proposers shall ensure that the response to this instruction includes all team members as may be known at this time not listed in the Team Member section of the cover page who participated in a substantial way in the development of the investigation concept or the proposal itself, or who will participate substantially in the development and conduct of the investigation.

The proposal evaluation process requires evaluators be free of Conflict of Interest. In order to assist in planning of the proposal evaluation process, NASA requires a comprehensive list of proposed investigation participants.

Requirement B-11. With the proposal submission via NSPIRES, the proposers shall identify any institution that is specified in the proposal but that does not appear in either the "Team Member" section of the cover page or in answer to the question about "participants […] who do not appear on the proposal's cover page." The proposer shall list the institution and division name, role (e.g., instrument component provider), and estimated funds to be received. This information will be used to avoid financial and organizational conflicts of interest during the evaluation process by checking evaluators against institutions that are proposed to supply materials, parts, or services.

A.3. Proposal Team Member Commitment Through NSPIRES.

The following expands requirements in the AO, in particular Requirement 98 and Requirement 106.

Every Proposal Team member must be identified on the NSPIRES proposal cover page and must indicate his/her commitment to the proposed investigation through NSPIRES prior to proposal cover page submission. Team members must additionally confirm the organization through which they are participating on this proposal; identification of the organization serves as the commitment to the team specified in *Requirement 106*.

The organization through which the Proposal Team member is participating in the proposal might not be the Proposal Team member's primary employer or primary mailing address. Note that the proposal cover page cannot be submitted until all identified team members have confirmed their participating organization.

Requirement B-12. Every Proposal Team member named on the proposal cover page shall personally commit to the proposed investigation through NSPIRES and identify the organization through which he/she is participating. The PI and every Proposal Team member shall ensure that the organization listed on the proposal cover page is the organization through which the Proposal Team member is participating in the proposal.

B. FACT SHEET

The following expands requirements in the AO, in particular Requirement 102.

Requirement B-13. Every proposal shall include a fact sheet that provides a brief summary of the proposed investigation. Information conveyed on this fact sheet shall include:

- Science, exploration, or technology objectives (including the importance of the investigation objectives to the sponsoring program goals);
- Investigation overview;
- Instrument complement;
- Key instrument and spacecraft (when applicable) characteristics;
- Investigation management and participating organizations (including teaming arrangements, as known);
- Schedule summary;
- The proposed PI-Managed Mission Cost in Real Year dollars (RY$) and in PEA-specific Fiscal Year dollars (FY$) from Tables B3a and B3b respectively; and
- The proposed Total Mission Cost, including a breakdown of any contributed costs by contributing organization, in RY$ and PEA-specific FY$ from Tables B3a and B3b respectively.

C. TABLE OF CONTENTS

The following expands requirements in the AO, in particular Requirement 102.

Requirement B-14. Every proposal shall contain a table of contents that conforms to the outlines provided in Sections D through J of this appendix, below.

D. SCIENCE, EXPLORATION, OR TECHNOLOGY INVESTIGATION

The following expands requirements in the AO, in particular Requirement 13 through Requirement 21.

D.1. Investigation Background, Goals, and Objectives.

Requirement B-15. This section shall describe the goals and objectives of the investigation, the compelling nature of the investigation, the investigation's value to advancing the NASA's objectives, and the relationship of the proposed investigation to past, current, and future investigations and missions.

D.2. Investigation Requirements and Baseline Investigation.

Requirement B-16. This section shall describe the investigation to be performed, the types of measurements to be taken; the characteristics, precision, and accuracy required to attain the investigation objectives; and the projected instrument performance. This section shall describe the data to be returned in the course of the investigation. The quality (e.g., resolution, coverage, pointing accuracy, measurement precision, etc.) and quantity (bits, images, etc.) of data that must be returned shall be described. The relationship between the proposed data products (e.g., flight data, ancillary or calibration data, theoretical calculations, higher order analytical or data products, laboratory data, etc.) and the investigation objectives, as well as the expected results, shall be described. How the investigation products and data obtained will be used to fulfill the investigation requirements shall be demonstrated and supported by quantitative analysis. These descriptions shall constitute the Baseline Investigation.

Requirement B-17. Traceability from investigation goals to measurement requirements to instrument requirements (functional and performance), and to top-level mission requirements shall be provided in tabular form and supported by narrative discussion. Projected instrument performance shall be compared to instrument performance requirements.

Table B1 of this appendix provides an example of a tabular Science Traceability Matrix, with examples of matrix elements. This matrix provides the reference points and tools needed to track overall investigation requirements, provide systems engineers with fundamental requirements needed to design the mission, show clearly the effects of any descoping or losses of elements, and facilitate identification of any resulting degradation to the investigation.

D.3. Threshold Investigation.

Requirement B-18. This section shall identify the minimum acceptable data and return for the investigation (the Threshold Investigation), below which the investigation would not be worth pursuing. The Threshold Investigation is identified with the "Threshold Science Requirements" in NPR 7120.5E. The scientific, exploration, or technology value of the Threshold Investigation shall be discussed. NASA recognizes that, in some circumstances, the Threshold Investigation may be identical to the Baseline Investigation. In such cases, the proposer shall explain why there is no viable investigation below the Baseline Investigation.

E. EXPERIMENT IMPLEMENTATION

The following expands requirements in the AO, in particular Requirement 16 through Requirement 30 and Requirement 66 through Requirement 70.

E.1. Instrumentation.

Requirement B-19. This section shall describe the instrumentation and the rationale for its selection. It shall identify the individual instruments and instrument systems, instrument subsystems, instrument components, and sample collection and preservation systems as applicable, including their characteristics and requirements, and indicate items that are proposed for development, as well as any existing instrumentation or design/flight heritage. It shall provide a clear understanding of how the concept will provide the required data, show how it can be accommodated by the spacecraft, demonstrate that instruments have the necessary unobstructed fields-of-view over the measurement period required, describe the technology readiness levels and the approach to bring each instrument to Technology Readiness Level (TRL) 6 (or TRL 5 as applicable for NASA STMD calls) by Preliminary Design Review (PDR). If no development plan is needed, the reasons for this shall be explicitly stated and the rationale shall be described. A preliminary description of each instrument design, with a block diagram showing the instrument subsystems and components, and their interfaces, along with a description of the estimated performance of the instrument, shall be included. These performance characteristics (which shall be considered as requirements on the flight system) shall include mass, power, volume, data rate(s), thermal, pointing (such as control, stability, jitter, drift, accuracy, etc.), spatial and spectral resolution, observable precision, retrieved parameter sensitivity and accuracy, and calibration requirements. This section shall demonstrate that the instrumentation can meet the measurement requirements, including factors such as retrieval results for each remote sensor, error analysis of the information in all sensors, vertical and horizontal resolution, signal-to-noise (S/N) calculations, etc. It shall also discuss environmental effects, such as radiation, temperature, and contamination, on each instrument's measurement capabilities as a function of mission time.

Requirement B-20. The following information shall be provided for each instrument proposed:
- Mass (include breakouts of electronics and optics);
- Viewing direction in body coordinates;
- Pointing accuracy and stability requirements
- Operational modes;

- Operational mode timeline;
- Data demand for each instrument operational mode;
- Onboard data processing and storage required from spacecraft;
- Power demand for each instrument operational mode including peak, average, and stand-by power;
- Instrument thermal control capability;
- Applicable instrument diagrams (e.g., optical path); and
- Characteristics of relevant instrument components (e.g., listing of size of optics) in the MEL.

E.2. Data Sufficiency.

Requirement B-21. This section shall discuss the quality and quantity of data delivered and processed by the ground data system.

E.3. Mission Profile.

Requirement B-22. This section shall discuss the observing profile, including all mission-relevant parameters, such as orbit, navigation accuracy, operational time lines (including observing periods, data transmission periods and techniques, and time-critical events), etc. The manner in which the proposed investigation objectives, selected instruments, and measurement requirements drive the proposed mission design and operations plan shall be included in this discussion.

E.4. Data Plan.

Requirement B-23. A schedule-based end-to-end data management plan, including approaches for data retrieval, validation, preliminary analysis, and archiving shall be described. The investigation products (e.g., flight data, ancillary or calibration data, theoretical calculations, higher order analytical or data products, laboratory data, etc.) shall be identified, including a list of the specific data products and the individual team members responsible for the data products. The plan shall identify the appropriate NASA data archive(s) and the formats and standards to be used. It shall include an estimate of the raw data volume and a schedule for the submission to the data archive of raw and reduced data in physical units accessible to the science community. The data plan shall be in compliance with terms and conditions stated in the *NASA Plan: Increasing Access to the Results of Scientific Research* or a justification shall be included that this is not necessary given the nature of the work proposed. The data management plan (DMP) (see Section 4.4.1) shall be addressed as part of the Data Plan.

E.5. Science Team.

Requirement B-24. This section shall identify each member of the investigation team and his/her role and responsibilities. Resumes or curriculum vitae of investigation team members shall be included as appendices to the proposal (see Section J.3 of this appendix). The role of the PI and each Co-investigator (Co-I) shall be explicitly defined, the necessity of that role shall be

justified, and the funding source (NASA or contributor) shall be noted; the role of each collaborator shall be described and the funding source shall be noted.

E.6. Plan for Science-Exploration-Technology Enhancement Options

Requirement B-25. If a Science-Exploration-Technology Enhancement Option (SEO) is proposed, this section shall define and describe the proposed activities (see Section 5.2.5 of the AO).

E.7. Plan for Technology Demonstration Opportunity

Requirement B-26. If a Technology Demonstration Opportunity (TDO) is proposed, this section shall define and describe the proposed activities (see Section 5.3.6 of this AO).

F. INVESTIGATION IMPLEMENTATION (Version A)

> Version A: This version of Section F is applicable to MOs in which the flight systems development and operations are not the responsibility of the PI (e.g. instrument only MOs). For MOs in which the flight systems development and operations are the responsibility of the PI (e.g. SCMs), see Version B of Section F.

The following expands requirements in the AO, in particular Requirement 26 through Requirement 54.

F.1. General Requirements.

Requirement B-27. Instrument Resource Contingencies and Margins: This section shall summarize contingencies and margins of all instrument resources. It shall provide estimates of implementation design margins with respect to the required performance or allocations for mass, power, data storage, and any other resource requirements. For proposals for more than one instrument, the mass, telemetry, and power and contingency and margins shall 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 contingency and margin). The allocation of contingency and margin to the instrument and/or suite shall be discussed.

Requirement B-28. Performance Margins: For each instrument performance, this section shall provide estimates of performance margin with respect to the performance requirements as compared to projected performance estimates and shall justify that these performance margins are appropriate.

Definitions:

Contingency, when added to the current estimate for a resource, results in the maximum expected value for that resource. Percent contingency is the value of the contingency divided by the value of the resource, less the contingency.

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

Example: A payload in the design phase has a maximum expected mass of 115 kg including a mass contingency of 15 kg. There is no other payload on the ELV and the ELV provider plans to allot the payload the full capability of the vehicle, if needed. The ELV capability is 200 kg. The mass contingency is 15/100 = 15% and the mass margin is 85 kg or 85/115 = 74%.

Example: The end-of-life (EOL) capability of a spacecraft power system is 200 Watts, of which 75 Watts has been allocated to the instrument and 100 Watts has been allocated to the spacecraft bus. The power margin is the unallocated 25 Watts or 25/175 = 14.3%. The current best estimate for the instrument power is 60 Watts, leaving 15 Watts or 15/60 = 25% contingency to the 75 Watt maximum expected value.

Acknowledging that the maximum expected resource value is equal to the maximum proposed resource value (including contingency), the above technical terms can be expressed in equation form as:

Contingency = Max Expected Resource Value – current estimate of Resource Value

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

Margin = Max Possible Resource Value – Max Expected Resource Value

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

Requirement B-29. Science Operations: This section shall address, at a minimum, the following elements of science operations to the extent that they are applicable to the proposed investigation and that they are known at the time of proposal submission. Any additional elements that are applicable to explaining the science operations and demonstrating their feasibility shall also be addressed. This section shall provide, at a minimum, the following items:

- Description of ground systems and facilities, including supporting ground software required for development and testing;
- A discussion of the science operations plan, including nominal sequence planning and commanding, team training, availability of experts for operations, and science operations center development.

F.2. Development Approach.

Requirement B-30. This section shall describe the systems engineering development approach. This description shall include the following items:

- Roles and responsibilities for the interface management process - as specified in NPR 7123.1B - and product development responsibilities;
- A description of how the interface management process will be developed and maintained;
- Mission assurance approach, including (i) fault tolerance and fault management, (ii) product assurance, and (iii) reliability;
- Essential trade studies to be conducted in Phase A including the considered options and driving requirements;
- Identification of the key Technical Performance Measures (TPMs) - as specified in NPR 7123.1B - and descriptions of how these margins and reserves are to be allocated, tracked, and monitored, with what tools and by whom, and who will have the authority to release the associated reserves and margins;
- Descriptions of when contracts are required, the acquisition strategy, including any incentive strategy.

F.3. New Technologies/Advanced Engineering Developments.

PEAs issued by NASA STMD, including those that solicit a technology demonstration investigation as opposed to a science or exploration investigation, will require technologies to be matured to TRL 5, not TRL 6, no later than PDR and therefore Requirement B-31 applies for TRL 5 by PDR. If Requirement B-31 is not applicable, it will be replaced by requirements in the applicable PEA.

Requirement B-31. This section shall describe any proposed new technologies and/or advanced engineering developments and the approaches that will be taken to reduce associated risks. Descriptions shall address, at a minimum, the following topics:

- Identification and justification of the TRL for each proposed system (level 3 WBS payload developments and level 3 WBS spacecraft elements if proposed) incorporating new technology and/or advanced engineering development at the time the proposal is submitted (for *TRL definitions*, see NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*, Appendix E, in the PEA-specific Library);
- Rationale for combining the TRL values of components and subsystems to derive each full system TRL as proposed, appropriately considering TRL states of integration (see NASA/SP-2007-6105 Rev 1, *NASA Systems Engineering Handbook*);
- Rationale for the stated TRL value of an element that is an adaptation of an existing element of known TRL;
- The approach for maturing each of the proposed systems to a minimum of TRL 6 (or TRL 5) by PDR:
  - Demonstration (testing) in a relevant environment can be accomplished at the system level or at lower level(s);
  - If applicable, justify what demonstration(s) in a relevant environment at lower level(s) (subsystem and/or subsystem-to-subsystem) would be sufficient to meet system level TRL 6 (or TRL 5), considering (i) where any new technology is to be inserted, (ii) the

magnitude of engineering development to integrate elements, (iii) any inherent interdependencies between elements (e.g., critical alignments), and/or (iv) the complexity of interfaces – see the PEA-specific Library for examples;
    - Include discussion of simulations, prototyping, demonstration in a relevant environment, life testing, etc., as appropriate;
- An estimate of the resources (staffing, cost, and schedule) required to complete the technology and/or advanced engineering development; and
- Approaches to fallbacks/alternatives that exist and are planned, a description of the cost, decision date(s) for fallbacks/alternatives, relevant development schedules, and performance liens they impose on the baseline design, and the decision milestones for their implementation.

If no new technologies or advanced engineering development is required, system TRL 6 (or TRL 5) or above at the time of proposal submission shall be clearly demonstrated.

F.4. Assembly, Integration, Test, and Verification.

Requirement B-32. An illustration and brief discussion of the time-phased flow of the Integration and Test (I&T) Plan shall be presented. It shall summarize the key facilities, testbeds, and team members involved in the I&T Plan.

Requirement B-33. The investigation's verification approach shall be described briefly in this section. Flow diagrams, narrative text, and/or other relevant data may be used to convey this information. Elements of the approach that pose special challenges for the project (e.g., mission critical performance or functional requirements that can't be tested on the ground, special facilities that may be required for testing, large scale simulation tools that must be developed and how they will be validated, critical path items, etc.) shall be highlighted. The I&T description shall demonstrate the credibility of the overall I&T approach, as reflected by consistency between the described test plans and the schedule, cost, and other resources needed to carry them out.

F.5. Schedule.

Requirement B-34. A project schedule foldout(s) covering all phases of the investigation shall be provided to at least WBS level 3, except where greater detail is necessary to identify critical paths, as well as significant TRL or engineering development activities and events. The first 3 foldouts will not be counted against the page limits. The schedule format shall indicate the month and year of each milestone, have a corresponding table of dates, and follow standard NASA WBS elements for task descriptions, as prescribed in NPR 7120.5E. The schedule foldout(s) and accompanying narrative (narrative is included in the page count for this section) shall address proposed major milestones including, at a minimum, the following items:

- Instrument development and major review dates, including instrument-to-spacecraft/host integration and test;
- Ground systems development and major review dates (e.g., science operations and data analysis development schedule);
- Major deliverables (e.g., Interface Control Documents (ICDs), simulators, engineering modules, flight modules, etc.);

- Long-lead item specifications, development paths, and their impacts to schedule;
- Development schedule for SEOs, if any;
- Schedule critical path identification; and
- Funded schedule reserve, with indications of appropriate reserves associated with major milestones and deliverables.

F. INVESTIGATION IMPLEMENTATION (Version B)

> Version B: This version of Section F is applicable to MOs in which the flight systems development and operations are the responsibility of the PI (e.g. SCMs). Address the following requirements in Version B to the extent applicable for MOs in which the flight systems development and operations are the responsibility of the PI (e.g. SCM). For other categories of SALMON investigations, see Version A of Section F.

The following expands requirements in the AO, in particular Requirement 26 through Requirement 54.

F.1. General Requirements and Mission Traceability.

Requirement B-35. This section shall provide a description of the spaceflight mission that is proposed to enable the science investigation.

In some areas *(*e.g., instruments), the data requested may have already been presented in another section of the proposal (e.g*.,* the Experiment Implementation section). In such a case, a proposal may provide a reference to that section and need not repeat the data in this section.

Requirement B-36. The mission requirements that the investigation goals and objectives impose on the mission design elements, including mission design, instrument accommodation, spacecraft design, required launch vehicle capability, ground systems, communications approach, and mission operations plan, shall be provided in tabular form and supported by narrative discussion. Table B2 provides an example of a tabular Mission Traceability Matrix, with examples of matrix elements. Specific information that describes how the investigation imposes unique requirements on these mission design elements shall be included.

This matrix, along with Table B1, provides the reference points and tools needed to track overall mission requirements, provides systems engineers with fundamental requirements needed to design the mission, shows clearly the effects of any descoping or losses of mission elements, and facilitates identification of any resulting degradation to the investigation.

Requirement B-37. NASA recognizes that the full depth of information requested in Requirement B-38 through Requirement B-49 may not be available for some aspects of mission implementation at this stage of mission design. In such cases, this section shall (i) describe the current design concept, (ii) explain why the design information is not complete, (iii) provide a time-based plan for completing the design, (iv) 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 (v)

explain why the lack of information at this stage does not translate into a risk to the proposer's ability to implement the mission as proposed. The approach for developing the required depth of information, along with a corresponding development schedule, shall be included among the plans for future activity. In cases where a mission is proposed at or near the PEA-specific Cost Cap, but depth of technical implementation detail is deferred, the proposal shall justify the adequacy of the proposed cost reserves to prevent increases beyond the PEA-specific Cost Cap during formulation and implementation of the mission.

This requirement is levied to establish NASA's standard for completeness of information necessary to support a comprehensive assessment of implementation feasibility and risk. The quality of the proposal's response to this requirement contributes significantly to the quality of the TMC assessment. However, NASA recognizes the preliminary nature of Pre-Phase A proposals, and thus Requirement B-37 will apply to all cases where the required information cannot, for whatever reason, be provided.

F.2. Mission Concept Descriptions.

Requirement B-38. Designs for all elements of the mission shall be described in sufficient detail to demonstrate that the proposed concept meets all of the basic requirements for a space flight mission, including mission design, spacecraft design, and supporting ground systems. Discussion of how the various mission elements meet the Mission Functional Requirements shall be included. At a minimum, the following mission elements shall be addressed: mission design, flight system capabilities, mission operations, and any additional elements.

Requirement B-39. Mission Design: This section shall address the following elements of mission design to the extent that they are applicable to the proposed mission and that they are known at the time of proposal submission. Any additional elements that are applicable to explaining the mission and demonstrating its feasibility shall also be addressed.

- Launch readiness date;
- Launch date flexibility;
- Mission duration;
- Orbit type (Earth orbit, heliocentric, etc.) and orbit information (semimajor axis, eccentricity, inclination, node time of day, argument of perigee, altitude, allowable dispersions), and/or trajectory design, as applicable to the proposed investigation;
- Critical events; and
- Ground station(s) usage (e.g., location(s) and transmitting and receiving communication parameters).

