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

Program Element Appendix (PEA) TBD

**SMALL COMPLETE MISSION OF
OPPORTUNITY:**

**SMALL INNOVATIVE MISSIONS
FOR PLANETARY EXPLORATION
(SIMPLE_x)**

Comments Due Date:

March 14, 2018

NNH17ZDA0040**THIRD STAND ALONE MISSIONS OF OPPORTUNITY NOTICE (SALMON-3)****NNH17ZDA0040-SIMPLEx****PROGRAM ELEMENT APPENDIX (PEA) TBD****SMALL COMPLETE MISSION OF OPPORTUNITY:****SMALL INNOVATIVE MISSIONS FOR PLANETARY EXPLORATION (SIMPLEx)**

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NNH17ZDA0040
THIRD STAND ALONE MISSIONS OF OPPORTUNITY NOTICE (SALMON-3)

NNH17ZDA0040-SIMPLEx
PROGRAM ELEMENT APPENDIX (PEA) TBD:
SMALL INNOVATIVE MISSIONS FOR PLANETARY EXPLORATION (SIMPLEx)

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 Small Innovative Missions for Planetary Exploration (SIMPLEx) as small complete mission of opportunity (SCM) science investigations.

Through this PEA, NASA Science Mission Directorate, Planetary Science Division (SMD/PSD) solicits investigations in response to the goals described in *2018 NASA Strategic Plan* and the *2018 NASA Science Plan*. The *2018 NASA Strategic Plan* will be publicly released concurrent with the submission of the FY 2019 budget to Congress; the *2018 NASA Science Plan* will be released at a later time. However, for planning purposes, it is to be expected that the planetary science objectives contained in these plans will be very similar to those in the 2014 Plans. These plans are, or will be, available in the Program Library. In order to advance the objectives outlined in the Science Plan, proposed investigations may target any planetary science scientific investigation that advances the objectives outlined in Section 2.1 of this PEA. Investigations that address NASA goals in other areas, such as astrophysics, Earth science, or heliophysics, are not solicited. Investigations of extrasolar planets are not solicited in this PEA.

Small complete missions (SCM) based on small satellite spacecraft (SmallSats) are solicited. SmallSats are defined as ESPA-Class or smaller, including CubeSats built from a set of standardized subunits that each measure 10x10x10 cm with a mass of 1.33 kg (designated '1U'). Allowable configurations include 1U, 2U, 3U (4kg), 6U (2Ux3U) (up to 14 kg) and 12U (2Ux6U or 1x12U) (up to 24 kg) satellites. ESPA-Class SmallSats are defined as spacecraft that can be launched from a standard evolved expendable launch vehicle (EELV) secondary payload adaptor (ESPA). The dimensions of an ESPA-Class SmallSat must be no larger than 61x71x97 cm, and the total wet mass of an ESPA-Class SmallSat must not exceed 180 kg.

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.

1.2 Overview of this Program Element

The SALMON-3 AO is an omnibus Announcement of Opportunity that provides the overall structure, guidelines and requirements for several types of Mission of Opportunity (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 (NNH17ZDA004O) can be found in the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at <http://nspires.nasaprs.com/> or at <https://soma.larc.nasa.gov/salmon-3>.

Proposals submitted in response to this PEA will be selected for flight through a two-step competitive process. Proposals submitted in response to this PEA will be evaluated based on the entire proposed flight project lifecycle (formulation through implementation, Phases A through F). As the outcome of the first step evaluation, NASA intends to fund one or more SCM investigations to proceed to a twelve month Phase A/B study concluding with a preliminary design review (PDR). In the second step, NASA will conduct an evaluation of the Phase A/B PDR results (KDP-C). From this evaluation, NASA expects to select one or more of the funded SCMs to proceed into implementation.

Selected missions will launch as a secondary payload on one of the specific flight opportunities described in Appendix A of this PEA. This Appendix of the PEA will be amended as new launch opportunities become available. Proposals will be accepted at any time, but there is a cut-off date for each specified launch opportunity nominally four years before its expected launch readiness date (LRD). Proposers are encouraged to factor specific launch information into their proposals; however, this solicitation will remain open and proposals that are not selected for one launch opportunity may be considered for subsequent launch opportunities if appropriate. In addition, launch opportunities to low Earth and geostationary transfer orbits are frequently available and proposers may target such launches at any time.

Investigations must provide a preliminary design for a flight-ready small spacecraft (Phase A-B), a critical design review (Phase C), a flight-qualified small spacecraft ready for integration into the launch vehicle and technical support for integration onto the launch vehicle (Phase D), the in-flight operations, the scientific analysis of the data, publication of the scientific results, the delivery of the data to the appropriate NASA data archive (Phase E), and close out (Phase F) as described in Section 4.1 of the SALMON-3 AO.

Activities such as extended missions, guest investigator programs, general observer programs, participating scientist programs, and/or interdisciplinary scientist programs, where appropriate, have the potential to broaden the scientific impact of investigations. Such optional activities may be proposed as Science Enhancement Options (SEOs). Flight hardware may not be proposed as SEOs. 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 underlying investigation is selected. NASA reserves the right to accept or decline proposed SEO activities at any time during the mission; in particular, the decision may not be made at the time the underlying investigation is selected for flight. The process for deciding on SEO activities may involve further reviews (e.g., a “Senior Review” for extended missions, including planetary protection review inputs during the extended mission process). NASA reserves the right to solicit and select all participants (e.g., guest investigators and participating scientists) in such programs.

The SALMON-3 AO and this PEA, particularly Section 4, 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 Planetary Science SIMPLEx Program Library at <https://soma.larc.nasa.gov/simplex/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.

1.3 NASA On-line Document Information System

NASA Policy Directives (NPD) and NASA Procedural Requirements (NPR) documents are available through the NASA On-line Document Information System (NODIS) at <http://nodis3.gsfc.nasa.gov/>. Note that NPD's and NPR's place requirements on selected flight investigations but not on proposals for flight investigations.

2. SCIENCE AND PROGRAM OBJECTIVES

SMD's objective is to develop and operate targeted science investigations requiring space flight that exploit the unique attributes of small satellites to conduct compelling science. These SmallSat investigations will take advantage of available launch capacity to reduce the overall costs of launching multiple missions, provide a means to mature technologies for future missions, and serve as additional opportunities to provide flight experience to the workforce.

This PEA solicits investigations responsive to the goals of the Planetary Science Division (PSD) as described in the *2018 NASA Strategic Plan* and the *2018 NASA Science Plan*. The *2018 NASA Strategic Plan* will be publicly released concurrent with the submission of the FY 2019 budget to Congress; the *2018 NASA Science Plan* will be released at a later time. However, for planning purposes, it is to be expected that the planetary science objectives contained in these plans will be very similar to those in the 2014 Plans. These documents are, or will be, available in the Program Library. In order to advance the objectives outlined in the Science Plan, proposed investigations may target any solid body in the Solar System except for the Earth and Sun. Investigations of extrasolar planets are not solicited in this PEA.

2.1 NASA Planetary Science Goals

NASA's strategic objective in planetary science is to "ascertain the content, origin, and evolution of the Solar System, and the potential for life elsewhere." NASA pursues this strategic goal by seeking answers to fundamental science questions that guide NASA's solar system exploration:

- How did our solar system form and evolve?
- Is there life beyond Earth?
- What are the hazards to life on Earth?

These questions have been translated into science goals that guide the focus of the Planetary Science Division's science and research activities. These goals are:

- Explore and observe the objects in the solar system to understand how they formed and evolve;
- Advance the understanding of how the chemical and physical processes in our solar system operate, interact, and evolve;
- Explore and find locations where life could have existed or could exist today;
- Improve our understanding of the origin and evolution of life on Earth to guide our search for life elsewhere; and
- Identify and characterize objects in the solar system that pose threats to Earth, or offer resources for human exploration.

Further information on NASA's strategic goals and objectives can be found in the *2018 NASA Strategic Plan* and the *2018 NASA Science Plan*. These documents are available through the SIMPLEx Program Library.

2.2 SIMPLEx Goals and Objectives

The goal of SIMPLEx is to increase the science return of future missions by launching secondary payloads to conduct planetary science that would otherwise not be possible, for instance, either because of cost constraints or by providing the opportunity to make simultaneous measurements at multiple locations. SIMPLEx secondary payloads are limited to SmallSats and will be cost capped. SIMPLEx missions will be science focused, not technology demonstrations, however SIMPLEx missions will accept technical risks that might not be acceptable on larger, higher cost primary missions. Sections 2.4.1 and 4.6.1 of this PEA provide more detail on the risk posture for this program.

2.3 Accommodation for Secondary Payload

The objective of this solicitation is to select for funding investigations in which a secondary payload small spacecraft is built and deployed from a primary spacecraft mission, followed by production of high quality and highly useful science data from that SmallSat, analysis of the data and publication of scientific results, and delivery of the data to an appropriate NASA archive. The decision to fly an investigation from this solicitation will balance the "accommodatability" of the proposed SmallSat onto the launch vehicle with the value of the science to be returned from the selected investigation. Accommodation considerations include but are not limited to the ability to select multiple CubeSats or the amount of additional boost that may be required by the launch vehicle as a result of the selected secondary mission.

2.4 NASA Management of SIMPLEx Payload Investigations

The selected investigation(s) will be considered part of the Solar System Exploration Program, by the Planetary Missions Program Office (PMPO). The Associate Administrator for SMD has established the PMPO at the NASA Marshall Space Flight Center (MSFC) to be responsible for programmatic oversight of spaceflight projects in the Solar System Exploration Program. The PMPO Program Manager at NASA MSFC reports programmatically to the Solar System Exploration Director within the Planetary Science Division at NASA Headquarters. MSFC has established the appropriate firewalls between the PMPO and the rest of NASA MSFC, allowing investigators from NASA MSFC to propose in response to this PEA.