Requirement B-40. Launch Services and Launch Vehicle Compatibility: Any non-NASA launch services shall be described. For both NASA-provided and non-NASA provided launch services, compatibility with the proposed launch vehicle shall be demonstrated by providing in the appropriate proposal section the launch site, fairing size, spacecraft mass, and mission orbit characteristics such as altitude (km – circular or apogee/perigee), inclination, C3, heliocentric and/or declination (DLA). Any known nonstandard requirements such as additional fairing doors, cleanliness and purge requirements, planetary protection, etc. shall be described.

Requirement B-41. Flight System Capabilities: This section shall address the following flight system capabilities to the extent that they are applicable to the proposed mission and that they are known at the time of proposal submission. Any additional elements that are applicable to explaining the mission and demonstrating its feasibility shall also be addressed.

i. Spacecraft Parameters:
    a. Figure of the complete spacecraft/instrument system, on the launch vehicle and inflight, with major components labeled and approximate overall dimensions.
    b. Block diagram of the spacecraft subsystems and their components.

ii. Subsystem descriptions including structure, telecommunications, thermal, power, propulsion (if required), attitude determination and control, command and data handling, in-flight fault management, flight software, and ground software. (Note that the discussion of the telecommunications subsystem should be limited to specifications, design, and proposed component hardware – discussion of the link performance is addressed as part of the mission operations approach). Subsystem detail shall include to the extent possible the following information:

(a) Propulsion, including (i) Delta-V budget; (ii) for each propulsion mode propulsion type(s) (monoprop, bi-prop, dual-mode, solar electric, etc.), engines and thrust levels, and specific impulse; (iii) propellant allocation (impulse vs. attitude control system); and (iv) propellant margin, including nominal (to meet Delta-V requirement) and additional (to meet mass growth).

(b) Command and Data Handling, including (i) spacecraft housekeeping data rates for nominal and safing strategy; (ii) data storage unit size (Mbits); and (iii) maximum storage record and playback rate.

(c) Power, including (i) expected power requirement for each mission phase; (ii) minimum power capability needed to meet all requirements; and (iii) associated battery Depth of Discharge (DOD).

(d) Attitude Determination and Control, including system pointing requirements and capabilities. Describe or define the following: (i) each spacecraft operational mode, including the sensors and actuators used, control method, and safing and/or contingency modes; (ii) attitude determination methodology and estimate of accuracy, including identifying whether ground post-processing is required to meet investigation needs; (iii) agility requirements for slews or scanning; (iv) appendage pointing requirements, including articulation control methods and deployment accommodations; (v) sensor selection and performance, including identifying mounting location and Field-Of-View (FOV); (vi) actuator selection and sizing, including identifying mounting location(s); (vii) translational maneuver (Delta-V) control and accuracy; (viii) momentum management approach and mitigation of impacts on navigation accuracy, if applicable; (ix) on-orbit calibrations, if required, including expected accuracy; and (x) attitude control requirements for the spacecraft pointing control, pointing knowledge (at the instrument interface), pointing stability, or jitter.

(e) Thermal control, including (i) temperature requirements including deltas, (ii) temperature control approach (i.e. passive vs. active), (iii) cooling loads, and (iv) special thermal design considerations (e.g., cryogenic instrument requirements).

Requirement B-42. Additional Mission Elements: This section shall address any other major mission elements (*e.g.*, picosatellite dispenser, ESPA-ring, etc.) to the extent that they are

applicable to the proposed mission and to the extent that they are known at the time of proposal submission. Any additional elements that are applicable to explaining the mission and demonstrating its feasibility shall also be discussed.

i. Provide a block diagram and description of relevant subsystems; and
ii. Demonstrate that the proposed design can accomplish the mission within the allocated resources.

Requirement B-43. Flight System Contingencies and Margins: This section shall summarize contingencies and margins of all key flight systems resources. For the driving mission element requirements derived from the Mission Functional Requirements, it shall provide estimates of implementation performance and design margins with respect to the required performance. At a minimum, it shall include the following:

- Dry Mass;
- Launch Mass not available to the proposed mission;
- Propellants;
- Power;
- Data Storage; and
- Attitude Control System.

For any other driving mission element requirements derived from the Mission Functional Requirements, estimates of implementation performance and design margins with respect to the required performance shall be provided. If internal documents such as Flight Project Practices are referenced, an externally accessible URL shall be provided to download them.

Contingency and *Margin* are defined following Requirement B-28.

Requirement B-44. Mission Operations: This section shall address, at a minimum, the following elements of mission operations to the extent that they are applicable to the proposed mission and that they are known at the time of proposal submission. Any additional elements that are applicable to explaining the mission operations and demonstrating their feasibility shall also be addressed. This section shall provide, at a minimum, the following items:

- Description of ground systems and facilities, including supporting ground software required for development and testing;
- Telecommunications, Tracking, and Navigation (Deep-Space, Lunar, and Earth Orbital missions, as well as missions that utilize telecom relay orbiters), including (i) downlink information data volume; (ii) uplink information; (iii) for all transmit and receive modes, provide mode timeline, data rate(s), and durations; and (iv) ground network utilization plan, including ground stations, downlink parameters (frequencies, periods, capacities, margins, etc.), and retransmission capability;
- Description of approach for acquiring and returning critical event data, including clear identification of procurement and costing for supplemental resources (e.g., mobile ground stations) if such are needed; and
- A high-level discussion of operations plan, including nominal sequence planning and commanding, team training, availability of spacecraft experts for operations, and operations center development.

F.3. Development Approach.

Requirement B-45. This section shall describe the systems engineering development approach. This description shall include the following items:

- Roles and responsibilities for the interface management process - as specified in NPR 7123.1B - and product development responsibilities;
- A description of how the interface management process will be developed and maintained;
- Mission assurance approach, including (i) fault tolerance and fault management, (ii) product assurance, and (iii) reliability;
- Essential trade studies to be conducted in Phase A including the considered options and driving requirements;
- Identification of the key Technical Performance Measures (TPMs) - as specified in NPR 7123.1B - and descriptions of how these margins and reserves are to be allocated, tracked, and monitored, with what tools and by whom, and who will have the authority to release the associated reserves and margins;
- Descriptions of when contracts are required, the acquisition strategy, including any incentive strategy.

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F.4. New Technologies/Advanced Engineering Developments.

PEAs issued by NASA STMD, including those that solicit a technology demonstration investigation as opposed to a science or exploration investigation, will require technologies to be matured to TRL-5, not TRL-6, no later than PDR and therefore Requirement B-46 applies for TRL-5 by PDR. If Requirement B-46 is not applicable, it will be replaced by requirements in the applicable PEA.

Requirement B-46. This section shall describe any proposed new technologies and/or advanced engineering developments and the approaches that will be taken to reduce associated risks. Descriptions shall address, at a minimum, the following topics:

- Identification and justification of the TRL for each proposed system (level 3 WBS payload developments and level 3 WBS spacecraft elements) incorporating new technology and/or advanced engineering development at the time the proposal is submitted (for *TRL definitions*, see NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*, Appendix E, in the PEA-specific Library);
- Rationale for combining the TRL values of components and subsystems to derive each full system TRL as proposed, appropriately considering TRL states of integration (see NASA/SP-2007-6105 Rev 1, *NASA Systems Engineering Handbook*);
- Rationale for the stated TRL value of an element that is an adaptation of an existing element of known TRL;
- The approach for maturing each of the proposed systems to a minimum of TRL-6 (or TRL-5) by PDR:
  - Demonstration (testing) in a relevant environment can be accomplished at the system level or at lower level(s);
  - If applicable, justify what demonstration(s) in a relevant environment at lower level(s) (subsystem and/or subsystem-to-subsystem) would be sufficient to meet system level TRL-6 (or TRL-5), considering (i) where any new technology is to be inserted, (ii) the

magnitude of engineering development to integrate elements, (iii) any inherent interdependencies between elements (e.g., critical alignments), and/or (iv) the complexity of interfaces – see the PEA-specific Library for examples;
    - Include discussion of simulations, prototyping, demonstration in a relevant environment, life testing, etc., as appropriate;
- An estimate of the resources (staffing, cost, and schedule) required to complete the technology and/or advanced engineering development; and
- Approaches to fallbacks/alternatives that exist and are planned, a description of the cost, decision date(s) for fallbacks/alternatives, relevant development schedules, and performance liens they impose on the baseline design, and the decision milestones for their implementation.

If no new technologies or advanced engineering development is required, system TRL-6 (or TRL-5) or above at the time of proposal submission shall be clearly demonstrated.

F.5. Assembly, Integration, Test, and Verification.

Requirement B-47. An illustration and brief discussion of the time-phased flow of the Integration and Test (I&T) Plan shall be presented. It shall summarize the key facilities, testbeds, and team members involved in the I&T Plan.

Requirement B-48. The project's verification approach shall be described briefly in this section. Flow diagrams, narrative text, and/or other relevant data may be used to convey this information. Elements of the approach that pose special challenges for the project (e.g., mission critical performance or functional requirements that can't be tested on the ground, special facilities that may be required for testing, large scale simulation tools that must be developed and how they will be validated, critical path items, etc.) shall be included. The I&T description shall demonstrate the credibility of the overall I&T approach, as reflected by consistency between the described test plans and the schedule, cost, and other resources needed to carry them out.

F.6. Schedule.

Requirement B-49. A project schedule foldout(s) covering all phases of the investigation shall be provided to at least WBS level 3, except where greater detail is necessary to identify critical paths, as well as significant TRL or engineering development activities and events. The first 3 foldouts will not be counted against the page limits. The schedule format shall indicate the month and year of each milestone, have a corresponding table of dates, and follow standard NASA WBS elements for task descriptions as prescribed in NPR 7120.5E. The schedule foldout(s) and accompanying narrative (narrative is included in the page count for this section) shall address proposed major milestones including, at a minimum, the following items:

- Spacecraft development and major review dates;
- Instrument development and major review dates, including instrument-to-spacecraft/host integration and test;
- Ground systems development and major review dates (e.g., mission operations and data analysis development schedule);
- Major deliverables (e.g., Interface Control Documents (ICDs), simulators, engineering modules, flight modules, etc.);

- Launch vehicle integration and launch readiness;
- Compliance with National Environmental Policy Act (NEPA) and Nuclear Launch Safety Approval processes, if appropriate;
- Long-lead item specifications, development paths, and their impacts to schedule;
- Development schedule for SEOs, if any;
- Schedule critical path identification; and
- Funded schedule reserve, with indications of appropriate reserves associated with major milestones and deliverables.

G. MANAGEMENT

The following expands requirements in the AO, in particular Requirement 31 through Requirement 33, Requirement 55 through Requirement 63, and Requirement 91.

Requirement B-50. This section shall describe the investigator's proposed management approach. The management organization (including an organization chart), decision-making authority, and the teaming arrangement and responsibilities shall be discussed. The organization chart shall clearly indicate how the investigation team is structured. The names of the primary team members, their organization, and their reporting relationship within the project shall be provided.

Requirement B-51. This section shall describe the specific roles and responsibilities of the PI, PM, and other named Key Management Team members. It shall describe the qualifications and experience, especially any unique capabilities or previous experience with similar systems and/or equipment (including their performance in meeting cost and schedule), of these Key Management Team members, and demonstrate that they are commensurate with the technical and managerial needs of the proposed investigation. The time commitment of each Key Management Team member shall be provided by mission phase. It shall also describe the qualifications and experience of the primary implementing institutions and demonstrate that they are commensurate with the technical and managerial needs of the proposed investigation.

Requirement B-52. This section shall describe the project risks and project resiliency considering these risks.

- Provide the top risks considered significant by the PI and the PM, especially technical risks and risks associated with contributed hardware (if any), and potential mitigation strategies and associated schedule impacts. If resources for these risks have been included in the basis of estimate, indicate so. Alternatively, reserves held to account for these risks shall be considered encumbered. If cost risks are in this list, they shall be described here and then discussed per Section H (see Requirement B-57).
- The approach to any potential descopes, including savings of resources (mass, power, dollars, schedule, etc.) by implementing descopes, the decision milestone(s) for implementing descopes and the scientific impact of individual as well as combined descopes shall be discussed.

Requirement B-53. If the proposal contains proposed contributions or cooperative arrangements, this section shall describe the technical and management interfaces in any proposed cooperative

arrangements, explicitly demonstrating that the contributions are within the contributors' scientific and technical capabilities, and contingency plans for coping with potential failures of the proposed cooperative arrangements.

Requirement B-54. In the case where a proposal does not provide the required management and schedule details, for whatever reason, this section shall (i) describe the current management approach and schedule, (ii) justify that the development of that aspect of the project management and schedule is not required at this stage and that it is acceptable to develop details later, (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, and (iv) justify the adequacy of the proposed cost reserves. The process for developing the required depth of information, along with a corresponding schedule, shall be explicitly included among the plans for future activity.

H. COST AND COST ESTIMATING METHODOLOGY

The following expands requirements in the AO, in particular Requirement 73 through Requirement 88.

This section of the proposal must include an estimated cost of the investigation, a description of the methodologies used to develop the estimate, and a discussion of cost risks.

Requirement B-55. This section shall include the estimated cost of the proposed investigation. The estimated cost shall encompass all proposed activities, including all applicable mission phases, mission unique or special launch services, flight systems, ground systems, ground network fees, contributions, any other AO-specific activities (*e.g.,* SC), and all cost reserves. These costs shall be consistent with the policies and requirements described in Section 4 and Section 5 of this AO.

Requirement B-56. This section shall provide a Basis of Estimate, including a description of the methodologies used to develop the primary cost estimate. The cost estimating methodology discussion in this section shall provide an overview of the cost estimate development process. Any additional cost estimates or other validation efforts shall be described, the results presented, and any significant discrepancies discussed. The rationale for the proposed cost reserve levels shall be presented. Proposers shall provide additional Basis of Estimate data to assist the validation of their cost estimates. Examples of useful Basis of Estimate data include cost comparisons to analogous items/missions, vendor quotes, and parametric model results.

Requirement B-57. This section shall include a discussion of cost risks.

Requirement B-58. This section shall provide foldout cost tables, Table B3a and B3b, which will not be counted against the page limit. Tables B3a and B3b shall identify the proposed cost required in each mission phase and in each fiscal year; the costs shall be in real year dollars (RY$) in Table B3a and fiscal year dollars (FY$, as specified in applicable PEA) in Table B3b. The top portion of Tables B3a and B3b shall contain cost data relevant to the PI-Managed Mission Cost. The lower portion shall contain cost data for contributions and enhanced mission costs. The rows in Tables B3a and B3b shall be the NASA standard WBS elements as defined in

NPR 7120.5E. The costs for most elements shall be provided to WBS level 2, as shown in Tables B3a and B3b. Exceptions are the costs of individual instruments and any unique flight system elements (such as coordinating science ground stations, DSN, nonstandard facilities, landers or sample return capsules), which shall be explicitly shown The columns in Tables B3a and B3b shall be grouped and subtotaled by mission phase and shall be labeled with the appropriate real or fiscal years. Years that span more than one mission phase shall be split into two columns by mission phase. The final columns in each of Tables B3a and B3b are totals in RY$ and totals in FY$. Proposers shall use their own forward pricing rates to translate between RY$ and FY$. For organizations that are without approved forward pricing rates, proposers shall use the most recent NASA inflation/deflation indices in the *NASA Y# New Start Inflation Index for FY ## Use* table (where Y# is the table publication year and ## are the appropriate FY year) provided in PEA-specific Library.

Requirement B-59. Tables B3a and B3b shall be provided additionally in Microsoft Excel format on each CD-ROM submitted. Microsoft Excel format templates are available for download in the PEA-specific Library.

Requirement B-60. This section shall include a statement as to whether the proposer's approved forward pricing rates were used or NASA's inflation/deflation indices were used. If the proposer's approved forward pricing rates were used, this section shall include the forward pricing rates, with an explanation of how they were derived to translate between RY$ and FY$ in Tables B3a and B3b.

I. EDUCATION PROGRAM PLAN, COMMUNICATIONS AND OUTREACH PROGRAM PLAN, AND OPTIONAL STUDENT COLLABORATION PLAN

The following expands requirements in the AO, in particular Requirement 71.

I.1. Education Program Plan

The applicable PEA will state the Education Program Plan requirements, if any.

Requirement B-61. This section shall include an Education Program Plan as required in the applicable PEA. .

I.2 Communications and Outreach Program Plan

The applicable PEA will state the Communications and Outreach Program Plan requirements, if any.

Requirement B-62. This section shall include a Communications and Outreach Program Plan as required in the applicable PEA.

I.3. Optional Student Collaboration Plan

Requirement B-63. If a Student Collaboration (SC), as described in Section 5.6.2 of this AO, is proposed, then this section shall provide details of the development schedule of the SC, including decision points for determining SC readiness for flight. This section shall describe how the SC can be incorporated into the mission on a nonimpact basis. This section shall show that the SC is clearly separable from the rest of the proposed effort.

J. PROPOSAL APPENDICES

Requirement B-64. 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, except as noted. The proposer shall not include in these Appendices material required in the page-limited sections in the body of the proposal. Any additional information not specifically required in a given appendix will not be considered by the evaluation panel and may result in reduced ratings during the evaluation process or, in some cases, could lead to rejection of the proposal without review. No other appendices are permitted.

J.1. Table of Proposal Participants

The following expands requirements in the AO, in particular Requirement 93.

Requirement B-65. A table of Proposal Participants shall be provided. The table shall include all organizations named in the proposal including contributing organizations. The primary purpose of the table is to aid NASA in avoiding conflicts of interest during the evaluation of the proposal. A secondary purpose is to provide material helpful for the evaluation and selection process. The table shall have three columns: (i) name of organization, including city and state/country where it is located, (ii) role of organization, and (iii) total cost or budget for that organization (over the life of the proposal for baseline investigation). The table shall have a row for every organization named in the proposal, and the rows shall be organized into three sections: (i) major partners; (ii) science only, nonhardware partners; and (iii) minor partners, vendors, and suppliers, as known at the time of the proposal. Major partners are defined to be organizations responsible for providing project management, system engineering, major hardware elements, science instruments, spacecraft accommodations, launch services, integration and test, science operations, and other major elements of the proposed investigation, as defined by the proposer.

J.2. Letters of Commitment.

The following expands requirements in the AO, in particular Requirement 90, Requirement 96, and Requirement 97.

Requirement B-66. Letters of commitment signed by an institutional official shall be provided from (i) all organizations offering contributions of goods and/or services (both U.S. and non-U.S.) on a no-exchange-of-funds basis and, (ii) unless otherwise explicitly excepted elsewhere in this AO or applicable PEA, all major participants in the proposal regardless of source of funding.

Major partners are the organizations in section (i) of the Table of Proposal Participants. Requirements for letters of commitment may be found in Section 5.9.1 of this AO.

J.3. Resumes.

The following expands requirements in the AO, in particular Requirement 55, Requirement 56, Requirement 67, and Requirement 69.

Requirement B-67. This section shall include resumes or curriculum vitae for the PI, PM, all Co-Is identified in the science section and for any other Key Management Team member. Specifically, each resume shall cite the individual's experience that is pertinent to the role and responsibilities that she/he will assume in the proposed investigation. Project management experience shall be included in the resumes of the PI, and PM. Resumes or curriculum vitae shall be no longer than three pages for the PI and one page for each additional participant. Resumes shall be organized alphabetically, by surname after that of the PI.

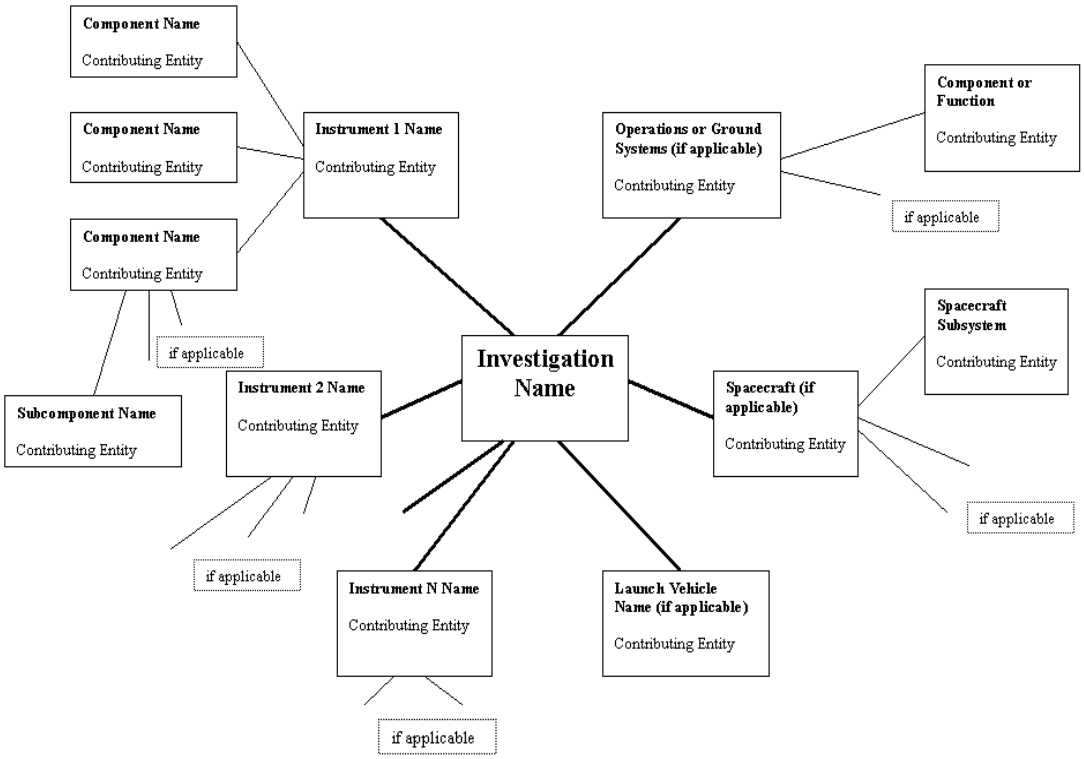
J.4. Summary of Proposed Program Cooperative Contributions.