2.4.1 Risk Classification

This opportunity solicits proposals requiring the development and operation of space-based science investigations. These investigations will be managed under the requirements of *NPR 7120.5E, NASA Space Flight Program and Project Management Requirements* document available through the Program Library, as described in Section 4.1.2 of the SALMON-3. Missions selected from the PEA are designated as Category 3 as defined in NPR 7120.5E and are designated as Class D as defined in *NPR 8705.4, Risk Classification for NASA Payloads* document available through the Program Library. The *NASA SMD Class-D Tailoring/Streamlining Decision Memorandum*, which can be found in the Program Library, describes necessary reviews, documentation, performance management, and implementation. Proposals are expected to demonstrate how the mission will be shown to meet its proposed science in the environments and durations proposed.

Requirement PEA-tbd-1. Proposals must demonstrate how the mission will meet its proposed science in the environments and durations proposed.

NPR 7120.5E, NPR 8705.4, and SMD Class-D Tailoring/Streamlining Decision Memorandum are all available through the Program Library.

3. PROPOSAL OPPORTUNITY PERIOD AND SCHEDULE

This solicitation is an appendix to the NASA SALMON-3 AO. The SALMON-3 AO provides the overall structure and guidelines for several types of mission of opportunity solicitations. Each new opportunity is announced with a Program Element Appendix (PEA). This document is such a PEA. The SALMON-3 AO (NNH17ZDA004O) can be found in the Program Library and the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at <http://nspires.nasaprs.com>.

This PEA solicits planetary science investigations that require a spaceflight mission that can be accomplished using small spacecraft as secondary payloads on future launch opportunities, listed in Appendix A. The launch readiness date and initial release trajectory will be individually determined for each primary mission. Proposal due dates for each launch opportunity are listed in Appendix A. Proposals for investigations to be launched from Low Earth Orbit (LEO) or Geostationary Transfer Orbit (GTO) will also be considered with no specific deadline imposed.

A Preproposal Conference will take place (via webinar) in association with this solicitation. Further information will be available at the SIMPLEx investigation acquisition homepage website (see Section 8 of this PEA) prior to the Preproposal Conference.

Questions concerning any portion of this PEA should be addressed to the Point of Contact given in Section 8 of this PEA.

Evaluation and selection of proposals in response to this PEA will be done using a two-step process. This is different from the traditional two-step approach, where NASA funds only Phase A before down-selection. In the SIMPLEx case, NASA funded Phase A/B activities will be conducted by the investigation team(s) selected as a result of the first step of this

solicitation. Proposals in response to this PEA will be accepted at any time. PSD will conduct up to two reviews per year. Cut-off dates for specific launch opportunities are as follows; refer to Appendix A for launch readiness dates for specific launch opportunities. A typical mission development lifetime is described below:

- Launch minus four years (L-4): Cut-off consideration for a specific mission
 - Select and award ~1 year Phase A/B design studies; expected product is PDR-level design
 - Launch Vehicle is unknown
- L-3 years: Down-select secondary mission(s) for specific primary mission
 - May be possible to select multiple secondaries for a given primary mission
 - Selections coordinated with launch vehicle selection
 - Provided for Phase C design/build:
 - More detailed launch vehicle trajectory, environments and interfaces
- L-2 years: Build/test secondary payload
- L-1 years: Build/test/integrate secondary payload
- L-3 months: Integrate secondary payload into the launch vehicle (nominal date)
- L: launch

A Notice of Intent (NOI) to propose to this announcement is extremely valuable to NASA for purposes of planning the proposal evaluation and peer reviews, and, therefore, is encouraged and requested no later than sixty days before the submission of the proposal.

For consideration for a specific mission, proposals are due no later than 11:59 p.m. Eastern Time on the date given in Appendix A of this PEA. Proposals received after that time may be considered for subsequent opportunities, which will be listed in Table A-1.

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. Proposals must be fully electronic and must be submitted through NSPIRES. Proposal submission requirements are outlined in Section 5 of this PEA.

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 6.3.2 of this PEA.

4. REQUIREMENTS AND CONSTRAINTS

4.1 Eligibility to Propose

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. There is no limitation on The Aerospace Corporation for this PEA.

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.

4.2 Type of Mission of Opportunity

In terms of MO investigation categories listed in the SALMON-3 AO, only Small Complete Missions (SCMs) are to be proposed in response to this PEA. A SCM is a scientifically valuable investigation that can be realized within the PEA-specific Cost Cap, including the cost of its access to space if not provided by NASA. However, for the purpose of this SIMPLEx PEA, the access to space will be provided by NASA.

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).

Requirement PEA-tbd-2. Proposals submitted in response to this PEA shall be for complete investigations including Phases A-F.

The investigation PI is responsible for conducting the proposed science investigation that includes, but is not limited to: (i) development and delivery of the SmallSat; (ii) working with NASA's Launch Services Program (LSP) to integrate the SmallSat on the chosen platform; (iii) commissioning, validating, and operating the SmallSat and ground systems while on-orbit in order to carry out the proposed science investigation; (iv) preparing and delivering appropriate data analysis software, including required calibration data, analyzing the data, publicly distributing all the proposed investigation data from the prime mission phase to the scientific community, archiving the data in the NASA Planetary Data System (PDS), and reporting the results of the science investigation in the scientific literature.

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

4.3 Science Requirements and Constraints

The science objectives are described in Section 2 of this PEA. Section 2 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 the stated science objectives as described in Section 2 are not solicited through this call.

4.4 Telecommunications, Tracking, and Navigation

Proposers responding to this PEA should refer to Section 5.3.11 of the SALMON-3 AO for requirements related to telecommunications, tracking, and navigation.

4.5 Cost and Schedule Requirements and Constraints

4.5.1 Cost Requirements and Constraints

The PI-Managed Mission Cost is defined in Section 4.3.1 of the SALMON-3 AO 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, 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 5.3.9 of the SALMON-3 AO). 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.

The PI-Managed Mission Cost Cap for a SIMPLEx mission, including all mission phases, is expected to be in the range of \$15-\$55 million in real-year dollars. This cap includes a minimum of 25% of unencumbered cost reserves against the cost to complete.

NASA intends to award multiple investigations through Phase A/B, and intends that those investigations will nominally span the range of the stated cost cap.

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. Costs associated with NASA provided access to space will be outside the PI-Managed Mission Cost.

Final funding profiles (Phases A-F) for all selected investigations will be negotiated between NASA and the selected investigation teams. The inability of NASA to accommodate the requested funding profile may be a reason for non-selection of a proposal.

4.5.2 Schedule Requirements and Constraints

Selected investigations under this solicitation will be expected to deliver a SmallSat that can be integrated onto the NASA launch vehicle according to the schedule provided for the proposed launch opportunity (see Appendix A). The appropriateness of the proposed funding period will be reviewed and adjustments may be requested. Programmatic balance may limit the opportunities for funding in some areas.

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, one or more Step 1 proposals may be selected for Phase A/B formulation 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/B formulation and through the Preliminary Design Review (PDR). Step 2 is the KDP-C decision to continue (down selection). As the outcome of Step 2, NASA may continue one or more investigations into the subsequent phases of mission development for flight and operations.

A proposal may be selected for development without first completing a Phase A/B design phase. The proposer must recognize that NASA would only make such a decision without a Phase A/B competition if the MO proposal were especially compelling for a particular launch opportunity.

Requirement PEA-tbd-3. Proposals shall include a development schedule and an associated cost for a SCM with a launch readiness date consistent with the launch opportunities listed in Table A-1. A project schedule foldout(s) covering all phases of the investigation shall be provided. This foldout 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 and accompanying narrative, which 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 NEPA 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.

4.5.3 Access to Space Requirements

Launch services will be provided at no cost to the investigation for up to an ESPA-class SmallSat (no larger than 180 kg and 61 x 71 x 97 cm). CubeSats sized equivalent to 12 U or below will be containerized and may be carried on the bulkhead of the second stage or an ESPA port. They will be deployed via a dispenser system using either rails or tabs; proposed concepts must be compatible with both rail and tab dispenser systems through PDR. SmallSats larger than 12 U equivalent will be deployed from an ESPA-ring. The SmallSat deployment system will be provided by NASA as government furnished equipment.

Requirement PEA-tbd-4. Proposed concepts must be compatible with either an ESPA-ring, or

rail- and tab-based CubeSat dispenser systems.

It is possible for the launch vehicle to provide power and telemetry if an ESPA ring is used. Proposers must include power and telemetry costs in the PI-Managed Mission Cost because such accommodations are not guaranteed. Proposers are encouraged to consult the user's guides for the launch vehicles associated with the relevant primary mission to determine allowable capability in support of ESPA missions. The use of a propulsive ESPA-ring is allowable as specified by the individual launch opportunities (See Appendix A). The cost of a propulsive ESPA must be included in the PI-Managed Mission Cost.

Requirement PEA-tbd-5. The cost of a propulsive ESPA-ring, if proposed, must be included in the PI-Managed Mission Cost. The cost of auxiliary services to be provided by the launch vehicle (such as power, telemetry) must be included in the PI-Managed Mission Cost.

4.5.4 Full Cost Accounting for NASA Facilities and Personnel

Section 5.7.5 of the SALMON-3 AO is applicable with the following modification:

All Centers shall use an identical CM&O burden rate of \$46K (FY2018) per "equivalent head." For years after FY2018, this number must be inflated for subsequent years.

The cost elements for NASA Center Budget Proposals are shown in Table 1.