The following expands requirements in the AO, in particular Requirement 85 through Requirement 88 and Requirement 93.

Cooperative contributions are defined to be those that are to be provided to the proposed investigation from a U.S. or non-U.S. partner on a no-exchange-of-funds basis. In order to aid NASA in conducting an equitable assessment of risks, this section must include (a) an "exploded diagram" of the investigation and (b) a supporting table.

a. An "exploded diagram" of the investigation.

SAMPLE EXPLODED DIAGRAM



Requirement B-68. If a proposal includes cooperative contributions, this section shall include an "exploded diagram" of the investigation (see example figure) 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 memorandum of agreement, shall be shown in this diagram. Each contribution shown shall display a unique name for the contribution, as well as the identity of the contributing entity. However, the following shall not be shown:

i. If there are no cooperative contributions of spacecraft, launch vehicle or services, or ground operations or facilities, these boxes shall 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, shall not be shown.
iii. U.S. or non-U.S. goods and services obtained by contract using NASA funds are not cooperative contributions and shall not to be shown.

b. A supporting table of collaborative contributions.

Requirement B-69. If a proposal includes cooperative contributions, this section shall include a supporting table with more information that elaborates upon each cooperative contribution shown in the exploded diagram. The table shall 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 organization, whether U.S. or non-U.S.;
iii. The roles and responsibilities of the providing organization, including cross reference to information in the proposal providing further detail as required in Section 5.7.6 of this AO;
iv. The identification of the funding sponsor, if different from the organization identified in item (ii) above;
v. The approximate value of the contribution, in U.S. dollars, as defined in Section 5.7.6 of this AO; and
vi. Cross reference to letters of commitment, as required in Section 5.9.1 of this AO.

J.5. Draft International Participation Plan - Discussion on Compliance with U.S. Export Laws and Regulations.

The following expands requirements in the AO, in particular Requirement 95.

Requirement B-70. If a proposal includes international participation, either through involvement of non-U.S. nationals and/or involvement of non-U.S. entities, this section shall discuss compliance with U.S. export laws and regulations; *e.g.,* 22 CFR parts 120-130, *et seq*. and 15 CFR parts 730-774, *et seq*., as applicable to the scenario surrounding the particular international participation. The discussion shall describe in detail the proposed international participation and is to include, but not be limited to, whether or not the international participation may require the proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or, if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at http://www.pmddtc.state.gov/ and http://www.bis.doc.gov/. Proposers are advised that under U.S. law and regulation, spacecraft and their specifically designed, modified, or configured systems, components, parts, etc., such as instrumentation responsive to 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*.

Requirement B-71. Foreign nationals requiring access to NASA facilities and information systems will be required to comply with Homeland Security Presidential Directive 12 (HSPD-12) (see http://www.dhs.gov/homeland-security-presidential-directive-12) where applicable. This appendix shall also discuss the impact, if any, on the investigation and the proposed international participation of compliance with HSPD-12. If no impact is anticipated, this shall be explicitly stated.

J.6. Compliance with Procurement Regulations by NASA PI Proposals.

The following expands requirements in the AO, in particular Requirement 65.

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 (NFS 1872.308).

Requirement B-72. For NASA Center proposals, this section shall include any descriptions, justifications, representations, indications, statements, and/or explanations that are required by the regulations.

J.7. Discussion of Limiting the Generation of Orbital Debris and End of Mission Spacecraft Disposal Requirements.

The following expands requirements in the AO, in particular Requirement 53.

This appendix is required only for proposed missions to Low Earth Orbit (LEO) (<2000 km perigee), near Geosynchronous orbit (GEO) (GEO ± 300 km), or the Moon (orbiters and landers).

Requirement B-73. This section shall discuss briefly how the mission meets the NPR 8715.6B and NASA-STD-8719.14 orbit debris requirements applicable to its proposed orbit. A mission analysis to control debris released under normal operations, limit accidental explosions, limit intentional breakups, and limit collisions with large and small debris shall be provided.

Requirement B-74. For LEO missions, this section shall briefly discuss the lifetime of the mission and whether it meets the 25-year post-mission (or 30-year from launch – whichever comes first) requirement. An orbital lifetime analysis addressing all assumptions and inputs contributing to the analysis shall be provided and describe, at a minimum:

- Vehicle Mass
- Drag Area or Cross-sectional Area
- Initial orbit used for the analysis
- Solar and atmospheric conditions assumptions (i.e., models or parameters)
- Methodology: analytical tool, table lookup, reference plot.

A vehicle reentry human casualty risk assessment shall also be provided.

Requirement B-75. If the plan is to dispose of the satellite at the end of mission, this section shall provide the parameters of the disposal orbit, the delta-v allocation for disposal, and any other relevant assumptions.

Requirement B-76. For Lunar missions, this section shall include a discussion of how end-of-mission requirements will be met.

The following references are available in the PEA-specific Library:

- NPR 8715.6B, *NASA Procedural Requirements for Limiting Orbital Debris*; and
- NASA-STD-8719.14, *NASA Process for Limiting Orbital Debris*.

J.8. Master Equipment List.

The following expands requirements in the AO, in particular Requirement 81.

Requirement B-77. This section shall include a Master Equipment List (MEL) summarizing all major components of each flight element subsystem and each instrument element component to support validation of proposed mass estimates, power estimates, contingencies, design heritage, and cost. A Microsoft Excel template of the MEL is available for download in the PEA-specific Library.

Requirement B-78. Contributed flight element subsystem components and individual instrument element components that are a part of the PI's proposed hardware development shall be included in the MEL. This does not include the spacecraft when the spacecraft is external to the PI's proposed hardware development. This does not include the launch vehicle.

Requirement B-79. The MEL shall be additionally provided in Microsoft Excel format on each CD-ROM submitted. A Microsoft Excel template of the MEL is available for download in the PEA-specific Library.

The breakouts should be traceable to block diagrams and heritage claims provided in other parts of the proposal. For each major component, Current Best Estimates (CBE) and contingency for mass and power, number of flight units required, and some description of the heritage basis must be provided. Power values should represent nominal steady-state operational power requirements. Information to be provided includes identification of planned spares, identification of engineering models and prototypes with their fidelities, required deliveries for simulators and testing, contingency allocations for individual components, and other component description/characteristics. Certain items should include additional details, sufficient to assess functionality and/or cost, to identify and separate individual elements.

List each electronic board separately, identify the functionality of each board (either in the MEL or in the Mission Implementation section), and provide the speed the board will be running at. If proposing Field-Programmable Gate Arrays (FPGAs) or Application-Specific Integrated Circuits (ASICs) or Radio Frequency Integrated Circuits (RFICs), list the design size (in the appropriate sizing parameter such as logic cells, logic elements), the board the chip(s) will be integrated onto, and how much heritage will be used in the design.

J.9. Heritage.

The following expands requirements in the AO, in particular Requirement 100 and Requirement 101.

Requirement B-80. This section shall discuss each element of any heritage from which the proposed investigation derives substantial benefit, including heritage from spacecraft subsystems, instruments, ground systems, flight and ground software, test set ups, simulations, analyses, etc. This discussion shall be at an appropriate level of granularity (*e.g.,* component, assembly, subsystem) to clearly separate the heritage element from other elements of the design. The discussion of each element shall include:

- a concise description of the design heritage claimed;
- the anticipated benefits to the proposed investigation;
- a brief rationale supporting the claim that the benefits of heritage will be achieved; and
- for any proposed elements with substantial design heritage, a comparison of the cost of the heritage items to the proposed cost.

The length of this Appendix is limited. See the Proposal Structure and Page Limits table.

Proposals must substantiate 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 must be provided to independently assess the current level of maturity.

Requirement B-81. If a proposal claims any heritage from which the proposed investigation derives substantial benefit, this appendix shall discuss each element to an appropriate level of granularity (e.g*.,* component, assembly, subsystem) to clearly separate the heritage element from other elements of the design.

The evaluation team will use a scale with three levels (full, partial, or none) as illustrated in the table below.

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

J.10. List of Abbreviations and Acronyms.

The following expands requirements in the AO, in particular Requirement 102.

Requirement B-82. This section shall provide a list of abbreviations and acronyms.

J.11. List of References (optional).

In addition to the above items, this appendix may provide a reference list of documents and other materials that were fundamentally important in generating the proposal. This may include a Uniform Resource Locator (URL) for documents that are available through the Internet. As noted at the outset of Appendix B of this AO, however, proposals must be self-contained: any data or other information intended as part of a proposal must be included within the proposal itself. If any documents or other materials are submitted as a part of a proposal, they must fit within the prescribed page limits.

J.12. Infusion Plan for Technology Infusion Opportunity.

The following expands on Section 5.3.7 of the AO.

Requirement B-83. This section, which shall not exceed five pages in length, shall describe any proposed utilization of NASA-developed technology. At a minimum, this description shall address the following topics to the extent that they are not addressed in the body of the proposal:

1) Demonstration of the offerors' understanding of the chosen NASA-developed technology, as well as their understanding of inherent risks associated with its use.
2) Description of technology infusion implementation plan with respect to utilization of the chosen NASA-developed technology. At a minimum, this shall include:
   (a) Description of any required flight hardware development and integration plans for producing flight-qualified hardware/software.
   (b) If any fallbacks/alternatives exist and are planned, description of the cost, schedule, and performance liens they will impose on the baseline design, as well as the decision milestones for their implementation.
3) Description of the application, appropriate use, and benefits of the NASA-developed technology in the proposed investigation, including description of how this technology could enhance the proposed investigation's science return.
4) Description of how the offeror would engage with the relevant NASA program office's intention to have insight into the flight hardware development, IV&V testing and results, flight development lessons learned, and performance data obtained during flight for the chosen NASA-developed technology.

This section need not repeat information that may be found in the body of the proposal. However, for completeness, discussions of NASA-developed technology in the body of the proposal should be referenced from this section.

TABLE B1
EXAMPLE SCIENCE TRACEABILITY MATRIX
An EXCEL version of this template is available in the PEA-specific Library.

Science Goals	Science Objectives	Scientific Measurement Requirements		Instrument Requirements		Projected Performance	Mission Requirements (Top Level)
		Physical parameters	Observables				
GOAL 1	Objective 1	Column Density of Absorber	Absorption Line	Alt. Range	XX km	ZZ km	Observing strategies: requires yaw & elevation maneuvers Launch window: to meet nadir and limb overlap requirement. Window applies day-to-day.
		Density and Temperature of Emitter	Emission Line				
		Size of Features	Morphological Feature	Vert. Resolution	XX km	ZZ km	Need NN seasons to trace evolution of phenomenon
				Horiz. Resolution	XX deg x XX lat x XX long	ZZ deg x ZZ lat x ZZ long	
			Rise Time of Eruptive Phenomena	Temperature Resolution	XX min	ZZ min.	Need MM months of observation to observe variability of phenomenon.
				Precision	XX K	ZZ K	
				Accuracy	XX K	ZZ K	

TABLE B2
EXAMPLE MISSION TRACEABILITY MATRIX
An EXCEL version of this template is available in the PEA-specific Library.

Mission 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
Examples				
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

TABLE B3a

TOTAL MISSION COST RY$ PROFILE TEMPLATE

Cost by WBS elements should be provided to the extent that they are known

An EXCEL version of this template is available in the PEA-specific Library.

Total Mission Cost Profile Template

FY Costs and Totals in Real Year Dollars (RY$)

WBS#	WBS Element	Phase A			Phase B			Phase C/D				RY$	Phase E				Phase F			RY$
		FY2017	FY2018	Total	FY2018	FY2019	Total	FY2019	FY2020	FY2021	Total	All Total	FY2021	FY2022	FY2023	Total	FY2023	FY2024	Total	All 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	Optional Student Collaboration (SC) in Excess of Incentive																			
	Reserves																			
	PI-Managed Mission Cost (PIMMC)																			
	Optional SC up to Incentive (if applicable)																			
	Other PEA-specific activities within the Total Mission Cost																			
	List by activity and WBS element																			
	Contributions																			
	List by organization and WBS element																			
	Total Mission Cost																			
	Optional SC up to Incentive (if applicable)																			
	Other PEA-specific activities within the Enhanced PIMMC																			
	List by activity and WBS element																			
	Enhanced PIMMC																			

*Please refer to the solicitation for PIMMC, Total Mission Cost and Enhanced PIMMC definitions and for more details.

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

TABLE B3b

TOTAL MISSION COST FY$ PROFILE TEMPLATE

Cost by WBS elements should be provided to the extent that they are known

An EXCEL version of this template is available in the PEA-specific Library.

Total Mission Cost Profile Template

FY Costs and Totals in Fiscal Year <<CAP YEAR>> Dollars (FY<<CAP YEAR>>$)

WBS#	WBS Element	Phase A			Phase B			Phase C/D			FY<<CAP YEAR>>$	Phase E			Phase F			FY<<CAP YEAR>>$
		FY2017	FY2018	Total	FY2018	FY2019	Total	FY2019	FY2020	FY2021	All Total	FY2021	FY2022	FY2023	FY2023	FY2024	Total	All 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	Optional Student Collaboration (SC) in Excess of Incentive																	
	Reserves																	
	PI-Managed Mission Cost (PIMMC)																	
	Optional SC up to Incentive (if applicable)																	
	Other PEA-specific activities within the Total Mission Cost																	
	List by activity and WBS element																	
	Contributions																	
	List by organization and WBS element																	
	Total Mission Cost																	
	Optional SC up to Incentive (if applicable)																	
	Other PEA-specific activities within the Enhanced PIMMC																	
	List by activity and WBS element																	
	Enhanced PIMMC																	

*Please refer to the solicitation for PIMMC, Total Mission Cost and Enhanced PIMMC definitions and for more details.

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

TABLE B4
MASTER EQUIPMENT LIST
An EXCEL version of this template is available in the PEA-specific Library.

MASTER EQUIPMENT LIST Template - MISSION X

S/C Element 1		# OF UNITS			FLIGHT HARDWARE MASSES			FLIGHT HARDWARE POWER			OTHER COMPONENT INFORMATION	
Subsystem/Component	Unit Mass, Current Best Estimate (CBE)	Flight Units	Flight Spares	EMs & Proto-types	Total Mass, kg CBE	Contin-gency %	Total Mass w/ Contin-gency	Total Power, W CBE	Contin-gency %	Total Power w/ Contin-gency	Description (Vendor, Part #, Heritage Basis)	Other characteristics/issues (volume, other component-specific information)
Total Mass/Power												

S/C Element *n*		# OF UNITS			FLIGHT HARDWARE MASSES			FLIGHT HARDWARE POWER			OTHER COMPONENT INFORMATION	
Subsystem/Component	Unit Mass, Current Best Estimate (CBE)	Flight Units	Flight Spares	EMs & Proto-types	Total Mass, kg CBE	Contin-gency %	Total Mass w/ Contin-gency	Total Power, W CBE	Contin-gency %	Total Power w/ Contin-gency	Description (Vendor, Part #, Heritage Basis)	Other characteristics/issues (volume, other component-specific information)
Total Mass/Power												

Payload Element 1		# OF UNITS			FLIGHT HARDWARE MASSES			FLIGHT HARDWARE POWER			OTHER COMPONENT INFORMATION	
Subsystem/Component	Unit Mass, Current Best Estimate (CBE)	Flight Units	Flight Spares	EMs & Proto-types	Total Mass, kg CBE	Contin-gency %	Total Mass w/ Contin-gency	Total Power, W CBE	Contin-gency %	Total Power w/ Contin-gency	Description (Vendor, Part #, Heritage Basis)	Other characteristics/issues (volume, other component-specific information)
Total Mass/Power												

Payload Element *n*		# OF UNITS			FLIGHT HARDWARE MASSES			FLIGHT HARDWARE POWER			OTHER COMPONENT INFORMATION	
Subsystem/Component	Unit Mass, Current Best Estimate (CBE)	Flight Units	Flight Spares	EMs & Proto-types	Total Mass, kg CBE	Contin-gency %	Total Mass w/ Contin-gency	Total Power, W CBE	Contin-gency %	Total Power w/ Contin-gency	Description (Vendor, Part #, Heritage Basis)	Other characteristics/issues (volume, other component-specific information)
Total Mass/Power												

END OF APPENDIX B

APPENDIX C

GLOSSARY OF TERMS AND ABBREVIATIONS

Part C.1: GLOSSARY OF TERMS

Announcement of Opportunity (AO) — A document used to announce opportunities to participate in NASA programs.

AO Process — A term used to describe the program planning and acquisition procedure used to acquire investigations through an AO.

AO Steering Committee — A NASA committee composed wholly of Civil Servants and Intergovernmental Personnel Act appointees (some of whom may be from Government agencies other than NASA) and appointed by the Associate Administrator for the Mission Directorate that provides advice to the Mission Directorate Associate Administrator and provides procedural review over the investigation evaluation, categorization, and selection process.

Backward contamination — The transmittal to Earth from another body of viable organisms by a spacecraft or spacecraft component.

Baseline Investigation — The investigation that, if fully implemented, would fulfill the Baseline Science/Exploration/Technology Requirements, which are the performance requirements necessary to achieve the full science, exploration, or technology objectives of the investigation

Baseline objectives — The entire set of Science/Exploration/Technology objectives proposed for the investigation.

Basis of Estimate (BOE) — A record of the procedures, ground rules and assumptions, data, environment, and events that underlie a cost estimate's development or update. Good documentation of the BOE supports the cost estimate's credibility.

Categorization — The process whereby proposed investigations are classified into four categories synopsized here as Category I (recommended for acceptance); Category II (recommended for acceptance but at a lower priority than Category I proposals); Category III (sound investigations requiring further development); Category IV (not recommended).

Categorization Subcommittee — A NASA Committee, composed wholly of Civil Servants and Intergovernmental Personnel Act appointees (some of whom may be from Government agencies other than NASA) and appointed by the Associate Administrator for the Mission Directorate, that categorizes proposals for investigations submitted in response to an AO based on the evaluations.

Co-Investigator (Co-I) — An investigator who plays a necessary role in the proposed investigation and whose services are either funded by NASA or are contributed by his/her employer. A NASA employee can participate as a Co-I on an investigation proposed by a private organization.

Collaborator — An individual who is less critical to the successful development of the investigation than a Co-I. A collaborator may not be funded through the NASA proposal. A collaborator may be committed to provide a focused contribution to the project for a specific task, such as data analysis. If funding support is requested in the proposal for an individual, that individual must not be identified as a collaborator but must be identified as a Co-Investigator or another category of team member.

Communications — Comprises the comprehensive set of functions necessary to effectively convey and provide an understanding of a program, its objectives and benefits to target audiences, the public, and other stakeholders. This includes a diverse, broad, and integrated set of efforts and is intended to promote interest and foster participation in NASA's endeavors and develop exposure to, and appreciation for, science, technology, engineering, and mathematics (STEM).

Complete spaceflight mission — A science investigation requiring an Earth-orbiting, near-Earth, or deep-space mission, that encompasses all appropriate mission phases from project initiation (Phase A) through mission operations (Phase E) and close out (Phase F), including the analysis and publication of data in the peer reviewed literature, delivery of the data to an appropriate NASA data archive, and, if applicable, extended mission operations or other investigation enhancements.

Contingency — That quantity, when added to a resource, results in the maximum expected value for that resource.

Contribution — Labor, services, or hardware funded by any source other than Program sponsoring the AO.

Data buy — An investigation based on data purchased using NASA funds but was collected by an observational platform developed and operated without NASA support or oversight.

Data product latency — The period of time between data collection and release to the public. During this period the data may be in sole possession of the investigation team for checkout purposes only.

Descope — Any alteration of an investigation that results in savings of resources (mass, power, dollars, schedule, etc.) at the cost of reduced scientific performance.