	Identify in proposal?	Include in PI-Managed mission cost?	Funding source	Comments
Civil Service Labor	Yes	Yes	SMD Program	Includes salaries and benefits
Civil Service Travel	Yes	Yes	SMD Program	
Other Direct/Procurements	Yes	Yes	SMD Program	Includes procurements as typically identified by flight projects in the NASA N2 budget database
CM&O	Yes	No	CASP	Applied to NASA provided labor, including Center civil servants and on-site contractors
AM&O	No	No	CASP	
NASA Contributed Costs	Yes	No	Identify	Must be non-SMD
Non-NASA Federal Government (funding requested from NASA)	Yes	Yes	SMD Program	If NASA funding is requested for the non-NASA Federal Government agency
Contributions	Yes	No	Identify	Includes all non-NASA contributions

Table 1: Cost Elements for NASA Center Budget Proposals in response to SMD AOs

4.5.5 PI-Managed Mission Cost

The 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.

This section identifies those costs that are constrained within the PI-Managed Mission Cost and those where NASA requires planning budgets that are outside the constrained PI-Managed Mission Cost. A summary of costs that are within or outside of the PI-Managed Cost for the SIMPLEx Investigations is listed in Table 2.

Contributions from sources other than NASA, whether U.S. or non-U.S., are accepted. These may include, but are not limited to, labor, services, and/or contributions to the investigation, subject to the following exceptions and limitations: (i) contributions of non-U.S. nuclear power or thermal sources are prohibited; and (ii) in order to ensure a preponderance of NASA interest in the investigation, as well as to ensure that investigations of roughly comparable scope are proposed for purposes of equitable competition, the sum of non-U.S. contributions of any kind to the entirety of the investigation is not to exceed one-half (1/2) of the proposed PI-Managed Mission Cost. 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.

Costs that are within the PI-Managed Mission Cost include: development and delivery of the SmallSat ready for integration onto the mission-provided platform, including test articles as required by NASA (Phases A-C); integration to the mission-provided platform (Phase D); development and delivery of functional algorithms and ground processing system (Phases B-D); supporting a science team that will contribute directly to the successful implementation of the investigation (Phases A-F); required calibration and validation activities (Phases C-E); operations, product generation, and data analysis during the proposed prime mission lifetime of the investigation (Phase E); and close out of the investigation once the investigation has been concluded (Phase F). The level of funding for the selected proposal will be decided after selection and capped at that level.

Portion of the Investigation	Within PI-Managed Mission Costs	Outside PI-Managed Mission Costs
Phase A/B/C/D/E/F	X	
Cost for access to space		X
ESPA Ring		X
Propulsive ESPA Ring	X	
Non-NASA contributions		X
Student collaboration (SC) beyond SC incentive	X	
Science-Exploration-Technology Enhancement Option (SEO)	X	

Table 2: List of which portions of an investigation are within and outside the PI-Managed Mission Cost. Budgets for items within and outside of PI-Managed Mission Costs are required except for access to space.

Proposers should propose a funding profile that is appropriate for their investigation. However, NASA cannot guarantee that every proposed funding profile can be accommodated within the available budget. The inability of NASA to accommodate the requested funding profile may be a reason for non-selection of a proposal. A final funding profile for the selected investigation will be negotiated between NASA and the selected investigation team.

Requirement PEA-tbd-6. Proposals shall include detailed plans and budgets for Phases A-F for costs that are within the PI-Managed Mission Cost (see Table 2). **In Table B3b (see Section H of Appendix B of the SALMON-3 AO), the cost shall be in federal fiscal year dollars using the fiscal year in which the proposal is submitted.** A federal fiscal year, extends from October 1 to September 30.

Requirement PEA-tbd-7. Proposals shall separate their costs to clearly show the cost of Phase A/B and then Phases C/D/E/F.

It is understood that minor changes may be required to a selected investigation once the final mission architecture is determined by NASA.

4.5.6 Education Communications and Outreach

The PI-led investigation selected through this PEA will not have an independent Education or Communications and Outreach program. No Education Program Plan or Communications and Outreach Program Plan is required in the proposal. Funded missions will be asked to identify and budget funding for a Subject Matter Expert to work with the SMD education office when and if needed.

4.5.7 Science Enhancement Options

Activities such as extended missions, guest investigator programs, general observer programs, participating scientist programs, and/or interdisciplinary scientist programs, where appropriate, have the potential to broaden the scientific impact of investigations. Such optional activities may be proposed as Science Enhancement Options (SEOs). Flight hardware may not be proposed as SEOs. 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 underlying investigation is selected. NASA reserves the right to accept or decline proposed SEO activities at any time during the mission; in particular, the decision may not be made at the time the underlying investigation is selected for flight. The process for deciding on SEO activities may involve further reviews (e.g., a “Senior Review” for extended missions, including planetary protection review inputs during the extended mission process). NASA reserves the right to solicit and select all participants (e.g., guest investigators and participating scientists) in such programs.

4.6 Technical Requirements and Constraints

4.6.1 New Technologies/Advanced Engineering Development

This Section intends to clarify the requirement for New Technologies and/or Advanced Engineering Developments and augments Section 5.3.5 of the SALMON-3 AO.