Earned Value Management (EVM) — A tool for measuring and assessing project performance through the integration of technical scope with schedule and cost objectives during the execution of the project. EVM provides quantification of technical progress, enabling management to gain insight into project status and project completion costs and schedules.

Education — Comprises those activities designed to enhance learning in science, technology, engineering, and mathematics (STEM) content areas using NASA's unique capabilities.

Federal Acquisition Regulation (FAR) — The regulations governing the conduct of acquisition.

Forward contamination — The transmittal from Earth to a targeted solar system body of viable organisms by a spacecraft or spacecraft component.

Guest Investigators — Investigators selected to conduct observations and obtain data within the capability of a NASA mission, which are additional to the mission's primary objectives. Sometimes referred to as Guest Observers or General Observers.

Hosted Payload — A payload comprised of one or more sensors or instruments that is attached and/or integrated into a host space vehicle for the purpose of obtaining one or more ongoing resources from the host for the life of the hosted payload. Hosted payloads are typically arranged through a partnership.

Implementing organization — The organization chosen by the Principal Investigator to manage the development of the investigation.

Investigation — Activities or effort aimed at the generation of new knowledge. NASA-sponsored investigations generally concern the generation and analysis of data obtained through measurement of space phenomena or Earth phenomena using spaceflight hardware developed and operated for that purpose.

Investigation Team — The group of scientists, engineers, and other professionals implementing an investigation.

Key Management Team members **—** The project leaders whose qualifications and experience are relevant and necessary to the success of the project. Key Management Team members are the PI, PM, PSE, and, where appropriate, PS and partner leads, and other roles as identified in the proposal.

Life-Cycle Cost — The total of the direct, indirect, recurring, nonrecurring, and other related expenses both incurred and estimated to be incurred in the design, development, verification, production, deployment, prime mission operation, maintenance, support, and disposal of a project, including closeout, but not extended operations. The Life-Cycle Cost of a project or system can also be defined as the total cost of ownership over the project or system's planned life cycle from Formulation (excluding Pre-Phase A) through Implementation (excluding extended operations). The Life-Cycle Cost includes the cost of the launch vehicle.

Margin — The allowance carried on a resource (e.g., budget, schedule, mass) to account for uncertainties and risks. It is the difference between the maximum possible capability of a resource (the physical limit or the agreed-to limit) and the maximum expected value for a resource.

Mission — Used interchangeably with investigation.

Mission Architecture — The summary level description of the overall approach to the mission in the context of achieving the science objectives including mission elements such as flight systems, instruments, high-level mission plan, high-level operations concept, etc.

NASA FAR Supplement — Acquisition regulations promulgated by NASA in addition to the FAR.

Notice of Intent — A notice or letter submitted by a potential investigator indicating the intent to submit a proposal in response to an AO.

Passivation — The complete removal of any stored energy on board a spacecraft including residual propellants (by venting or burning), residual pressurants (by venting), electrical energy (by discharge or disconnection of batteries), kinetic energy (by unloading or de-spinning momentum wheels or gyros), and the disabling of range safety explosives.

Payload — A specific complement of instruments, space equipment, and support hardware carried to space to accomplish a mission or discrete activity in space.

PEA-specific Cost Cap — The nominal value that the PI-Managed Mission Cost is limited to. Represents the publicly announced Program funding available for a selected investigation. It may be adjusted for individual proposals by incentives and/or charges allowable under the applicable PEA. Expressed in applicable Fiscal Year Dollars.

Peer Review (n) — A gathering of experts in related disciplinary areas convened to review proposals for flight investigations.

Peer Review (v) — The process of proposal review utilizing a group of peers in accordance with the review criteria as outlined in the Announcement of Opportunity.

Performance Metrics — A multi-party agreement between the Program Office, the PI institution, the project management institution, and other major partners that is used for project evaluation by NASA.

PI-Managed Mission Cost — The cost proposed by the PI's implementation team to be funded by the Program sponsoring the AO for the development and execution of the proposed project, Phases A through F. It includes any reserves applied to the development and operation of the mission as well. It also includes any costs that are required to be accounted for against the PI-Managed Mission Cost even though the PI is not responsible for those costs (e.g., NASA-provided telecom and network). The term does not imply that a contractual relationship between the PI's institution and other proposal team members is required. When the PI-Managed Mission Cost is capped, the PEA-specific Cost Cap will be stated on the applicable PEA.

Planetary Protection — The practice of avoiding biological contamination of other planetary bodies and samples to be returned to Earth, to preserve the capability to perform future scientific and other investigations.

Principal Investigator (PI) — The person who conceives of an investigation and leads implementation of it. The PI is invested by NASA with primary responsibility for implementing and executing selected investigations. A NASA employee can participate as a PI only on a Government-proposed investigation.

Program — An activity involving human resources, materials, funding, and scheduling necessary to achieve desired goals.

Project — Within a program, an undertaking with a scheduled beginning and ending, which normally involves the design, construction, and operation of one or more spacecraft and necessary ground support in order to accomplish a scientific or technical objective.

Project Manager (PM) — The individual responsible to the PI for overseeing the technical and programmatic implementation of the project. The PM works closely with the PI in order to ensure that the mission meets its objectives within the resources committed to the project.

Project Office — An office established to manage a project.

Project Scientist (PS) — The member of the science team designated by the PI to be responsible for ensuring the scientific success of the project. The Project Scientist may have other responsibilities as defined by the PI or the implementing organization.

Proposal Team — The Proposal Team includes, but is not be limited to, all members of the Key Management Team and any Co-I or collaborator who is not part of the Key Management Team.

Proposing Organization — The organization that submits the proposal; commonly this is also the Principal Investigator's home institution.

Reserve — Resource not allocated to any specific task but held by the project for unexpected needs.

Resiliency — The quality of an investigation to gracefully degrade from the Baseline Investigation to the Threshold Investigation as technical, schedule, or budgetary problems occur.

Risk — The combination of the probability that a program or project will experience an undesired event and the consequences, impact, or severity of the undesired event, were it to occur. The undesired event may come from technical or programmatic sources (e.g., a cost overrun, schedule slippage, safety mishap, health problem, malicious activities, environmental impact, failure to achieve a needed scientific or technological objective, or success criterion). Both the probability and consequences may have associated uncertainties.

Science-Exploration-Technology Enhancement Options (SEO) — An activity, such as extended missions, guest investigator programs, general observer programs, participating scientist programs, interdisciplinary scientist programs, or archival data analysis programs that have the potential to broaden the scientific impact of investigations.

Selection Official — The NASA official designated to determine the source for award of a contract or grant.

Technology Demonstration Opportunity — An activity that demonstrates innovative technological approaches.

Termination review — A review established to determine whether remedial actions, including changes in management structure and/or key personnel, would better enable a project to operate within established cost, schedule, and/or technical constraints. If a termination review determines that no remedy is likely to improve matters, NASA may consider termination of the project.

Threshold Investigation — A descoped Baseline Investigation that would fulfill the Threshold Requirements, which are defined in NPR 7120.5E as the performance requirements necessary to achieve the minimum science, exploration, or technology acceptable for the investment.

Total Mission Cost — The PI-Managed Mission Cost, plus any Student Collaboration costs up to the student collaboration incentive, plus any additional costs that are contributed or provided in any way other than through the Program sponsoring the AO.

Unencumbered reserve — Reserves that are free of liens identified by proposers and are held for risks that may be realized during project execution.

Work Breakdown Structure (WBS) — A product-oriented hierarchical division of the hardware, software, services, and data required to produce a project's end product(s), structured according to the way the work will be performed, and reflective of the way in which program/project costs, schedule, technical and risk data are to be accumulated, summarized, and reported.

Part C.2: 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.

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).

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 Approval Engineering or Launch Approval Process — The process by which National Environmental Protection Act and any applicable launch safety approval requirements are satisfied.

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.

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, flight mission data evaluation, oversight of the launch service and coordination of mission-specific integration activities.

Mission Operations and Data Analysis (MO&DA) — This cost element refers only to Phases E and F(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 Science-Exploration-Technology Enhancement Option (SEO) activities.

NASA Center Costs (all categories) — Additional costs borne 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.

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

Prelaunch Ground Data System (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 (MOC) and the Science Operations Center (SOC). (For more information, refer to *NASA's Mission Operations and Communications Services* document in the PEA-specific 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.

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

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.

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 preallocated 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.

Science-Exploration-Technology Enhancement Option (SEO) Activities --- Options for enlarging the science-exploration-technology impact beyond the baseline investigation, such as extended missions, guest investigator programs, general observer programs, or archival data analysis programs are termed SEO activities. These costs do not count against the PEA-specific Cost Cap.

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

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

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 PEA-specific Library.)

Part C.3: ABBREVIATIONS AND ACRONYMS

AA	Associate Administrator
a.k.a.	also known as
AM&O	Agency Management and Operations
AO	Announcement of Opportunity
AOR	Authorized Organizational Representative
ASIC	Application-Specific Integrated Circuits
BOE	Basis of Estimate
CADRe	Cost Analysis Data Requirement
CARA	Conjunction Assessment Risk Analysis
CBE	Current Best Estimate
CCR	Central Contractor Registry
CD-ROM	Compact Disc-Read Only Memory
CDR	Critical Design Review
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CM&O	Center Management and Operations
Co-I	Co-Investigator
CTS	Cornell Technical Services
DOR	Differential One-way Ranging
DSN	Deep Space Network
EA	Environmental Assessment
EAR	Export Administration Regulations
EASSS	Evaluations, Assessments, Studies, Services, and Support
EBPOC	Electronic Business Point of Contact
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
EOL	End-of-Life
ERT	Earth Resources Technology, Inc.
EV	Earth Venture
EVM	Earned Value Management

EVM-#	Earth Venture Mission - #, where # is the Earth Venture Mission solicitation number
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
FOV	Field of View
FPGA	Field-Programmable Gate Array
FY	Fiscal Year
GAO	Government Accountability Office
GDS	Ground Data System
GEO	Geosynchronous Orbit
GFE	Government Furnished Equipment
GFS	Government Furnished Service
HBCU	Historically Black Colleges and Universities
HBZ	HUB Business Zone
HEO	Human Exploration and Operations
HEOMD	HEO Mission Directorate
HQ	Headquarters
HSPD	Homeland Security Presidential Directive
HUB	Historically Underutilized Business
HUBZone	Historically Underutilized Business Zone
IAT	Integration, Assembly, and Test
ICD	Interface Control Document
ISS	International Space Station
I&T	Integration and Test
ITAR	International Traffic in Arms Regulations
IV&V	Independent Verification and Validation
JPL	Jet Propulsion Laboratory
KDP	Key Decision Point
LEO	Low Earth Orbit
LSP	Launch Services Program
MB	Megabyte
MD	Mission Directorate
MEL	Master Equipment List
MO	Mission of Opportunity
MOC	Mission Operations Center
MO&DA	Mission Operations and Data Analysis
MOS	Mission Operations Services
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NASA-STD	NASA-Standard
NEN	Near Earth Network
NEPA	National Environmental Policy Act
NFS	NASA FAR Supplement

NISN	NASA Integrated Services Network
NLSA	Nuclear Launch Safety Approval
NMES	New Mission using Existing Spacecraft
NODIS	NASA Online Directives Information System
NOI	Notice of Intent
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NRA	NASA Research Announcement
NRP	NASA Routine Payload
NSPIRES	NASA Solicitation and Proposal Integrated Review and Evaluation System
NTRS	NASA Technical Reports Server
OCFO	Office of the Chief Financial Officer
OMI	Other Minority Institution
OSMA	Office of Safety and Mission Assurance
OSTP	Office of Science and Technology Policy
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
PMC	Program Management Council
PMO	Partner Mission of Opportunity
POC	Point of Contact
PS	Project Scientist
RHU	Radioisotope Heater Unit
PSE	Project Systems Engineer
ROSES	Research Opportunities in Space and Earth Sciences
RPS	Radioisotope Power System
RY	Real Year
SALMON	Stand Alone Missions of Opportunity Notice
SB	Small Business
SC	Student Collaboration
SCaN	Space Communication and Navigation
SCM	Small Complete Mission
SDB	Small Disadvantaged Business
SDVOSB	Service Disabled Veteran Owned Small Business
SE	System Engineer(ing)
SEO	Science-Exploration-Technology Enhancement Option
SMA	Safety and Mission Assurance
SMD	Science Mission Directorate
SMEX	Small Explorer
SN	Space Network
S/N	Signal-to-Noise
SOC	Science Operations Center

SOW	Statement of Work
SPG	Strategic Programming Guidance
START	Standards and Technical Assistance Resource Tool
TA	Technical Authority
TDO	Technology Demonstration Opportunity
TIO	Technology Infusion Opportunity
TMC	Technical, Management, and Cost
TRL	Technology Readiness Level
UARC	University Affiliated Research Center
URL	Uniform Resource Locator
U.S.	United States
U.S.C.	United States Code
USPI	U.S. Participating Investigator
VOSB	Veteran Owned Small Business
WBS	Work Breakdown Structure
WOSB	Women Owned Small Business

APPENDIX D

SALMON-3 AND PEA-SPECIFIC ACQUISITION HOMEPAGES

SALMON-3 Acquisition Homepage

The SALMON-3 Acquisition Homepage may be found at http://soma.larc.nasa.gov/SALMON-3/.

PEA-specific Acquisition Homepages for individual Program Element Appendices may be accessed from the SALMON-3 Acquisition Homepage.

PEA-specific Acquisition Homepages and Libraries

PEA-specific Acquisition Homepages for individual Program Element Appendices will contain relevant information associated with the PEA solicitation. Information includes the PEA, PEA related announcements, the PEA-specific Library, Preproposal Teleconference dates and agenda, and Questions and Answers.

The PEA-specific Library will contain documents referenced in the SALMON-3 AO and the applicable PEA.

APPENDIX E

REQUIREMENTS FOR SUBSEQUENT PHASES

This appendix provides references to documents that govern subsequent phases of mission development for selected investigations. These documents may contain requirements on selected missions; however, they do not place requirements on proposals submitted in response to this AO. Proposed investigations should be implementable within the program and project management environment that these documents describe. These documents may be found in the NASA Online Directives Information Service (NODIS) at http://nodis3.gsfc.nasa.gov/.

NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*
NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*
NPR 8705.4, *Risk Classification for NASA Payloads*
NPR 8715.3, *NASA General Safety Program Requirements*
SPD-19*, Meeting the 70% JCL Requirement in PI-led Missions*

APPENDIX F

COMPLIANCE CHECKLIST

This appendix contains a checklist with the list of items that NASA will check for compliance before releasing a proposal for evaluation. All other requirements will be checked during evaluation.

Administrative	
1. Electronic proposal received on time	Requirement 1
2. Proposal on CD-ROMs received on time	Requirement 2
3. Original signatures of PI and of authorizing official included	Requirement B-8
4. Meets page limits	Requirement 102
5. Meets general requirements for format and completeness (maximum 55 lines text/page, maximum 15 characters/inch -- approximately 12 pt font, 1 inch margins)	Requirement B-3
6. Required appendices included; no additional appendices	Requirement B-64
7. Budgets are submitted in required formats	Requirement B-58
8. All individual team members who are named on the cover page indicate their commitment through NSPIRES	Requirement B-12
9. All export-controlled information has been identified	Requirement 99
10. Complied with restrictions Involving China	Requirement 3
Science, Exploration, or Technology	
11. Addresses solicited science, exploration, or technology programs	Requirement 13
12. Requirements traceable from objectives to mission	Requirement 16
13. Plan to calibrate, analyze, publish, and archive the data returned	Requirement 17
14. Baseline Investigation and Threshold Investigation defined	Requirement 20
Technical	
15. Complete spaceflight mission (Phases A-F) proposed	Requirement 26
16. Team led by a single PI	Requirement 55
17. PI-Managed Mission Cost within PEA-specific Cost Cap (if a PEA-specific Cost Cap is stated in the applicable PEA)	Requirement 74
18. Contributions within contribution limit (if PEA specifies a contribution limit)	Requirement 86
19. Co-Investigator costs in budget	Requirement 68
20. Launch/Commitment date prior to launch deadline (if PEA specifies a deadline)	PEA Requirement
21. Includes table describing non-U.S. participation	Requirement 93
22. Includes letters of commitment from funding agencies for non-U.S. participating institutions	Requirement 90
23. Includes letters of commitment from all U.S. organizations offering contributions	Requirement 96
24. Includes letters of commitment from all major partners and non-U.S. institutions providing contribution of efforts of anyone on the Proposal Team.	Requirement 97

APPENDIX G

REQUIREMENTS CROSSWALK

Part G.1: This appendix contains an approximate crosswalk between proposal requirements in the AO and proposal requirements in Appendix B. Proposal requirements in Appendix B provide further definition of the proposal requirements in the AO and provide specific requirements for the format and content of the proposal. Some AO requirements do not require further definition by an Appendix B requirement. Not all possible crosswalk relations are shown.

AO Reqmt	AO Section	AO Reqmt Topic	Appendix B Reqmt
Requirement 1	3	Proposal submission	Requirement B-5
Requirement 2	3	CD-ROM submission	Requirement B-6
Requirement 13	5.2.1	Goals & Objectives	Requirement B-15
Requirement 16	5.2.2	Flow-down from Goals & Objectives	Requirement B-17
Requirement 17	5.2.2	Calibrate, analyze, publish, archive returned data.	Requirement B-19, Requirement B-23
Requirement 19	5.2.3	Proposed instrumentation	Requirement B-19
Requirement 20	5.2.4	Baseline and Threshold Investigations	Requirement B-16, Requirement B-18
Requirement 28	5.3.2	Implementation approach	Requirement B-30, Requirement B-45
Requirement 30	5.3.2	Calibration and Validation	Requirement B-19
Requirement 31, Requirement 32	5.3.3	Management approach	Requirement B-50
Requirement 35	5.3.5	Systems' Maturation	Requirement B-31, Requirement B-46
Requirement 39	5.3.8	Access to Space	Requirement B-40
Requirement 52	5.3.12	Critical Events	Requirement B-39, Requirement B-44
Requirement 55, Requirement 56, Requirement 57	5.4.1, 5.4.2	PI and PM roles and responsibilities	Requirement B-24, Requirement B-50, Requirement B-51
Requirement 58, Requirement 59	5.4.3	Key management qualifications	Requirement B-51
Requirement 65	5.4.6	NASA Centers compliance	Requirement B-72
Requirement 67, Requirement 68	5.5.2	Team Member roles and responsibilities	Requirement B-24, Requirement B-51
Requirement 73, Requirement 80	5.7.1, 5.7.3	Work Breakdown Structure (WBS)	Requirement B-58

Requirement 76	5.7.2	Cost estimation	Requirement B-55, Requirement B-56
Requirement 81	5.7.4	Master Equipment List (MEL)	Requirement B-77
Requirement 85, Requirement 86	5.7.6	Contributions	Requirement B-68, Requirement B-69
Requirement 93	5.8.2	International participation	Requirement B-70, Requirement B-71
Requirement 95	5.8.4	Export control guidelines	Requirement B-70
Requirement 98	5.9.2	Team Member commitments	Requirement B-12
Requirement 99	5.9.3	Export controlled material	Requirement B-70
Requirement 102	6.2.1	Uniform proposal format	Requirement B-4, Requirement B-13, Requirement B-14
Requirement 104	6.2.3	Electronic submission of proposals	Requirement B-5
Requirement 105	6.2.3	CD-ROM submission address	Requirement B-6

Part G.2: This appendix lists those requirements that are explicitly called out for specification in the applicable PEA. The PEA will have further requirements in addition to these, and the PEA may modify other requirements found in this AO in addition to those listed here. This list may be incomplete.

Section 2.4	Goals and objectives for proposed investigations
Section 2.4	Funding available for selected investigations (including funding for Category III proposals, if applicable)
Section 3, Section 6.2.3	Proposal submittal deadline, Deadline for Receipt of Proposal on CD-ROMs, sponsoring mission directorate and division, type of MO
Section 4.1.2	Program-specific safety, reliability, and quality assurance requirements document
Sections 4.1.2, 7.4.3	Designated NASA Center for program office
Section 4.2.1	Additional organizations used for evaluation services and any restrictions on their participation in proposals
Section 4.2.1	Additional restrictions on participation by The Aerospace Corporation in proposals
Sections 4.3.1, 5.7.1	Additional costs to be included in, and cap on, PI-Managed Mission Cost
Section 4.3.2	Additional costs to be included in Total Mission Cost
Section 4.3.3	Additional costs to be included in Enhanced PI-Managed Mission Cost
Section 4.3.4	Any constraints on funding profile, selection date, and launch readiness date
Section 5.1	Identification of permitted categories of missions of opportunity

Section 5.1.1	Endorsement date for PMOs.
Section 5.1.1	Any investigation date constraints for PMOs.
Section 5.1.1	Policies and constraints associated with specific PMO potential partnerships.
Section 5.1.2	Decision requirement date for NMES
Sections 5.1.3, 5.3.8	Identification of any NASA-provided launch services
Section 5.1.3	Launch date constraints for SCMs
Section 5.1.3	Access to space constraints for SCMs
Section 5.2.5	State whether SEOs allow flight hardware.
Section 5.3.1	Determination to use a two-step competitive process
Section 5.3.2	Broadening of allowable platforms beyond spacecraft
Section 5.3.4	Mission category and the payload risk classification that will be applied to selected investigations
Section 5.3.5, Appendix B Section F.3	Deadline for technology maturation other than TRL 6 by PDR for non NASA STMD sponsored investigations
Section 5.3.5, Appendix B Section F.3	Deadline for technology maturation other TRL 5 by PDR for NASA STMD sponsored investigations
Section 5.3.6	Technology Demonstration Opportunity allowed
Section 5.3.7	Technology Infusion Opportunity available
Section 5.3.8	Charge, if any, for NASA insight for non-NASA launch services
Section 5.3.8	Addition of the term “top risk” referring to launch delays for non-NASA provided access to space (applicable for missions with launch windows)
Section 5.3.10	That the proposed use of radioactive materials of any quantity and any isotope, including radioisotope power sources, radioisotope heater units, or radioactive calibration sources for science instruments, is not permitted
Section 5.4.5	Schedule requirements
Section 5.6.1	Education Program Plan and Communications and Outreach Program Plan
Section 5.6.2	Requirements and constraints for Student Collaborations if allowed
Section 5.7.2	The required minimum Phases A/B/C/D unencumbered cost reserves percentage.
Section 5.7.2	The required minimum Phases E and F unencumbered cost reserves percentage (if any).
Section 5.7.5	The applicable CM&O burden rate per “equivalent head”
Section 5.7.6	Constraints on contributions, if any
Section 5.8.2	Any PEA-specific exemptions on the description of any proposed non-U.S. contribution essential to the success of the proposed investigation to the same level of detail as those of U.S. partners
Section 5.9.4	The address for delivery of the package containing the classified

	appendix.
Section 6.1.1	Existence and logistics for a preproposal conference
Section 6.1.2	Whether a Notice of Intent (NOI) to propose is required
Section 6.1.2	Deadline for the NOI
Section 6.1.5	Links to any PEA-specific acquisition homepage and program library
Section 6.1.6	Contact information for the PEA-specific point-of-contact
Section 6.2.1	Modification of any proposal general content or structure requirements
Section 7.1	Identification of selection official
Section 7.1.1	Request clarifications on potential major weaknesses on the Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation or the Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation criteria or both
Section 7.4.2	Whether a PI-lead Team Masters Forum attendance is required for selected investigations

APPENDIX H

REPRESENTATIONS AND CERTIFICATIONS

Submission of the signed proposal including Section V of the Proposal Summary Information indicates the prospective awardee's agreement with the requirement to submit and maintain representations and certifications, as mandated by Federal contracting and assistance agreements regulations.

Duns and Bradstreet Universal Numbering System (DUNS) Number and System for Award Management (SAM):

Each applicant (unless the applicant is an individual or Federal agency that is exempt from those requirements under 2 CFR 25.110(b) or (c), or has an exception approved by the agency under 2 CFR 25.110(d)) is required to: (i) Be registered in the SAM prior to submitting its application; (ii) provide a valid DUNS number in its application; and (iii) continue to maintain an active SAM registration with current information at all times during which it has an active Federal award or an application or plan under consideration by an agency. An award will not be made to an applicant until the applicant has complied with all applicable DUNS and SAM requirements.

Offerors whose proposals are recommended for award will be contacted by a Contracting Officer/Grant Officer to discuss any additional information required for award. This may include representations and certifications, revised budgets or budget explanations, certificate of current cost or pricing data, subcontracting plan for small businesses, and other information as applicable to the proposed award. The anticipated award start date will be determined at this time. The appropriate award document, when signed by the Government Contracting/Grants Officer is the authorizing award document

For CONTRACT Proposals:

Certifications and representations shall be completed by successful offerors prior to award. Federal Acquisition Regulation (FAR) Online Representations and Certifications are to be completed through SAM at website https://www.SAM.gov. Any additional NASA FAR Supplement and contract specific certification packages will be provided to the contractor for completion prior to award.

For GRANT and COOPERATIVE AGREEMENT Proposals:

Grant awards greater than $100,000 require a certification of compliance with a national policy mandate concerning lobbying. Statutes and Government-wide regulations require the certification to be submitted prior to award. The certification is set forth at Appendix A to 32 CFR 28 regarding lobbying. When submitting your grant through Grants.gov, by completing blocks 17 and 19 of the Standard Form 424 Research and Related (R&R) Form, the grant applicant is providing the certification on lobbying required by 32 CFR Part 28, otherwise a signed copy by the authorized representative must be provided.

NOTICE: Amended June 11, 2019. This amendment makes the following changes to this PEA, listed in summary in order of their appearance by section name or section number:

- **In Sections 4.3.1 and 8.2 language is added that defers the Data Analysis Plan until Step-2.**

This PEA is clarified by adding the following text:

- **In the Foreword and Section 8.1 language is added to clarify that investigations may propose to use small amounts of radioactive materials.**

New text is in bold and deleted text is struck through.

FOREWORD

Proposers should be aware of the following major changes in this PEA from previous Astrophysics Explorers Program MO PEAs.

- Investigations to be flown aboard the International Space Station (ISS) may be proposed. NASA will provide accommodations on the ISS, as well as transportation to the ISS, at no charge against the PI-Managed Mission Cost. The FY20 President's Budget Request proposes continued support of ISS beyond 2025, and it is expected that the ISS will be accessible as a science platform beyond that date.
- Proposers should be aware that all of the evaluators of scientific merit (criterion A) and scientific implementation merit and feasibility of the proposed investigation (criterion B) will review a version of the proposal in which any export controlled material has been redacted.

Some changes have been made from the draft PEA released in November 2018. These include:

- Alternative access to space (non-PEA-provided launch vehicle and launch services) will not be an option in the final PEA, because the commercial market for the small launch vehicles and rideshare is evolving rapidly. Delaying identification of options for the launch vehicle or rideshare opportunity from the Step 1 proposal (by the PI) until approximately Preliminary Design Review (for a PEA-provided launch) allows missions to benefit from additional entrants into the commercial small launch vehicle and rideshare market. NASA expects to allow PI-obtained alternative access to space in future AOs. (Section 5.3.6).
- PEA-provided access to space is expanded to include rideshare on ESPA or ESPA Grande to Low Earth Orbit or Geostationary Transfer Orbit (Section 5.3.6). These may be rideshares on government or commercial launches.
- Within the class of Small Complete Missions, NASA is emphasizing SmallSats: small payloads within a $35M cost cap. For SmallSats, PEA-provided rideshare access to space is outside the PEA cost cap.
- PEA-provided access to space is expanded to allow CubeSats up to 12U to be proposed as payloads to cislunar space.
- CubeSats and CubeSat Constellations for PEA-provided rideshare to Low Earth Orbit or Geostationary Transfer Orbit are solicited only as SmallSats, packaged for rideshare on ESPA or ESPA Grande.
- Balloon-borne missions are not solicited at this time. NASA is studying alternative opportunities to propose highly-capable balloon and CubeSat missions within the Astrophysics Research Program.

- Delay Tolerant Networking capability is not offered (deleted Telecommunications section from draft)
- Space Systems Protection will be required (Section 5.3.7), but the requirements are deferred until Step-2, and the associated costs will be outside the PEA Cost Cap.
- **Investigations may baseline use of small amounts of radioactive material for uses such as radiological calibration sources for science instrumentation; however no radioactive material may be used for supplemental power (Section 5.3.10 of SALMON-3). [Amended June 11, 2019]**

This PEA offers opportunities to make use of the lunar Gateway:

- investigations operating in cislunar space may propose use of the communications and data relay capabilities of the lunar Gateway;
- investigations may be proposed as attached payloads on modules of the lunar Gateway; and
- rideshare on SLS (Space Launch System) launches may be proposed for payloads with maximum mass and dimensions comparable to those solicited for AO-provided rideshare to Low Earth Orbit or Geostationary Transfer Orbit.

Opportunities for investigations in cislunar space, including those using the lunar Gateway, may evolve during the AO process. Proposer documents in the Program Library may be updated periodically, but no later than 30 days before the proposal due date. It is each proposer's responsibility to check for updates.

NNH17ZDA004O
THIRD STAND ALONE MISSIONS OF OPPORTUNITY NOTICE (SALMON-3)

NNH17ZDA004O-APEXMO
PROGRAM ELEMENT APPENDIX (PEA) O
2019 ASTROPHYSICS EXPLORERS MISSION OF OPPORTUNITY

NNH17ZDA004O
THIRD STAND ALONE MISSIONS OF OPPORTUNITY NOTICE (SALMON-3)

NNH17ZDA004O-APEXMO
PROGRAM ELEMENT APPENDIX (PEA) O:
2019 ASTROPHYSICS EXPLORERS MISSION OF OPPORTUNITY

1 BACKGROUND

1.1 Programmatic Overview

The National Aeronautics and Space Administration (NASA) issues this Third Stand Alone Missions of Opportunity Notice (SALMON-3) Program Element Appendix (PEA) for the purpose of soliciting proposals for Astrophysics Mission of Opportunity (MO) science investigations to be implemented through its Explorers Program.

Two Mission of Opportunity types may be proposed in response to this PEA: (1) Partner Missions of Opportunity (PMOs), and (2) Small Complete Missions (SCMs). SCMs that may be proposed to make use of PEA-provided access to space include SmallSat missions utilizing a small launcher or as secondary "rideshare" payloads, and investigations on the International Space Station (ISS) or the lunar Gateway. Options for PEA-provided access to space are described in the *LSP Small Payload Access to Space Catalog* in the Program Library.

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

1.2 Explorers Program Background

The Explorers 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 recognized Cosmic Background Explorer (COBE) mission, the Explorers Program has launched over 90 missions.

Though historically not always this way, the program currently administers only Principal Investigator (PI)-led science investigations for the Heliophysics and Astrophysics Divisions of NASA's Science Mission Directorate (SMD). Competitive selection by peer review ensures that the best and most current science affordable within the Cost Cap will be accomplished.

Since the early 1990s, the Explorers Program has provided several types of flight opportunities for addressing astrophysics and heliophysics science objectives. These mission types are defined

by their Cost Caps and are designed to increase the number of flight opportunities in response to recommendations from the scientific community. The Explorers Program currently consists of two types: larger stand-alone "full missions," for which NASA offers a dedicated launch vehicle, and smaller investigations called "missions of opportunity" (MOs).

An Explorers MO is an investigation generally characterized by being part of a host space mission other than a strategic SMD mission, or by being a small complete mission with its own identified access to space, or by being a new science investigation utilizing an existing operating spacecraft (NMES) that has completed its prime mission. For each Explorers AO, full mission or MO, the budget available varies, as do the types of investigations that may be proposed.

Explorers MOs are solicited through the SALMON-3 AO (NNH17ZDA004O) by amending it with the addition of a specific Program Element Appendix. This solicitation for 2019 Astrophysics Explorers Mission of Opportunity is one such PEA.

1.3 Overview of this Program Element Appendix

The SALMON-3 AO is an omnibus solicitation that provides the overall structure, guidelines and requirements for several types of MO solicitations. Each new opportunity is announced through a PEA that details the solicitation and may include additional guidelines and requirements. This document is one such PEA. The SALMON-3 AO can be found in the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at http://nspires.nasaprs.com/.

NASA issues this PEA as an appendix of the SALMON-3 AO for the purpose of soliciting proposals for 2019 Astrophysics Explorers MO investigations to be managed under the NASA Explorers Program. All investigations proposed in response to this solicitation must support NASA's astrophysics science goals (Section 2.1 of this PEA) and the goals and objectives of the Explorers Program (Section 2.2 of this PEA), must be implemented by Principal Investigator (PI)-led investigation teams (Sections 4.2.4 and 5.4.1 of the SALMON-3 AO), and must result in the provision of complete space investigations (Section 5.3.2 of the SALMON-3 AO).

Proposals submitted in response to this PEA will be selected for flight nominally through a two-step competitive process. Proposals submitted in response to this PEA will undergo the first step evaluation. As the outcome of the first step evaluation, NASA intends to fund two or more MO investigations to proceed to a nine month Phase A concept study. In the second step, NASA will conduct an evaluation of the Phase A concept study reports. From this evaluation, NASA expects to select one or more MOs to proceed into Phase B and subsequent mission phases.

The SALMON-3 AO and this PEA present the requirements and constraints that apply to proposals that are to be submitted. Appendix B of the SALMON-3 AO contains additional requirements on the format and content of the proposals. Documents available through the 2019 Astrophysics Explorers Mission of Opportunity Program Library at https://explorers.larc.nasa.gov/2019APSMEX/MO/programlibrary.html (hereafter referred to as the Program Library) are intended to provide guidance for investigations selected; they are specifically not intended to impose requirements on proposals.

2 SCIENCE AND PROGRAM OBJECTIVES

2.1 NASA Astrophysics Science Objective and Goals

One of NASA's strategic goals is to expand the frontiers of knowledge, capability, and opportunity in space. Further information on NASA's strategic goals may be found in NASA Policy Directive (NPD) 1001.0C, the *NASA 2018 Strategic Plan*, available through the Program Library (Appendix D).

NASA SMD addresses this NASA strategic goal through four broad strategic objectives. One of these strategic objectives is to "discover how the universe works, explore how it began and evolved, and search for life on planets around other stars." SMD addresses this objective by conducting astrophysics investigations designed to address the following science goals:

- Probe the origin and destiny of our universe, including the nature of black holes, dark energy, dark matter, and gravity;
- Explore the origin and evolution of the galaxies, stars, and planets that make up our universe;
- Discover and study planets around other stars and explore whether they could harbor life.

Further information on the goals and objectives of NASA's astrophysics programs may be found in the *NASA 2014 Science Plan* and in the Astrophysics roadmap, *Enduring Quests Daring Visions, NASA Astrophysics in the Next Three Decades*, available through the Program Library.

2.2 Explorers Program Goals and Objectives

The goal of NASA's Explorers Program is to provide frequent flight opportunities for high quality, high value, focused astrophysics and heliophysics 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 three years.

The Explorers 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 Explorers 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 astrophysics science are addressed, permitting a steady improvement in our understanding of astronomical systems and the processes that affect them. The frequent, steady nature of the investigations ensures 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 Explorers Program strives to:

- advance scientific knowledge of astrophysics and heliophysics processes and systems;
- add scientific data and other knowledge-based products to data archives for all scientists to access;

- lead to scientific progress and the publishing of results in the peer-reviewed literature to encourage, to the maximum extent possible, the fullest commercial use of the knowledge gained;
- 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.

3 PROPOSAL OPPORTUNITY PERIOD AND SCHEDULE

The following schedule applies to this PEA.

- A Preproposal teleconference/WebEx will take place in association with this solicitation. (See Section 6.1.1 for details).
- Questions concerning any portion of this PEA should be addressed to the Point of Contact given in Section 9 of this PEA. The period for questions will close two weeks before the proposal due date. Answers will be provided no later than ten days before the proposal due date.
- A Notice of Intent (NOI) to propose to this announcement is required (see Section 6.1.2 for details) and must be submitted no later than 11:59 p.m. Eastern Time on the date given in Section 9 of this PEA.
- All proposals are due no later than 11:59 p.m. Eastern Time on the date given in Section 9 of this PEA. Proposals must be fully electronic and must be submitted through NSPIRES. Proposal submission requirements are outlined in Section 6 of this PEA.
- Evaluation and selection for flight will be done using a two-step selection process.
- NASA funded Phase A activities will be conducted by the investigation team(s) selected as a result of the first step of this solicitation.
- NASA funding for selected proposals will begin as soon as appropriate funding vehicles can be put in place, usually within four weeks following receipt of the Statement of Work, as set forth in Section 7.3.2 of this PEA.

4. POLICIES

4.1 NASA Management of the 2019 Astrophysics Explorers MO investigations

The selected investigation(s) will be managed by the Explorers Program Office. The Associate Administrator for SMD has established the Explorers Program Office at the NASA Goddard Space Flight Center (GSFC) to be responsible for project oversight. The Explorers Program Manager at NASA GSFC reports to the Astrophysics Division Director at NASA Headquarters. Additional details about the program office staffing, structure, and goals can be found in the *Explorers Program Plan*, available through the Program Library. Safety, reliability, and mission assurance requirements for 2019 Astrophysics Explorers Mission of Opportunity investigations will be consistent with the *Explorers Program Mission Assurance Requirements (MAR) Mission Risk Classification – NPR 7120.5 Class D* document*, EXP-RQMT-0003 Revision B*, found in the Program Library. Because Partner Missions of Opportunity (PMOs) are subject to their host

mission's risk classification requirements, the *Explorers Program MAR NPR 7120.5 Class C EHPD-RQMT-0001,* found in the Program Library may be applicable instead.

4.2 Eligibility to Participate in this PEA

Refer to Section 4.2 of the SALMON-3 AO for general rules on participation policies. For this particular PEA, NASA will place full or partial limitations (as described in the SALMON-3 AO) on organizations that will be involved in the evaluation process. Cornell Technical Services LLC (CTS) is subject to the "Full Limitation" as described in Section 4.2.1 of the SALMON-3 AO. Arctic Slope Regional Corporation (ASRC) Federal Technical Services will also be subject to the "Full Limitation" described in Section 4.2.1 of the SALMON-3 AO. There is no limitation on Aerospace Corporation. No other organizations have been identified to provide evaluation services for this PEA.

4.3 Data Return Policies

This section, in conjunction with Section 4.4 of this PEA, supersedes Section 4.4 of the SALMON-3 AO.

4.3.1 Data Analysis

The PI will be responsible for analysis of the mission data necessary to complete the proposed science objectives, for archiving the data in the relevant NASA astrophysics data archive for public use, and for timely publication of initial scientific results in refereed scientific journals, as part of their mission operations (Phase E) and/or post-mission (Phase F) activities. Data analysis may be continued during Phase F.

Requirement O-1. A Data Analysis Plan including approaches for data retrieval, validation, and preliminary analysis shall be described. The technology and any science products (e.g., flight data, ancillary or calibration data, theoretical calculations, higher order analytical or data products, laboratory data, etc.) shall be identified, including a list of the specific data products and the individual team members responsible for the data products. This requirement, in conjunction with Requirement O-2 of this PEA, supersedes Requirement B-23 in Appendix B of the SALMON-3 AO. **This requirement is deferred until Step 2. [Amended June 11, 2019]**

4.3.2 Increasing Access to the Results of Federally Funded Research

As a Federal agency, NASA requires prompt public disclosure of the results of its sponsored research to generate knowledge that benefits the Nation. To this end, contracts arising from this PEA will include the clause FAR 52.227-14, Rights in Data—General, and accordingly, Alternate IV to this clause, permitting the automatic assertion of copyright in any data produced under the contract by a contractor, will not be applicable. Thus, it is NASA's intent that all knowledge developed under awards resulting from this solicitation be shared broadly. In keeping with the *NASA Plan for Increasing Access to the Results of Scientific Research* (available in the Program Library) new terms and conditions about making manuscripts and data publicly accessible may be attached to awards that derive from this PEA. Proposals are required to include a Data Management Plan (DMP) in accordance with the requirements and guidelines in

the *NASA Plan for Increasing Access to the Results of Scientific Research* or to justify that one is not necessary given the nature of the work proposed (see Requirement O-2). The kind of data that requires a DMP is described in the *NASA Plan for Increasing Access to the Results of Scientific Research*.

SMD anticipates that awards deriving from this PEA will include terms and conditions requiring that accepted manuscript versions of peer-reviewed publications (hereinafter "manuscripts") resulting from PEA awards be uploaded into NASA's part of the PubMed Central (PMC) repository called NASA PubSpace at https://www.ncbi.nlm.nih.gov/pmc/funder/nasa/. This applies only to peer reviewed publications. Patents and publications that contain material governed by personal privacy, export control, proprietary restrictions, or national security law or regulations will not be covered by this requirement. The manuscript will appear in PMC for free public access following a maximum 12-month embargo period after the publication date. PMC will release the manuscript when the embargo has ended. For more details on public access to scientific publications and digital scientific data resulting from NASA-funded research, please see: https://www.nasa.gov/open/researchaccess. DMPs must describe how data sharing and preservation will enable validation of published results or how such results could be validated if data are not shared or preserved. Furthermore, DMPs must provide a plan for making science data that underlie the results and findings in peer-reviewed publications digitally accessible *at the time of publication or within a reasonable time period after publication*.