This PEA solicits SCMs for flight science investigations, not technology or advanced

engineering development projects. This PEA does not encourage Technology Demonstration Opportunities (TDOs). TDO is defined in Section 5.3.6 of the SALMON-3 AO. If a TDO is proposed, its cost is within PIMMC. Technology Infusion Opportunities (TIO) are allowed. TDO is defined in Section 5.3.7 of the SALMON-3 AO.

It is expected that new technologies may be required to accomplish planetary science missions proposed under this PEA. Proposals must justify how the proposed technology will contribute to mission success.

For technologies and subsystems that do not have flight heritage, the proposal must include a reference to the details and the results of testing and/or analysis that demonstrate performance in a relevant environment under conditions that simulate all known significant failure modes of the technology to demonstrate technical maturity of TRL 6. If a combination of this testing and analysis is proposed to be accomplished in Phase A/B, then a reference must be included describing what testing/analysis is planned or has been completed at the time of proposal submission to demonstrate a plan for maturing these systems to TRL 6 by PDR. A summary of the test/analysis should be included in the body of the proposal. This is consistent with Requirement B.46 in the SALMON-3 AO. Proposals must include a limited life item list and for those items show plans for how they can meet 1.5 times the worst-case expected operating life of the proposed mission.

For technologies and subsystems that do have flight heritage, claims of heritage must be supported by a description of the similarities in design and flight environments between the heritage and the proposed mission. This must be summarized in the body of the proposal, and more fully described in a non-page-limited appendix. This is consistent with Requirement B-80 and B-81 in the SALMON-3 AO.

Requirement PEA-tbd-8. The proposal must include a reference to the details and the results of testing and/or analysis that demonstrate performance in a relevant environment under conditions that simulate all known significant failure modes of the technology to demonstrate technical maturity of TRL 6, and/or a description of the similarities in design and flight environments between the heritage and the proposed mission. Proposals must include a limited life item list and for those items show plans for how they can meet 1.5 times the worst-case expected operating life of the proposed mission.

4.6.2 Additional Requirements for Alternative Access to Space

The following requirements are in addition to those given in section 5.3.8 *Access to Space* of the SALMON-3 AO.

SIMPLEx missions will be flown as secondary payloads and therefore are subject to launch delays should the primary mission be delayed. Proposers should be aware that it may be necessary for NASA to adjust the launch date and phasing of selected investigations from that proposed in order to conform to the needs of the primary mission and/or the available budget profile; therefore, the degree of launch date flexibility must be indicated in the proposal.

Requirement PEA-tbd-9. The PI assumes all risk for any delays in the implementation of the parent mission and shall, therefore, propose appropriate reserves for such schedule contingencies. Proposal shall include, at minimum, 9 months of funded schedule reserve for this risk. The proposal shall also describe the degree of launch date flexibility.

For each mission, the SmallSat will be deployed from the secondary stage after the primary payload has deployed. After award, NASA's launch vehicle integration team will work with the SmallSat mission's principal investigator to determine the specific timing of the SmallSat deployment.

Proposed CubeSats sized 6U and smaller are recommended to comply with Cal Poly *CubeSat Design specifications*, found at <http://www.cubesat.org/resources>. Concepts that do not comply with the Cal Poly CubeSat and Poly Picosat Orbital Deployer (P-POD) standards should clearly describe how their designs are packaged and deployed. NASA Launch Services Program has issued a *Program Level Dispenser and CubeSat Requirements* Document with requirements for CubeSats sized up to 6U (2U x 3U). Both of these documents can also be found in the Program Library.

Requirement PEA-tbd-10. All proposals that use the 1U through 6U CubeSats shall be compliant with the requirements in the NASA Launch Services Program *Program Level Dispenser and CubeSats Requirements* Document. The mass limitation is dependent on the launch and dispenser used. The 1.33 kg/U is the most constraining limit and good for any scenario.

For further information, please contact:

Anne E. Sweet,
Launch Services Program Executive,
Phone: 202-358-3784,
E-mail: anne.sweet-1@nasa.gov

4.6.2.1 Launch Opportunities

Possible launch opportunities for SIMPLEx SCMs are listed in Appendix A of this PEA. NASA does not expect to fly secondary payloads on all of these missions, and highly meritorious proposals that target one launch opportunity may be selected for a subsequent opportunity at NASA's discretion, if the proposed mission is suitable for a subsequent launch opportunity. In addition, NASA anticipates that there will be frequent flight opportunities for launch to low earth orbit (500 to 800 km) and geostationary transfer orbits. Proposals for launch to LEO or GTO may be considered at any time. This PEA will be amended to include other launch opportunities for secondary payloads as they become available.

4.6.3 Planetary Protection

Investigations will be subject to the established NASA policies and procedures that address forward contamination (transmittal from Earth to a targeted Solar System body) and backward contamination (transmittal to Earth from the targeted body) with respect to other Solar System bodies (see NPD 8020.7G, *Biological Contamination Control for Outbound*

and Inbound Planetary Spacecraft; NPR 8020.12D, *Planetary Protection Provisions for Robotic Extraterrestrial Missions*; and NASA-HDBK-6022, *NASA Handbook for the Microbiological Examination of Space Hardware*, in the SIMPLEx Library). Note that forward contamination is of particular concern for Mars and for possible liquid water within icy satellites, such as Enceladus and Europa.

In addition to planetary protection requirements placed on SIMPLEx investigations based on the nature of their target body and science, proposers must describe any implementation or operation effects that may increase risk to the planetary protection compliance of the primary payload (for example, propellant emissions that risk depositing on the primary payload, End of Mission scenarios for the secondary payload that influence interactions with the primary payload's target body, etc.). Proposers should provide a strategy and associated risk management plan to meeting all planetary protection requirements. Missions targeting objects unlikely to provide habitats for Earth life are only required to submit documentation, and have no restrictions on operations. Restrictions on operation and hardware cleanliness apply to all missions that are intended to operate in environments where Earth-life could proliferate – currently that is considered to be Mars, Europa, Enceladus, and anywhere in the Solar System where warm ice or liquid water is possible. Sample return missions, and missions to Mars that carry instruments capable of detecting signs of life or biosignatures receive additional requirements for planetary protection.

Proposals shall address plans for planetary protection, as required by NPD 8020.7G and NPR 8020.12D; such investigations shall bear all additional costs generated by any special planetary protection requirements.

Proposals should describe, as appropriate to the proposed target body and primary payload, such factors as how the design and material choices are compatible with 1) bioburden reduction methods for surface and encapsulated bioburden; 2) recontamination prevention approaches; and, if relevant, 3) reduction of contamination by organic compounds. Proposers are encouraged to communicate informally with the Office of Planetary Protection regarding planetary protection categorization and specific requirements with a future mission interest as they relate to design and development. For additional information, proposers may contact the Acting NASA Planetary Protection Officer, Dr. Frank J. Groen at frank.j.groen@nasa.gov and cc Doris.Daou@nasa.gov and Betsy.Pugel@nasa.gov. Introductory information can be found at <http://planetaryprotection.nasa.gov/>

Requirement PEA-tbd-11. Proposals that include an encounter with a Solar System body other than the Earth (via flyby, orbiter, lander, or impact, including end of mission) shall address plans for contamination control, as required by NPD 8020.7G and NPR 8020.12D, and include all costs associated with planetary protection requirements in the proposed budget.

At a minimum, the proposal should address (i) the anticipated planetary protection Category of the mission under NASA directives; (ii) the steps intended to be taken for planetary protection compliance, including potential for affecting primary payload compliance; (iii) the proposed mission operational accommodations to comply with anticipated requirements, including organizational responsibilities; (iv) the proposed steps to be taken for the preparation of flyby, orbital, and/or landed portions of the spacecraft to comply with any requirements for overall microbiological cleanliness and recontamination

prevention prior to launch; (v) End of Mission disposal, consistent with Section 4.6.6; and (vi) the proposal should identify the organization(s) responsible for implementing planetary protection requirements.

4.6.4 Environmental Compliance

SmallSat investigations that utilize explosive devices will not be considered.

CubeSat investigations that utilize propulsion systems may require a waiver from LSP-REQ-371.01B, *Launch Services Program Dispenser and CubeSat Requirements Document*. The waiver process is described in LSP-P-317.01 *Dispenser and CubeSat Program Level Requirements: Violation and Waiver Process*. Both of these documents are found in the Program Library.

4.6.5 Use of Radioactive Material

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.

4.6.6 Orbital Debris Assessment and End-of Mission Spacecraft Disposal

Section 5.3.13 of the SALMON-3 AO discusses the requirements related to orbital debris and end-of-mission spacecraft disposal.

As applicable for Earth, Moon, and Mars 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 of Salmon-3 AO, for additional detail).

4.6.7 Science Data Policy

For planning purposes for proposals, proposers responding to this PEA should abide by the science data policy described in Section 4.4 of the SALMON-3 AO and below.

Selected investigations may result in data products that are of broad use to the science community, including maps, data with improved calibrations, etc. NASA strongly encourages that such data be archived in the Planetary Data System (<http://pds.nasa.gov/>), or equivalent public archive, by the end of the award period.

Proposed investigations of any planetary or satellite surface that are intended to result in the publication of a Scientific Investigations Map (SIM) by the U.S. Geological Survey (USGS) should check the relevant box on the proposal Cover Page and clearly indicate this intention in the Proposal Summary, as well as in the text of the proposal. The scientific goal of such a geologic map product should be clearly explained and justified.

Requirement PEA-tbd-12. Proposals shall clearly identify the standard products from the investigation and describe the complete data processing flow leading to archived data products, including the time required to complete the initial and final flight calibration and

validation of the measurements. In accordance with the SMD requirement for open data and related software, any specialized software and algorithms required for basic data analysis and processing will be made available by the PI to the science community and public with appropriate documentation.