4.3.3 Delivery of Data to Archive

The investigation team will make mission data fully available to the public through a NASA-approved astrophysics data archive (High Energy Astrophysics Science Archive Research Center (HEASARC), Mikulski Archive for Space Telescopes (MAST), or Infrared Science Archive (IRSA)), in readily usable form, in the minimum time necessary, but, barring exceptional circumstances, within six months following its collection. The PI will be responsible for collecting the scientific, engineering, and ancillary information necessary to validate and calibrate the data prior to delivery to the archive.

Archival data products will include low-level (raw) data, high-level (processed) data, and derived data products such as maps, ancillary data, calibration data (ground and in-flight, and intercalibration as needed), documentation, related software, and/or other tools or parameters that are necessary to interpret the data. The PI will be responsible for generating data products that are documented, validated, and calibrated in physical units that are usable by the scientific community at large.

NASA data archives have budgets to support core activities, including the basic ingestion and review of new data. Proposed mission data archiving plans and budgets must be consistent with the policies and practices of the appropriate NASA data archive. Proposers should contact the archive directly to obtain information regarding the appropriate policies and practices. Proposals may include funding for up to one year after end-of-operations for the generation and archiving of derived data products. This funding will be included in the PI-Managed Mission Cost (PIMMC).

Requirement O-2. A Data Management and Archive Plan, including approaches for the release of peer-reviewed publications, the release of the research data that underlie the results and findings in peer-reviewed publications, and the archiving of all technology and any science products shall be described. The technology and any science products (e.g., flight data, ancillary or calibration data, theoretical calculations, higher order analytical or data products, laboratory data, etc.) shall be identified, including a list of the specific data products and the individual team members responsible for the data products. The Data Management and Archive Plan shall be in compliance with requirements and the guidelines in the *NASA Plan for Increasing Access to the Results of Scientific Research* (available through the Program Library) or a justification shall be provided that this is not necessary given the nature of the work proposed (see Section 4.4.1 of the SALMON-3 AO). The Data Management and Archive Plan shall identify the appropriate NASA data archive and the formats and standards to be used. It shall include an estimate of the raw data volume and the data latency by product for submission of raw and reduced data, to the data archive, in physical units accessible to the science community. This requirement, in conjunction with Requirement O-1 of this PEA, supersedes Requirement B-23 in Appendix B of the SALMON-3 AO.

4.4 Intellectual Property Rights

This section, in conjunction with Section 4.3 of this PEA, supersedes Section 4.4 of the SALMON-3 AO.

4.4.1 Invention Rights

Recipients that are Small Businesses or nonprofit organizations may elect to retain title to any inventions made under a funding agreement pursuant to the Bayh-Dole Act (35 U.S.C. § 202). Large business recipients are subject to section 20135 of the National Aeronautics and Space Act (51 U.S.C. § 20135) relating to property rights in inventions. Title to inventions made under an agreement by a large business recipient initially vests with NASA. However, these recipients may request a waiver to obtain title to inventions made under the agreement. Such a request may be made in advance of the agreement or within 30 days thereafter. Even if a waiver request is not made, or denied, a large business recipient may request a waiver on individual inventions made during the course of the agreement.

4.4.2 Data Rights

All science data returned from investigations led by NASA-funded PIs will be made available to the public as rapidly as possible (see Sections 4.3.2 and 4.3.3 of this PEA). Following a short latency period, all data will be made available to the user community, to the extent consistent with the approved Data Management Plan and the data rights clause incorporated into the award instrument. No period of exclusive access is permitted. The PI proposes and justifies any data product latency period for standard data products listed in the proposal, based primarily on the time required to produce, quality check, and validate the products. Barring exceptional circumstances, data product latency may not exceed six months.

4.4.3 Trademark

The National Aeronautics and Space Act directs NASA to "provide for the widest practicable dissemination of the information concerning its activities and the results thereof." 51 USC 20 112(a)(3). NASA's mission supports broad public engagement, enhanced educational opportunities, and open scientific inquiry. Accordingly, selected or down-selected missions may not assert trademark or other ownership rights in the mission name, mission logos, mission graphics, or any other program identifier.

4.4.4 Sharing of Data from Partner Mission of Opportunity Investigations

The data that are returned from Partner Mission of Opportunity (PMO) investigations, at least from those aspects of the mission in which NASA is involved, must be made available to the U.S. scientific community in a timely manner.

Requirement O-3. In addition to the requirements given in Section 5.1.1 of the SALMON-3 AO, all proposed PMO investigations shall also provide: (1) a detailed description of the proposed provisions for sharing of science data; plans for returned scientific data, at least from those aspects of the mission in which NASA is involved, shall be made available to the U.S. scientific community in a timely manner, 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. astrophysics science community benefits from the proposed investigation.

5 REQUIREMENTS AND CONSTRAINTS

5.1 Types of Mission of Opportunity

Two Mission of Opportunity types may be proposed in response to this solicitation: (1) Partner Missions of Opportunity (PMOs), and (2) Small Complete Missions (SCMs). SCMs that may be proposed to make use of PEA-provided access to space include those utilizing a small launcher, rideshare payloads, and investigations hosted on the ISS or the lunar Gateway. SCMs may not be proposed using PI-provided access to space. See Section 5.1 of the SALMON-3 AO for complete descriptions of these types of MOs as well as constraints and requirements for proposals. Additional requirements for this PEA are listed in the subsections below. Schedule requirements specific to the PMO and SCM investigations are included in Section 5.4.1. See Section 5.3.6 for access to space requirements.

5.1.1 Partner Missions of Opportunity

The following requirements are in addition to those given in Section 5.1.1 of the SALMON-3 AO.

Requirement O-4. In addition to the requirements given in the SALMON-3 AO, all proposed PMO investigations shall 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.

PMOs may be proposed for participation in nonstrategic NASA missions. A PMO may be proposed for participation in a PI-led NASA mission from a program other than Explorers. However, an Explorers MO may not be proposed as a PMO for an Explorers mission.

Requirement O-5. A proposal for a PMO hosted by a PI-led mission from a program other than the Explorers Program shall satisfy the following requirements: (1) the proposal shall include a Letter of Commitment from the PI of the host mission endorsing the partnership, and (2) the feasibility assessment of the host mission, i.e., the Technical, Management, and Cost (TMC) evaluation in Step 1 and Step 2, shall include the accommodations for the proposed PMO instrument.

5.1.2 Small Complete Missions

The following requirements are in addition to those given in Section 5.1.3 of the SALMON-3 AO.

5.1.2.1 Investigations utilizing ESPA Access to Low Earth Orbit or Geostationary Transfer Orbit

SCMs may be proposed for flight on an Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) or ESPA Grande. Hereafter, ESPA is used to include ESPA Grande, unless the contrary is indicated specifically.

Launches on an ESPA as a secondary payload are offered as PEA-provided launch services to the following orbit categories:

a) to Low Earth Orbit (LEO) at 400km-600km
b) to Geostationary Transfer Orbit (GTO) and beyond: this option may include the ESPA Grande on the NASA Heliophysics IMAP mission if space is available, and a rideshare with ESA's PLATO for a mission proposed as a science collaboration with ESA scientists.

Investigations may utilize one or two ESPA ports. Investigations requiring two ports shall comply with the requirements for each port.

The 2019 Astrophysics ESPA Rideshare Users Guide and Do-no-harm Requirements Document (hereafter 2019 Astro ESPA RUG) provides ground rules and assumptions for RPLs utilizing NASA-PEA-provided ESPA access to space. Information on Rideshare opportunities may evolve during the AO process, so both the 2019 Astro ESPA RUG and the Rideshare Accommodation worksheet may be updated periodically, but no later than 30 days before proposals are due. It is each proposer's responsibility to check the Program Library for updates.

Proposals for such investigations shall clearly demonstrate compliance to the requirements and enveloping characteristics in the 2019 Astro ESPA RUG, and give details of any deviations from

the guidelines of that document in the Rideshare Accommodation worksheet of Requirement O-6. The requirements outlined in the 2019 Astro ESPA RUG cannot be exhaustive because the primary payload and the launch vehicle will not be known at the time of proposal. Specific interface requirements and generic environment definitions will not be formalized until the launch vehicle contractor and primary observatory have been selected and the mission integration cycle has begun. Guidelines for Maximum Flight Opportunity are given to assist proposers looking to maximize their opportunity for rideshare. Violating these guidelines does not make a payload ineligible for inclusion as a rideshare, but may limit the number of missions that are compatible with the payload's launch requirements, and may increase integration and launch costs. Examples of specific rideshare requirements are given in the Evolved Expendable Launch Vehicle Rideshare User's Guide (May 2016), and the 2018-09-18-IMAP-ESPA-SIS, both of which can be found in the Program Library.

The SMD-specific RPL policy is described in the SMD Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) Secondary Payloads Rideshare policy document (SPD-32), found in the Program Library.

The NASA Small Spacecraft Systems Virtual Institute (https://www.nasa.gov/smallsat-institute) will operate a website that consolidates and shares known public information on ESPA-Class launch accommodation opportunities and capabilities. Proposers may describe specific LEO or GTO launch opportunities if they know of them, but NASA may not be able to procure space on those particular launches.

After the evaluation, but prior to the selection decision, NASA will perform an accommodation study of selectable rideshare investigation proposals to assess the extent to which the proposed investigation is compatible with the expected rideshare opportunities. A proposed investigation with a high probability of being compatible with several platforms is more likely to be selected than one with less flexible accommodation and orbit requirements.

Requirement O-6. Proposals for investigations using an ESPA as a platform shall summarize the technical requirements that their investigation places on the vehicle, and the orbital characteristics required for the proposed science investigation, using the Rideshare Accommodation worksheet template provided in the Program Library. This table shall be provided in electronic form, and in the experiment implementation section (Section E) of the proposal. This table must summarize information from other sections of the proposal, and not provide new information; it will not be considered during the evaluation and does not count towards the proposal page limit.

Questions concerning potential ESPA investigations may be addressed to:

Scott A. Higginbotham
Launch and Flight Operations
NASA Kennedy Space Center
KSC, Florida 32899
Telephone: 321-867-6079
E-mail: scott.a.higginbotham@nasa.gov

5.1.2.2 CubeSats and CubeSat Constellations in Low Earth Orbit or Geostationary Transfer Orbit

SCMs may be proposed for flight as CubeSats, or as constellations of CubeSats, when these are packaged for flight on ESPA. The proposing team must provide the CubeSat dispenser, to be hard-mounted to the ESPA ring. Such SCMs will be treated as SmallSats.

5.1.2.3 Investigations Deployed to Cislunar Space

SCMs for flight as single CubeSats up to 12U may be proposed for PEA-provided access to cislunar space, potentially using the SLS EM-2, or a future lunar transportation task order under the Commercial Lunar Payload Services (CLPS). As specified in Requirement 53 in Section 5.3.13 and in Appendix J.7 of the SALMON-3 AO, a plan will be required in Step-2 to dispose of the payloads after the mission is complete, either onto the lunar surface or into space beyond any lunar orbit. The cost cap for such CubeSats will be the same as for SmallSat payloads.

In the same way as for other SCMs proposed for rideshare access to space, NASA will perform an accommodation study of selectable proposals after the evaluation, but prior to the selection decision, to assess the extent to which the proposed investigation is compatible with the expected opportunities. For rideshares to cislunar space, a similar accommodation study will be conducted after review of the Phase A study and prior to the downselection decision. Selection or downselection will be informed by the likely availability of suitable rides.

Information for proposers of investigations in cislunar space is provided in the Program Library. Information on opportunities for cislunar payloads may evolve during the AO process, so this information may be updated periodically, but no later than 30 days before proposals are due. It is each proposer's responsibility to check for updates.

Questions concerning potential investigations in cislunar space may be addressed to:

Jason E. Jenkins
Program Executive for Exploration
Science Mission Directorate
NASA Headquarters, Washington DC 20546
Telephone: 202-358-1755
E-mail: jason.e.jenkins@nasa.gov

5.1.2.4 Investigations on the ISS

SCMs may be proposed for hosting on the ISS.

Requirement O-7. In addition to the requirements given in the SALMON-3 AO, all proposed SCM investigations requiring flight on the ISS shall provide a Letter of ISS Technical Interface and Resource Accommodation Feasibility Assessment from the NASA International Space Station Research Integration Office demonstrating that the proposed payload to be flown aboard the ISS can meet the access and accommodation requirements for ISS payloads. This ISS Letter of Feasibility Assessment shall contain: (1) a preliminary assessment of the feasibility of

proposed provisions for access to and accommodation on the ISS, (2) identification of known technical interface 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.

Proposers requiring an ISS Letter of Technical Interface and Resource Accommodation Feasibility Assessment should contact:

Dr. George C. Nelson
ISS Research Integration Office/Mail Stop OZ
Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058
Telephone: 281-244-8518
E-mail: george.nelson-1@nasa.gov

Note that the issuance of the ISS Letter of Technical Interface and Resource Accommodation Feasibility Assessment can take several weeks; therefore, proposers are urged to contact the ISS Research Integration Office as early as possible for such a request.

The document *External Payloads Proposer's Guide to the International Space Station*, available through the Program Library, provides an overview of the capabilities, accommodations, and the requirement for operating on the ISS. For any selected investigations, flight commitment to the ISS will be negotiated during Phase A. Selection of any investigation to be flown aboard the ISS is conditional until negotiations for ISS access and accommodation are successfully completed.

5.1.2.5 Opportunities involving the Lunar Gateway

This PEA offers opportunities to make use of the lunar Gateway:

- investigations operating in cislunar space may propose use of the communications and data relay capabilities of the lunar Gateway;
- investigations may be proposed as attached payloads on modules of the lunar Gateway.

Investigations that make use of the lunar Gateway may be proposed. NASA will provide necessary accommodations on the Gateway, as well as use of the Gateway for relay, with no charges imposed on the AO Cost Cap. The interface requirements on the Astrophysics Explorers side of the Gateway interface (e.g., hardware, software, logistics, mission operations, etc.), as well as costs for preparing flight and ground safety data packages, participating in flight and ground safety reviews, developing an integration verification plan, and conducting any related testing and analyses to satisfy the verification requirements, must be included within the PI Managed Mission Cost. The proposer is responsible for costs associated with instrument or observatory operations and the support for any contingency diagnostic activities.

Information for proposers of investigations using the lunar Gateway is provided in the Program Library. These opportunities may evolve during the AO process, and the Program Library documents may be updated periodically, but no later than 30 days before the proposal due date. It

is each proposer's responsibility to check for updates.

5.1.2.6 Investigations on High-Altitude Balloons

SCMs for flight on high-altitude scientific balloons are not solicited under this PEA. NASA has learned lessons from developing an earlier balloon mission within the Explorers Program, and qualified superpressure balloons are not yet available. NASA is studying alternative opportunities to propose highly-capable balloon missions within the Astrophysics Research Program.

5.1.2.7 Investigations on suborbital Reusable Launch Vehicles

SCMs for flight on suborbital Reusable Launch Vehicles (sRLVs) are not solicited under this PEA.

5.2 Science Requirements and Constraints

5.2.1 Scope of Proposed Investigations

The science goals are described in Section 2 of this PEA. Any appropriate science question relevant to NASA's astrophysics science goals may be addressed with the proposed investigations. Section 2 of this PEA provides the basis for the evaluation of intrinsic science merit, as described in Section 7.2.2 of the SALMON-3 AO. Investigations addressing areas of science outside astrophysics science goals, as described in Section 2 of this PEA, are not solicited.

Requirement O-8. Proposals shall address appropriate science questions relevant to the NASA astrophysics science objectives and goals described in Section 2 of this PEA.

5.2.2 Traceability of Proposed Investigations

Requirements for documentation in the proposal of the flow-down of requirements from the proposed science goals and objectives are described in Section 5.2.2 of the SALMON-3 AO. The following requirement is related, additional requirements for this PEA.

Requirement O-9. Each proposal shall clearly define its science question or questions, shall demonstrate how the science questions map into high-level science requirements, and shall show how the science requirements subsequently map into measurement, data, instrument, and mission requirements.

5.2.3 Baseline and Threshold Investigations

Baseline and Threshold investigations are defined in Section 5.2.4 of the SALMON-3 AO. The following requirement is a related, additional requirement for this PEA.

Requirement O-10. Each proposal shall clearly state the baseline and threshold requirements for the mission and the baseline and threshold mission lifetime.

5.2.4 Science Enhancement Options

No information on Science Enhancement Options (SEOs) is needed for the Step-1 proposal. Instead, plans and costs for proposed SEO activities must be defined in the Step 2 Concept Study Report. SEOs include, but are not limited to, guest investigator programs, general observer programs, participating scientist programs, interdisciplinary scientist programs, and archival data analysis programs. NASA intends to assume that all selected Astrophysics missions will offer a Participating Scientist or Guest Investigator Program and that the Astrophysics Data Analysis Program element will be opened to proposals to analyze data produced by such missions once those data have been certified by the High Energy Astrophysics Science Archive Research Center (HEASARC), Mikulski Archive for Space Telescopes (MAST), or Infrared Science Archive (IRSA); proposals should only describe SEOs *other than* Participating Scientist, Guest Investigator, or Data Analysis Programs.

5.3 Technical Requirements

5.3.1 Two-Step Evaluation and Selection Process

For this PEA, it is intended that proposed investigations be evaluated and selected through a two-step competitive process. Step 1 is the solicitation, submission, evaluation, and selection of proposals prepared in response to this PEA. The Step-1 evaluation and selection process is described in Section 7 of the SALMON-3 AO. As the outcome of Step 1, NASA intends to select two or more Step-1 proposals for Phase A study and evaluation. 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, and evaluation of the Concept Study Reports, followed by the continuation decision (downselection). As the outcome of Step 2, NASA expects to select one or more MOs to proceed into Phase B and subsequent mission phases.

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 also that it is 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 were especially compelling.

5.3.2 Complete Investigations

Section 5.3.2 of the SALMON-3 AO states that the PEA may broaden the allowable platforms beyond spacecraft. This PEA specifies that suborbital-class investigations are NOT allowed.

Requirement O-11. Proposals shall be for complete investigations including Phases A-F.

Each observation from space has natural synergies with other observations. Some proposed observations may either require or desire additional observations in order to better address the science questions as proposed for the investigation. Some of these observations may be currently existing or planned either from other NASA missions or from missions by other U.S. or non-U.S.

agencies. Proposers are expected to clearly state any dependencies on other data sets, what assumptions are made on the likelihood that these observations will exist during potential time frames for operation of their proposed investigations, and the implications if those observations do not exist.

NASA expects each proposal to fully describe the requirements for calibration and validation of the instruments and the data returned. Other data policies and requirements are given in Section 4.4 of the SALMON-3 AO and Section 4.3 of this PEA.

Requirement O-12. Each proposal shall fully describe the requirements for calibration and validation of the instruments and the data returned. This requirement supersedes SALMON-3 Requirement 30.

5.3.3 Mission Category and Risk Classification

This Section provides Risk Classification requirements that supersede those in Section 5.3.4 of the SALMON-3 AO.

This PEA solicits proposals for science investigations requiring the development and operation of space-based investigations. The projects are designated as Category 3 as defined in NPR 7120.5E, *NASA Space Flight Program and Project Management Requirements*. The payloads are designated as Class D as defined in NPR 8705.4, *Risk Classification for NASA Payloads,* with the possible exception of PMOs, hosted payloads, and investigations deployed from another spacecraft, where the designation may be driven by the host mission's risk classification requirements, which must be specified in the proposal.

NASA's Science Mission Directorate has defined a new approach to managing Class-D science investigations that are less than $150M, not including launch services. The *NASA Science Mission Directorate (SMD) Class-D Tailoring/Streamlining Decision Memorandum* describes the approach that has been approved by SMD leadership to guide the implementation of Streamlined Class D investigations. This Memorandum, along with other Class-D policy and guideline documents are in the Program Library. All Class-D investigations solicited by this PEA will be considered to be Streamlined Class-D Investigations and thus must use the principles, guidelines, and approaches described in the documents.

Streamlined Class-D Investigations must identify the tailorable requirements not specifically identified as being waived in the *NASA Science Mission Directorate (SMD) Class-D Tailoring/Streamlining Decision Memorandum* (e.g., Earned Value Management) and described in NPR 7120.5E that are proposed for adjustment, provide a rationale for each adjustment, and describe any cost or schedule impacts that would occur should the adjustment be rejected by NASA.

Investigations in other risk classes (i.e., A, B, or C) may also contain proposed adjustments to NASA requirements. Proposers must identify the tailorable requirements described in NPR 7120.5E that are being adjusted, provide a rationale for each adjustment, and describe any cost or schedule impacts that would occur should the adjustment be rejected by NASA.

The panel evaluating the third evaluation criterion, TMC Feasibility of the Proposed Investigation Implementation, will provide comments to the Selection Official on the proposed adjustments and their justifications. These comments will not be considered for the TMC Feasibility of the Proposed Investigation Implementation risk rating but may be considered in the selection decision.

Requirement O-13. Proposals shall identify any tailorable NASA requirement—not specifically waived—being adjusted, include the rationale for the adjustment, and describe the cost and/or schedule impacts should the adjustments be rejected by NASA.

5.3.4 New Technologies/Advanced Engineering Developments

This PEA solicits science PMO and SCM investigations with associated TRL 6 by PDR requirements; it does not solicit technology or advanced engineering development projects.

New Technologies/Advanced Engineering Developments are described in Section 5.3.5 of the SALMON-3 AO. Note that Section 5.3.5 of SALMON-3 AO references NASA/SP-2007-6105 Rev 1, *NASA Systems Engineering Handbook.* The latest version of this document, NASA/SP-2016-6105 Rev 2, should be used instead, and is available in the Program Library.

5.3.5 Technology Demonstration and Infusion Opportunities

This science PEA does not encourage standalone Technology Demonstration Opportunities (TDOs). If a TDO is proposed, its cost must be included in the PIMMC. This PEA does not solicit proposals focused solely on Technology Infusion Opportunities (reference SALMON-3 AO Sections 5.3.6 and 5.3.7)

5.3.6 Access to Space, or Near Space

Cost requirements related to PEA-provided access to space, or near space are addressed in Section 5.6.2 of this PEA.

The following classes of platforms represent PEA-provided access to space, or near space.

- SCMs on International Space Station (ISS).
- SCMs hosted on the lunar Gateway, as described in Section 5.1.2.5 above.
- Accommodation on an Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) or ESPA Grande. A CubeSat or CubeSat constellation packaged with its dispenser for launch on an ESPA will be treated as a SmallSat.
- A CubeSat accommodated on a cislunar launch, as described in Section 5.1.2.2 above.
- SCMs using a small launcher, as specified in the *LSP Small Payload Access to Space Catalog* in the Program Library.
- SCMs operating in cislunar space may propose use of the communications and data relay capabilities of the lunar Gateway, as described in Section 5.1.2.5 above.

Alternative (non-PEA-provided) access to space is not allowed under this PEA.

5.3.7 Space Systems Protection

Previously identified threats and vulnerabilities to space systems have indicated that the command uplink to robotic spacecraft need to be better protected. On February 1, 2019, the NASA Associate Administrator issued a letter directing that all newly started or newly solicited robotic spacecraft protect their command uplink through the use of encryption that is compliant with Level 1 of the Federal Information Processing Standard (FIPS) 140-2. This requirement does not apply, however for (1) hosted instrument payloads; (2) Class C or D spacecraft lacking propulsion subsystems; and (3) spacecraft that will operate more than two million kilometers ("deep space") from the Earth.

Additionally, the letter from the Associate Administrator required that the command uplink, position, navigation, and timing subsystems recognize and survive interference. Finally, information pertaining to the command uplink, including command dictionaries, must be protected — at least to the level of Sensitive But Unclassified (SBU).

The requirements associated with this section are deferred until Step 2. Because these are new requirements, the additional costs associated with them will be outside the PEA Cost Cap.

5.4 Management Requirements

5.4.1 Schedule

For PMOs, the proposing PI must provide evidence that the sponsoring organization intends to fund the primary host mission, including currently-not-yet-selected missions from an identified mission opportunity of another agency, and that the NASA commitment for U.S. participation is required by the sponsoring organization prior to December 2023. The launch date itself for a PMO is not constrained.

For Small Complete Mission (SCM) MOs, proposers must specify the launch readiness date in the proposal, which is to be no later than May 2025.

Proposers should be aware that 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 Explorers Program budget profiles and/or NASA's ability to negotiate a launch opportunity to the International Space Station or the lunar Gateway; therefore, the degree of launch date flexibility must be indicated in the proposal.

Requirement O-14. Proposals shall include a detailed development schedule (including integration plans) and an associated cost, that for an SCM has a launch readiness date no later than May 2025, or for PMOs is consistent with the documented launch and operations schedule of the primary host mission.

5.5 Education Program Plan, Communications and Outreach Program Plan, and Student Collaborations

5.5.1 Education Program Plan and Communications and Outreach Program Plan

No Education Plan is required by this PEA, nor will one be reviewed if provided.

No information on a Communications and Outreach Program Plan is required for the Step-1 proposal. A Communications and Outreach program (previously referred to as Public Outreach) is required for this solicitation; the communications plan must be developed during Phase B of the mission. The plan must include topline messaging, target audiences, and media processes linked to reaching target audiences. All associated detailed budgets, milestones, metrics and timelines, and reporting requirements must be included in the plan. Mission-related communications are funded directly through a NASA center or JPL (see Section 4.1.3 of the SALMON-3 AO) and are not within the PIMMC.

5.5.2 Student Collaboration

Section 5.6.2 of the SALMON-3 AO states that proposals may define a Student Collaboration (SC) that is a separate part of the proposed investigation. This PEA so states, and Requirements 71 and 72 of the SALMON-3 AO apply to this PEA. SCs are defined and described in the SMD Policy Document on Student Collaboration, SPD-31, in the Program Library. SPD-31 states that undergraduate students are a priority for SC because it is at this critical junction that individuals, including from groups traditionally underrepresented or underserved in STEM, make decisions to pursue and persist in degrees that will provide the skills required by the future space science workforce.

The following language from SPD-31 supersedes the fourth paragraph of section 5.6.2 of the SALMON-3:

> The objective of an SC is enhancement of student research experience through collaborative work associated with a specific NASA spaceflight mission. This is not to be confused with a Scholarship or Fellowship, where the sole objective is the training/development of a particular student. This flight mission SC is not one of the specific opportunities for NASA Scholarships and Fellowships. OMB Uniform Guidance, 2 CFR Part 200.466: Scholarships and student aid, clarifies the difference between a Scholarship or Fellowship and the allowable compensation of a student research assistant employed under an SC.

5.6 Cost Requirements

5.6.1 PEA O Cost Cap and Cost Constraints

The PIMMC, Total Mission Cost, and Enhanced PIMMC are defined in Section 4.3 of the SALMON-3 AO. Each selected investigation is PI-managed, and the PI will be responsible for defining and controlling the costs within the proposed budget for each phase of the investigation.

Requirement O-15. Investigations will be cost capped, including all mission phases, reserves, and the cost of accommodation on and/or delivery to the host mission. The intended PIMMC, including all mission phases, reserves, and the cost of accommodation on and/or delivery to the host mission shall not exceed the applicable PEA O Cost Cap, as follows:

- $75M (FY20) for "full" (not SmallSats) SCMs and PMOs.
- $35M (FY20) for SmallSats, and for CubeSats to be deployed to cislunar space. SCMs that fall under the cost cap for SmallSats are eligible for PEA-provided access to space on an ESPA at no charge against the cost cap (see below). The NASA SMD Class-D Tailoring/Streamlining Decision Memorandum explains that SMD is willing to assume higher risk with Class-D missions so as to broaden the science output of the portfolio, and also recognizes the importance of these missions for training purposes, accepting the risks originating from less experienced key personnel where mentoring and support tools are in place. These considerations are especially strong for the SmallSats.

Requirement O-16. Proposals shall include detailed plans and budgets (in FY2020$) for Phases A-F for costs that are within the PIMMC.

5.6.2 Cost of Access to Space

The 2019 Astrophysics Explorer MO *LSP Small Payload Access to Space Catalog,* available through the Program Library, lists options and costs for PEA-provided access to space. The costs for PEA-provided access to space options listed below will be subtracted from the PEA O Cost Cap and held in the Astrophysics Division at NASA, who will also manage any and all launch contingencies. The following costs to the PIMMC are associated with access to space provided under this PEA:

- Costs associated with access to the ISS or the lunar Gateway for SCMs will be outside the PIMMC.
- Costs associated with lunar CubeSats will be outside the PIMMC.
- Costs associated with access to space for SmallSats utilizing one or more ports on an ESPA will be outside the PIMMC.
- Cost to the PIMMC associated with "full" SCMs utilizing one or more ports on an ESPA will be $10M total.
- For missions utilizing a small launcher, see the *LSP Small Payload Access to Space Catalog* in the Program Library for costs.

Requirement O-17. For any nonstandard services for NASA-PEA-provided access to space, costs shall be included in the PIMMC.

The cost cap and cost of access to space for the SCM options are reiterated in the following table.

SCM option	Cost cap (see Section 5.6.1)	Cost of access to space to PIMMC (see Section 5.6.2)

Hosted on ISS or lunar Gateway	$75M	None
CubeSat up to 12U for ride to cislunar space	$35M	None
SmallSat on ESPA	$35M	None
"Full" SCM on ESPA	$75M	$10M
SCM (including SmallSat) using a Small Launcher	$75M or $35M	See above

For all rideshare investigations, investigation costs during any potential gap between delivery and the start of integration to the designated launch vehicle will be outside the PEA O cost cap. Proposers will be required to estimate costs to minimally support the investigation during a gap between delivery and the start of integration to the launch vehicle.

Requirement O-18. All rideshare proposals shall estimate costs to minimally support the investigation during a gap between delivery and the start of integration to the launch vehicle.

5.6.3 Cost of the Phase A Concept Study

The Phase A concept study is capped at $500,000 Fiscal Year (FY) 2020 dollars with duration of approximately nine months.

Final funding profiles (Phases A-F) for all downselected investigations will be negotiated between the Explorers Program and the downselected investigation teams. The inability of NASA to accommodate the requested funding profile may be a reason to not select a proposal or downselect a concept.

For PMOs, following completion of Phase A, but prior to final selection by the parent mission's sponsoring organization, NASA funding for additional work will be limited to $250K/year. (See SALMON-3 Section 5.7.1.)

5.6.4 Cost Reserve Management

The required minimum Phases A/B/C/D unencumbered cost reserves percentage measured against the Phases A/B/C/D cost is 25%. The required minimum Phases E and F unencumbered cost reserves percentage measured against the Phases E and F cost is 15% (See SALMON-3, Section 5.7.2). Unencumbered cost reserves for access to space provided by NASA are not required.

5.6.5 Full Cost Accounting for NASA Facilities and Personnel

Full cost accounting for NASA facilities and personnel is described fully in Section 5.7.5 of the SALMON-3 AO, with the following modification: All Centers must use an identical Center Management and Operations (CM&O) burden rate of $47,000 (FY2019) per "equivalent head".

For years after FY2019, this number must be inflated.

5.6.6 Contributions

This PEA is sponsored by SMD and it does not permit contributions of funding from SMD programs other than the funding offered through this PEA. There are no limits to funding contributions from sources other than SMD (See SALMON-3 Section 5.7.6).

5.7 Non-US Participation Requirements

For this PEA, no exemptions are made to the SALMON-3 Requirement 92 that proposed non-U.S. contributions essential to the success of the proposed investigation must be described at the same level of detail as those of U.S. partners.

5.8 Additional Requirements

5.8.1 Institutional Letters of Commitment

Refer to the SALMON-3, Sections 5.9.1 and 5.9.2 for guidance on Institutional letters of commitment (LoCs). Specific to this solicitation, Institutional LoCs are not required for contributed Co-Is or collaborators. However, proposers should note that, as stated in Section 5.9.2 of the SALMON-3 AO, the Proposal Team is defined to include, but not be limited to, all named Key Management Team members, all Co-Is, and all collaborators, and that every Proposal Team member must be identified on the Proposal Team section of the NSPIRES proposal cover page, and must indicate his/her commitment to the proposed investigation through NSPIRES prior to proposal cover page submission.

5.8.2 Classified Materials

This section supersedes Section 5.9.4 of the SALMON-3 AO.

Requirement O-19. Proposals submitted in response to this solicitation, as well as the proposed investigations and all proposed technologies, shall be unclassified. The proposal shall be complete including an unclassified appendix regarding heritage (see Section J.9, Appendix B, of the SALMON-3 AO, for further details).

In order to increase the capabilities of investigations proposed in response to this solicitation, while minimizing the development and operations risks within the PIMMC, proposers may choose to leverage technology with classified heritage that was developed by other institutions and agencies as well as technology developed by NASA and NASA-funded partners.

If a proposer chooses to submit a classified appendix regarding heritage, the requirements on content, format, and length are the same as, but independent from, those for the unclassified appendix regarding heritage included in the proposal (see Section J.9, Appendix B, of the SALMON-3 AO, for further details) with the exceptions that Letters of Validation and cost basis of estimates (BOEs) may be included in the classified appendix regarding heritage.

The entire proposal including the unclassified appendix regarding heritage will be read and evaluated by the entire evaluation panel. The evaluation panel will *not* have access to the classified appendix regarding heritage, however. Proposers are strongly encouraged to provide as much information and detail as possible on their technology heritage in the unclassified appendix regarding heritage.

NASA allows three options for proposers to support heritage claims from classified programs: 1) delivery to NASA of a classified appendix regarding heritage, 2) "delivery in place" of a classified appendix regarding heritage, and subject to possible restriction 3) sponsor verification of the heritage claims derived from classified programs. Each option is explained in a subsection below.

5.8.2.1 Delivery to NASA

Proposers may provide NASA access to a classified proposal appendix for validation of classified heritage claims. The classified appendix regarding heritage may include Letters of Validation for classified heritage claims from technology development sponsors and classified cost BOE. The proposer is responsible for determining what information is classified and what information is unclassified; any classified information provided to NASA must be handled appropriately to include marking and declassification information and must comply with the applicable Security Classification Guide (SCG) or similar document. The proposer is responsible for obtaining any "need to know" permission for at least one reviewer with appropriate clearance and relevant expertise to evaluate the classified appendix regarding heritage.

The delivery to NASA option of a classified appendix regarding heritage requires delivery to NASA Headquarters (HQ) separately from the proposal. A single copy of the classified appendix regarding heritage must be submitted along with a cover letter referencing the submitted proposal by name, PI, and proposing organization. The "need to know" permission for the reviewer should be discussed in a cover letter. The proposer assumes all responsibility for determining the appropriate security clearance and method of delivery to NASA HQ of the classified appendix regarding heritage. The classified appendix regarding heritage must be handled and delivered to NASA HQ in compliance with NPR 1600.1A, *NASA Security Program Procedural Requirements*.

Requirement O-20. Proposers that choose to deliver to NASA a classified appendix regarding heritage shall submit the appendix and a cover letter to NASA HQ no later than the deadline for receipt for the CD-ROM in Section 9 of this PEA. The proposer shall determine the appropriate security classification for the classified appendix, the proposer shall obtain any permission required for a reviewer to read the classified appendix, and the proposer shall ensure that all appropriate security requirements are followed in delivering the classified appendix to NASA HQ.

Requirement O-21. The point-of-contact (POC) for the solicitation (Section 9 of this PEA) shall be notified of the intent to submit a classified appendix regarding heritage and its level of classification to ensure sufficient evaluator clearance. The PEA POC notification shall include whether the sender is considering delivery to NASA via a classified email system in lieu of

physical delivery. The unclassified appendix regarding heritage shall also indicate that a classified appendix is being submitted.

The address for delivery of the package containing the classified appendix regarding heritage is: Mr. Paul Raudenbush, Chief, NASA Headquarters Security Office, Suite 1M40, 300 E Street SW, Washington, DC 20546. The package containing the classified appendix regarding heritage should be sent to NASA HQ by an appropriate means (e.g., courier, U.S. Registered Mail, etc.) with coordination in advance with the receiving facility.

Should a proposer choose to deliver a classified appendix regarding heritage to NASA in addition to a complete proposal, the evaluation process (Section 7.1.1 of the SALMON-3 AO) will be supplemented. At least one NASA-selected evaluator with appropriate clearance and relevant expertise will review the classified appendix regarding heritage; this evaluator may be a member of the evaluation panel or this evaluator may be a specialist reviewer. All findings generated during the review of the classified appendix regarding heritage will be unclassified, and these findings will be provided as input for assessing the Technical, Management, and Cost (TMC) Feasibility of the Proposed Mission Implementation. Clarifications may be requested concerning findings from evaluation of the classified appendix regarding heritage.

5.8.2.2 "Delivery in Place"

Proposers may choose to utilize the option for "delivery in place" of the classified appendix regarding heritage, where the classified material is not delivered to NASA but is kept at the point of origin. The complete, unclassified proposal must state that a classified appendix regarding heritage has been delivered in place and provide the classification level of the material, the location of the material, and the POC to be contacted to access the material.

Should a proposer choose to submit a classified appendix regarding heritage to NASA in addition to a complete proposal using the "delivery in place" mechanism, the evaluation process (Section 7.1.1 of the SALMON-3 AO) will be supplemented. At least one NASA-selected evaluator with appropriate clearance and relevant expertise will travel to the delivery location and review the classified appendix regarding heritage; this evaluator may be a member of the evaluation panel or this evaluator may be a specialist reviewer. All findings generated during the review of the classified appendix regarding heritage will be unclassified, and these findings will be provided as input for assessing the Technical, Management, and Cost (TMC) Feasibility of the Proposed Mission Implementation. Clarifications may be requested concerning findings from evaluation of the classified appendix regarding heritage.

Requirement O-22. Proposers that choose the option of "delivery in place" of a classified appendix regarding heritage shall develop—and deliver to a designated POC/custodian—the appendix by the deadline for electronic proposal submission in Section 9 of this PEA, with a cover page record of the last date that the document was edited. The POC/custodian of the classified appendix shall certify the date of receipt of the document and its unchanged status, each time the classified appendix is viewed by a reviewer. The proposer shall determine the appropriate security classification for the classified appendix, the proposer shall obtain any permission required for a reviewer to read the classified appendix at the proposer's designated facilities, and the proposer shall ensure that all appropriate security requirements are followed in

the handling of the classified appendix.

Requirement O-23. The POC for the solicitation (Section 9 of this PEA) shall be notified of the intent to utilize the "delivery in place" option for a classified appendix regarding heritage, the level of classification to ensure sufficient evaluator clearance, and the POC/custodian contact information.

5.8.2.3 Sponsor Verification

Proposals that include technologies with classified heritage may utilize sponsor verification. This option is only available if the sponsor organization is not a proposed partner. Such proposals would only *reference* classified materials, including associated cost BOEs; the materials would not be provided to NASA in any format. In lieu of a direct review of the classified materials, the evaluation panel will compile a list of questions regarding claims made in the proposal that need substantiation by the classified material. The list would be sent to the sponsor of the classified programs who must verify that the claims are supported.

Requirement O-24. Proposers that choose the option of sponsor verification of classified materials shall provide an enumeration of claims related to the classified materials in the body of the proposal.

Requirement O-25. The POC for the solicitation (Section 9 of this PEA) shall be notified of the intent to utilize the sponsor verification option and the POC to whom associated questions would be sent.

6 PROPOSAL PREPARATION AND SUBMISSION

6.1 Preproposal Activities

6.1.1 Preproposal Conference

A Preproposal teleconference/WebEx will take place in association with this solicitation on the date indicated in Section 9 of this PEA. The purpose of this Conference will be to address questions about the proposal process for this PEA. Questions should be sent to the NASA POC identified 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 2019 Astrophysics Explorer MO Acquisition Homepage no later than two weeks after this event. Additional questions and answers subsequent to the conference will also appear in this location, if necessary.

Further information will be available at the 2019 Astrophysics Explorer MO Acquisition Homepage (https://explorers.larc.nasa.gov/2019APSMEX/MO/index.html) prior to the Preproposal teleconference/WebEx.

6.1.2 Notice of Intent to Propose

NOIs are required, and are due no later than 11:59 p.m. Eastern Time on the date given in Section 9 of this PEA. Section 6.1.2 of the SALMON-3 AO provides information on electronic NOI submission through NSPIRES. Submitting an NOI does not commit the team to submitting a proposal.

6.1.3 Point of Contact for Further Information

Questions concerning any portion of this PEA should be addressed to the Point of Contact (POC) given in Section 9 of this PEA. The period for questions will close three weeks before the proposal due date. Answers will be provided no later than 10 days before the proposal due date.

In order to make sure that all proposers receive the same information, all questions concerning the content provided in this PEA, or in the documents available through the 2019 Astrophysics Explorers MO Program Library, should be sent to the e-mail address for the POC that is listed in Section 9 of this PEA. Responses that are helpful and informative to proposers will be posted on the website also listed in Section 9 of this PEA. Anonymity of the authors of all questions will be preserved.

6.2 Proposal Preparation and Submission

6.2.1 Structure and Content of Proposals

Requirement O-26. Proposal content shall conform to the guidelines set forth in Appendix B of the SALMON-3 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.

The program specific data associated with the electronic submission of proposals (see Section 6.2 of the SALMON-3 AO) includes questions indicating whether or not a proposal contains export-controlled information (see Section 5.9.3 of the SALMON-3 AO).

All proposers shall answer the program specific data questions, regarding the presence of export-controlled information in the proposal, either YES or NO when completing the electronic submission; these questions shall not be left unanswered.

All proposals must further identify any export-controlled material in the proposal as instructed in Section 5.9.3 of the SALMON-3 AO. To the extent possible, ITAR sensitive material should be organized into separate clearly marked sections.

Proposers should expect that the criteria A and B evaluators will review a version of the proposal in which the export controlled material has been redacted.

Requirement O-27. All proposals shall identify any export-controlled material in the proposal as instructed in Section 5.9.3 of the SALMON-3 AO; in addition, the export-controlled material shall be printed in a red font or enclosed in a red box as described in the required statement in Requirement 99 of the SALMON-3 AO.

The following Requirement supersedes Requirement B-4 of the SALMON-3 AO and clarifies the information requested on page limits.

Requirement O-28. Proposals shall conform to the page limits specified in the *Proposal Structure and Page Limits* table in Appendix B of the SALMON-3 AO. Two extra pages each are allotted for each additional separate**,** nonidentical science instrument in the Science Sections (Sections D and E), and two extra pages each are allotted for each additional separate, nonidentical flight element (*e.g.,* additional spacecraft are allotted two extra pages, but only if they are nonidentical spacecraft) in the Mission Implementation and Management Sections (Sections F and G). Different instruments on identical spacecraft buses will only be allotted extra pages for additional nonidentical science instruments; no extra pages will be allotted for additional nonidentical flight elements. The total number of such extra pages in the Science and Mission Implementation sections combined shall not exceed a maximum of ten extra pages regardless of the number of science instruments and unique flight elements. Every page upon which printing appears will count against the page limits and, unless specifically exempted (*e.g.*, Requirement B-34 or B-49 and Requirement B-58 of the SALMON-3 AO), each foldout page will count as two pages against the page limits as appropriate for its area (*e.g.,* a fold-out with the total area of two standard pages counts as two pages, *etc.*).

6.2.2 Submission of Proposals

Proposal submission instructions and requirements are provided in Section 6.2 of the SALMON-3 AO, and further clarified and expanded upon in Appendix B. Note that the mandatory NOI must precede the proposal, and must be received by the NOI due date given in Section 9 of this PEA.

Requirement O-29. The proposal shall be received electronically through NSPIRES no later than the time deadline on the proposal due date given in Section 9 of this PEA. Proposal CD-ROMs shall be received at the address given in the SALMON-3 AO no later than the CD-ROM due date given in Section 9 of this PEA.

7 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

7.1 Scientific/Technical Evaluation Factors

The evaluation process will be as described in Section 7.1.1 of the SALMON-3 AO. As part of that process, NASA will request clarifications on potential major weaknesses on *the Scientific Merit, Experiment Science Implementation, and Feasibility Merit of the Proposed Investigation*; these will be in addition to those for the *TMC Feasibility of the Proposed Investigation Implementation* specified in Section 7.1.1 of the SALMON-3 AO.

Proposals will be evaluated according to the evaluation criteria set forth in Section 7.2 of the

SALMON-3 AO, with the exceptions of Factor B-5 and Factor C-4 for Streamlined Class D missions, which are amended to delete evaluation of the PI's spaceflight experience.

In Factor B-5, the *scientific* expertise of the PI will be evaluated but not his/her experience with NASA missions. Comments about the managerial experience of the PI, and whether appropriate mentoring and support tools are in place, will be made to the Selecting Official but these comments shall not impact the "Investigation Implementation Merit" rating.

In Factor C-4, the capability of the management team will be evaluated as a whole, as opposed to assessing the capabilities of each of the Key Team Members independently. Comments about the managerial experience of the PI, and whether appropriate mentoring and support tools are in place, will be made to the Selecting Official but these comments shall not impact the "Technical, Management, and Cost Feasibility" rating.

The wording of Factor B-3 is amended to delete mention of returned samples, to read: 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 of the investigation; 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 the professional literature (e.g., refereed journals); and assessment of the proposed plan for the timely release of the data to the public domain for enlarging its science impact.

The panel evaluating the third evaluation criterion, TMC Feasibility of the Proposed Investigation Implementation, will also provide comments to NASA regarding the extent to which proposed ESPA rideshare investigations are compatible with potential launch opportunities. These comments will not be considered for the TMC Feasibility of the Proposed Investigation Implementation evaluation.

After the evaluation, but prior to the selection decision, NASA will perform an accommodation study of selectable ESPA rideshare investigation proposals to assess the extent to which the proposed investigations are compatible with potential ESPA interfaces and operations. This accommodation study will also consider the accommodations of selectable ESPA proposals for launch.

Half-step ratings for the Intrinsic Science Merit and Experiment Science Implementation Merit and Feasibility criteria will be used.

7.2 Selection Process

After the review by the AO Categorization and Steering Committees, the final evaluation results will be presented to the Associate Administrator for SMD, who will make the final 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.

As stated in Section 7.3 of the SALMON-3 AO, the Selection Official may take into account a wide range of programmatic factors, including, but not limited to, planning and policy considerations, available funding, programmatic merit and risk of any proposed partnerships, and maintaining a programmatic balance across the mission directorate(s).

7.3 Implementation Activities

Proposal selection and award will be implemented according to the guidelines set forth in Section 7.4 of the SALMON-3 AO and Section 7 of this PEA with the following amendments.

7.3.1 Principal Investigator-led Team Masters Forum

A one-day PI-led Team Masters Forum is planned for investigations selected under this PEA.

7.3.2 Award Administration and Funding of Investigations

Oversight management responsibilities have been assigned to the Explorers Program Office at the Goddard Space Flight Center. The responsibilities of the Program Office will include oversight of investigation implementation; coordination of Government-furnished services, equipment and facilities; and contract management for selected investigations.

It is anticipated that the appropriate Program Office will provide funding to each selected investigation. This award to perform a Phase A concept study is to be initiated as soon as possible after notification of selection. NASA Centers will receive funding via intra-agency funding mechanisms. Statements of Work (SOWs), certified cost and pricing data (as applicable), and small business subcontracting plans (as applicable) will be required in order to put awards in place for the Phase A concept studies.

Proposals are *not* required to include SOWs, cost and pricing data for Phase A concept studies and subsequent phases, or small business subcontracting plans. These will be required *only* for investigations that are selected at the outcome of the Step-1 competition. If more than one contractual arrangement between NASA and the proposing team is required, a separate SOW will be required for each organization.

For those investigations that are selected, it will be in the best interest of their PI-led mission management teams to provide SOWs, certified cost and pricing data (as applicable), and small business subcontracting plans (as applicable) in as timely a manner as possible. The process of awarding contracts cannot begin until SOWs, certified cost and pricing data (as applicable), and small business subcontracting plans (as applicable) have been received, and funds cannot be provided to the implementing organizations until this process has been completed.

SOWs will be required for selected investigations regardless of whether a proposing organization is Governmental or non-Governmental. SOWs will include the requirement for a Phase A Concept Study Report as described in the *Guidelines and Criteria for the Phase A Concept Study*

document available in the Program Library, as well as general task statements for Phases B through F. SOWs will include the following as a minimum: Scope of Work, Deliverables (including science and/or engineering data), and Government responsibilities (as applicable). SOWs need not be more than a few pages in length.

Each Phase A contract will contain a priced option for a Bridge Phase, to be exercised upon investigation downselection to proceed into Phase B. The Bridge Phase option will allow work to be continued uninterrupted under the contract after a Step-2 downselection decision is made. The Bridge Phase is intended to cover a four-month period of Phase B effort to provide program continuity while negotiations are completed to modify the contract to include Phases B, C/D, and E/F. The Bridge Phase Option will be exercised only on the contract for the investigation that is chosen during the Step-2 downselection process to continue beyond the Phase A concept study. The Bridge Phase option will allow the Government to continue work under the contract after a Step-2 downselection decision is made. Additional phases will be added to the contract after each Phase has been approved through the program review process. The four-month Bridge Phase period will be used to begin the negotiation of the remaining phases of the contract with the successful PI downselected during Step 2.

7.3.3 Conduct of the Phase A Concept Study

The concept studies are intended to provide NASA with more definitive information regarding the cost, risk, and feasibility of the investigations, as well as a detailed plan for the conduct of any optional Student Collaboration, before downselection for implementation. The product of the concept studies is a Phase A Concept Study Report to be delivered by each selected investigation team 9 months following the establishment of initial contracts. The content and format of the study reports are specified in the *Guidelines and Criteria for the Phase A Concept Study* document in the Program Library.

The PI will provide in the Phase A Concept Study Report a proposed set of Level 1 requirements, including the criteria for full investigation success satisfying the Baseline Science Investigation and the criteria for minimum investigation success satisfying the Threshold Science Investigation. The PI will also provide in the Phase A Concept Study Report the allocation of the proposed cost reserves among the appropriate WBS elements. The PIMMC will not increase by more than 20% from that in the Step-1 proposal to that in the Phase A Concept Study Report, and, in any case, will not exceed the applicable PEA O Cost Cap. The NASA review of the completed Concept Study Report will include all investigation facets. Risk reduction that has been accomplished during Phase A will be closely reviewed. NASA may request presentations and/or site visits to review the final concept study results with the investigators.

Each investigation's Concept Study Report must conclude with a commitment by the PI for the cost, schedule, and scientific performance of the investigation. For each Phase B selection, and unless otherwise stated in the selection letter, the selected investigation's cost will be set at the Concept Study Report's cost.

NASA cannot guarantee that the proposed funding profile can be accommodated within the Astrophysics Explorers Program's budget. A funding profile for the selected investigation will be

negotiated during Phase B.

7.3.4 Downselection of Investigations

The SMD Associate Administrator will make downselection decisions based on the evaluation of the Phase A Concept Study Reports and on programmatic considerations. The criteria for evaluating the concept study are as follows:

1. Scientific merit of the proposed investigation;
2. Science implementation merit and feasibility of the proposed investigation;
3. Technical, management, and cost feasibility of the proposed investigation implementation; and
4. Quality of plans for small business subcontracting and for an optional Student Collaboration, if proposed.

The evaluation criteria and downselection factors are described in the *Guidelines and Criteria for the Phase A Concept Study* document that will be available in the Program Library. Any substantial changes to science contained in the Phase A Concept Study Report will result in its re-evaluation; if no substantial changes are found to have been made to science, the Step-1 evaluation of the first criterion will be maintained.

Proposers may be asked for specific information at the time of selection for a competitive Phase A. This requested information will need to be included in the Phase A Concept Study Report and will be considered at the time of downselection for flight.

At the conclusion of Phase A, it is anticipated that the Selection Official will continue one or more investigations into the subsequent phases of mission development for flight and operation. The target date for this continuation decision (i.e. "downselection") is given in Section 9 of this PEA.

An investigation may be downselected to enter Phase B or may be downselected for a funded Extended Phase A so they can retire one or more risks before they are allowed to proceed to Phase B. There is no guarantee that an investigation downselected for an Extended Phase A will be approved to enter Phase B, even if all risks have been retired during the Extended Phase A.

Upon a continuation decision, NASA will execute the Bridge Phase option and begin to provide additional funding for the project that is continued beyond the Phase A concept study (see Section 7.3.3). During the Bridge Phase, NASA and the continued project will negotiate and sign a contract modification necessary for the remaining portion of mission phases. Deliverables will be negotiated during the Bridge Phase, on the basis of information provided in the Concept Study Report.

In no case is NASA required to exercise any option. NASA will not exercise any contract option nor continue funding those investigations not selected to proceed. For those investigations that are not continued, the contracts will be allowed to expire without further expense to NASA. Every investigation team will be offered a debriefing of the evaluations of its Concept Study

Report.

All international missions will follow the guidance in Section 5.8 of the SALMON-3 AO. Should a non-U.S. mission or a U.S. mission with non-U.S. participation be downselected, NASA's Office of International and Interagency 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. Regarding participation, collaboration, or coordination with China, follow the guidance in Section 4.2.2 of the SALMON-3 AO.

8 SALMON-3 Specifications and Exceptions

8.1 SALMON-3 Specifications for PEA

The SALMON-3 AO states that the PEAs will provide certain information for the solicitation. For this PEA, the following table lists these topics and the location of each in this PEA.

SALMON-3 Section(s)	Required Specifications for PEA	PEA Section(s)
Section 2.4	Goals and objectives for proposed investigations	1.1, 2
Section 2.4	Funding available for selected investigations (including funding for Category III proposals, if applicable)	5.6
Section 2.5	Single Step Selection exception	5.3.1
Section 3, Section 6.2.3	Proposal submittal deadline, Deadline for Receipt of Proposal on CD-ROMs, sponsoring mission directorate and division, type of MO	3, 4.1, 9
Section 4.1.2	Program-specific safety, reliability, and quality assurance requirements document	4.1
Sections 4.1.2, 7.4.3	Designated NASA Center for program office	4.1
Section 4.2.1	Additional organizations used for evaluation services and any restrictions on their participation in proposals	4.2
Section 4.2.1	Additional restrictions on participation by The Aerospace Corporation in proposals	4.2
Sections 4.3.1, 5.7.1	Additional costs to be included in, and cap on, PI-Managed Mission Cost	5.6
Section 4.3.2	Additional costs to be included in Total Mission Cost	5.6.1
Section 4.3.3	Additional costs to be included in Enhanced PI-Managed Mission Cost	5.6.1
Section 4.3.4	Any constraints on funding profile, selection date, and launch readiness date	5.4.1, 5.6
Section 5.1	Identification of permitted categories of missions of opportunity	5.1
Section 5.1.1	Endorsement date for PMOs.	5.4.1
Section 5.1.1	Any investigation date constraints for PMOs.	5.4.1
Section 5.1.1	Policies and constraints associated with specific PMO potential partnerships.	5.1.1
Section 5.1.2	Decision requirement date for NMES	N/A

Sections 5.1.3, 5.3.8	Identification of any NASA-provided launch services	5.3.6
Section 5.1.3	Launch date constraints for SCMs	5.4.1
Section 5.1.3	Access to space constraints for SCMs	5.3.6
Section 5.2.5	State whether SEOs allow flight hardware.	5.2.4
Section 5.3.1	Determination to use a two-step competitive process	1.3, 3, 5.3.1
Section 5.3.2	Broadening of allowable platforms beyond spacecraft	5.3.2
Section 5.3.4	Mission category and the payload risk classification that will be applied to selected investigations	5.3.3
Section 5.3.5, Appendix B Section F.3	Deadline for technology maturation other than TRL 6 by PDR for non NASA STMD sponsored investigations	N/A
Section 5.3.5, Appendix B Section F.3	Deadline for technology maturation other TRL 5 by PDR for NASA STMD sponsored investigations	N/A
Section 5.3.6	Technology Demonstration Opportunity allowed	5.3.5
Section 5.3.7	Technology Infusion Opportunity available	5.3.5
Section 5.3.8	Charge, if any, for NASA insight for non-NASA launch services	5.3.6
Section 5.3.8	Addition of the term "top risk" referring to launch delays for non-NASA provided access to space (applicable for missions with launch windows)	N/A
Section 5.3.10	~~That the proposed use of radioactive materials of any quantity and any isotope, including radioisotope power sources, radioisotope heater units, or radioactive calibration sources for science instruments, is not permitted.~~ **Investigations may baseline use of small amounts of radioactive material for uses such as radiological calibration sources for science instrumentation; however no radioactive material may be used for supplemental power. [Amended June 11, 2019]**	~~N/A~~ **Foreword**
Section 5.4.5	Schedule requirements	5.4.1
Section 5.6.1	Education Program Plan and Communications and Outreach Program Plan	5.5.1
Section 5.6.2	Requirements and constraints for Student Collaborations if allowed	5.5.2
Section 5.7.2	The required minimum Phases A/B/C/D unencumbered cost reserves percentage.	5.6.4
Section 5.7.2	The required minimum Phases E and F unencumbered cost reserves percentage (if any).	5.6.4
Section 5.7.5	The applicable CM&O burden rate per "equivalent head"	5.6.5
Section 5.7.6	Constraints on contributions, if any	5.6.6
Section 5.8.2	Any PEA-specific exemptions on the description of any proposed non-U.S. contribution essential to the success of the proposed investigation to the same level of detail as those of U.S. partners	5.7
Section 5.9.4	The address for delivery of the package containing the classified	5.8.2

	appendix.	
Section 6.1.1	Existence and logistics for a preproposal conference	6.1.1
Section 6.1.2	Whether a Notice of Intent (NOI) to propose is required	6.1.2
Section 6.1.2	Deadline for the NOI	9
Section 6.1.5	Links to any PEA-specific acquisition homepage and program library	9
Section 6.1.6	Contact information for the PEA-specific point-of-contact	9
Section 6.2.1	Modification of any proposal general content or structure requirements	6.2.1
Section 7.1	Identification of selection official	7.2
Section 7.1.1	Request clarifications on potential major weaknesses on the Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation or the Experiment Science, Exploration, or Technology Implementation Merit and Feasibility of the Proposed Investigation criteria or both	7.1
Section 7.4.2	Whether a PI-lead Team Masters Forum attendance is required for selected investigations	7.3.1

8.2 Exceptions to General SALMON-3 Requirements

This PEA makes no amendments to Appendix A. This PEA contains the following exceptions to the SALMON-3 AO requirements.

SALMON-3 Section(s)	Required Specifications for PEA	PEA Section(s)
4.4.2, 4.4.3, 4.4.4.2	Data policies and requirements supersede SALMON-3 AO	4.3, 4.4
Appendix B	Requirement O-28 supersedes SALMON-3 AO Requirement B-4 on page limits	0
5.3.5, App B Sec F	NASA/SP-2016-6105 Rev 2, *NASA Systems Engineering Handbook* replaces earlier version	5.3.4
4.5.1	SALMON-3 AO Independent Verification and Validation is deferred for this Step One of the Two-Step process	N/A
4.5.4	SALMON-3 AO Conjunction Assessment Risk Analysis is deferred for this Step One of the Two-Step evaluation process	N/A
Appendix B	Sections 4.3 and 4.4 supersede SALMON-3 AO Section 4.4 on data policies and intellectual property; Requirement O-1 and Requirement O-2 supersede SALMON-3 AO Requirement B-23 on data plan; **Requirement O-1 is deferred until Step-2. [Amended June 11, 2019]**	4.3, 4.4
Appendix B	SALMON-3 AO Requirements B-58 to B-60 for costs in real year dollars (RY$) in Table B3a are deferred for this Step One of the Two-Step proposal evaluation process; SALMON-3 AO Requirement B-65 is amended to specify costs in FY 2020 terms	5.6.1

5.3.13, App B J-7	SALMON-3 AO Requirement 53 and Requirements B-73 through B-76 on orbital debris and disposal are deferred for this Step One of the Two-Step evaluation process	N/A
4.5.4, 5.3.13, App B J-7	NPR 8715.6B, *NASA Procedural Requirements for Limiting Orbital Debris and Evaluating the Meteroid and Orbital Debris Environments* replaces earlier version	N/A
5.3.13, App B J-7	NASA-STD-8719.14A, *NASA Process for Limiting Orbital Debris* replaces earlier version	N/A

9 SUMMARY OF KEY INFORMATION

Funding available	See Section 5.6.1 of this PEA
Community Announcement	June 13, 2018, revised July 31, 2018
Release of Draft PEA Date	November 6, 2018
Comments Due on Draft PEA	December 7, 2018
Final PEA Release Date	April 3, 2019
Date for Preproposal Conference	Early May 2019. Check the Acquisition website, https://explorers.larc.nasa.gov/2019APSMEX/MO/index.html for the date.
Due Date for mandatory NOI (notice of intent to propose)	11:59 pm Eastern Time on May 15, 2019
Due Date for Comments and Questions on Final PEA	Comments and Questions may be submitted up to 21 days prior to Due Date for Proposals; answers to questions will be provided no later than 10 days prior to Due Date for Proposals.
Due Date for Proposals	11:59 pm Eastern Time on August 1, 2019
Due Date for Receipt of CD-ROMs with Proposal and Tables	4:30 pm Eastern Time four business days after the due date for the electronic proposal
Selection Date for Competitive Phase A Studies	Q2 CY 2020 (target)
Concept Study Reports Due	9 months after selection (target)
Down-Selection Date	Fall 2021 (target)
Web site for additional information for the Astrophysics Explorers MO PEA	https://explorers.larc.nasa.gov/2019APSMEX/MO/index.html
Program Library for the Astrophysics Explorers MO	https://explorers.larc.nasa.gov/2019APSMEX/MO/programlibrary.html

Proposal Submission Medium	Electronic copies and CD-ROM submission required; see Section 6.2.2 of this PEA
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. Linda Sparke Astrophysics Explorers Program Scientist Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Tel: 202-358-7335 E-mail: linda.s.sparke@nasa.gov

END OF PEA O