4.6.7.1 Data Analysis

The PI will be responsible for production and analysis of the investigation data necessary to achieve the proposed science objectives, for archiving the data in the relevant NASA planetary science 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) or post-mission (Phase F) activities. Proposals must allocate sufficient resources for this data analysis and archiving. Science studies with the archived data sets beyond the PI-led teams proposed science investigation will be solicited and selected by NASA in subsequent NASA solicitations through ROSES NRAs.

Requirement PEA-tbd-13. Proposals shall clearly present a plan for analysis of the investigation data leading to completion of the proposed science investigation and achieving the identified investigation goals and objectives. Proposals shall show that adequate resources, including funding, schedule, and personnel, are identified to complete the proposed science investigation.

4.6.7.2 Data Rights

By NASA policy, all science data returned from NASA investigations led by a NASA-funded PI are made available immediately in the public domain. Following a post-flight checkout period, all data will be made available to the user community. There shall be no period of exclusive access. The principal investigator will propose the data product latency period for standard products listed in the proposal, and a justification for it must be demonstrated. Barring exceptional circumstances, data product latency may not exceed six months.

Requirement PEA-tbd-14. Proposals shall include a clear commitment to minimizing the latency for data products. Proposals shall specify the minimum necessary data latency period and shall provide a justification for that data latency period.

4.6.7.3 Delivery of Data to Archive

Mission data will be made fully available to the public by the investigator team in usable form, in the minimum time necessary and, in any case, within the proposed data latency period not to exceed six months following data receipt from the spacecraft. The PI will be responsible for collecting the scientific, engineering, and ancillary information necessary to validate and calibrate the data prior to making it fully available. By the investigation closeout, the investigation will deliver to the planetary data system (PDS) all final data products, along with the scientific algorithm software, coefficients, ancillary data used to generate these products, and the algorithm and calibration documentation.

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, 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 and provided within the proposed data latency period not to exceed six months following data receipt from the spacecraft.

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.

Proposals may include funding for up to one year after end-of-operations for the generation and archiving of derived data products. This funding must be included in the capped PI-Managed Mission Cost.

The PI will be responsible for collecting this information and using it for validation and calibration prior to making the investigation data fully available. Data delivered to the PDS during Phases E and F will include the relevant ancillary information. By no later than the investigation closeout, the investigation will have delivered to the PDS all final data products, along with the scientific algorithm software, coefficients, ancillary data used to generate these products, and the algorithm and calibration documentation.

Archival data products will include pre-flight and in flight radiometric and geometric calibration data, ancillary and/or engineering data needed or simply useful for the full understanding of the experiment, and observation geometry data.

If derived data products such as maps are to be considered a result of the proposed investigation, these must also be archived with suitable documentation. Complete documentation of the experiment and related software and/or other tools or parameters that are necessary to interpret the data will also be included. The inclusion of software in an archive may be appropriate, although this can present special problems and should be discussed with the relevant archive.

International coordinate system and nomenclature standards are required to be used when archiving data and products into the PDS (<https://pds.nasa.gov/pds4/about/>, particularly chapter 2). Additionally, data archived in the PDS must be compliant with the PDS's "PDS4" archive standards (which have been also adopted by the International Planetary Data Alliance).

The International Astronomical Union (IAU) approves international standards for coordinate systems and nomenclature. Appropriate working groups and their contact information can be found by following links from (<http://astrogeology.usgs.gov/groups>). NASA's Planetary Cartography Program maintains the core software infrastructure for cartographic processing of a variety of planetary data sets but does not fund mission specific applications needed to utilize this infrastructure. More information on this software is available from (<http://isis.astrogeology.usgs.gov/>). If proposing to produce geologic maps, extensive guidelines and other materials are available through the NASA/USGS Planetary Geologic Mapping

Program (<http://planetarymapping.wr.usgs.gov>). NASA funds open facilities for producing stereogrammetric and radargrammetric topography and geographical information system products. Information on the capabilities of these facilities and contact information for their leads can be found at (<http://astrogeology.usgs.gov/facilities/photogrammetry-guest-facility>) and (<http://astrogeology.usgs.gov/facilities/mrctr-gis-lab>). The photogrammetry guest facility also provides limited support for investigators wishing to make their own digital topographic models from planetary stereo images.

All archive submissions must go through a peer review organized by the PDS. Each data provider must participate in the peer review and will be responsible for correcting any liens identified. Data will not be considered submitted to the PDS until the peer review is completed and any liens have been addressed and accepted by the PDS. Depending on the length of the mission, there could be a single peer review at the end of the mission, or, more likely, a series of peer reviews at regular intervals throughout the life of the mission, typically every three months.

NASA data archives have budgets to support core activities, including the basic ingestion and review of new data. Proposed investigation data archiving plans and budgets must be consistent with the policies and practices of the PDS. For the PDS, guides to the archiving process and tools for data archive preparation may be downloaded from the PDS website (<https://pds.nasa.gov/pds4/about/>). Proposals may include funding for up to one year after end-of-operations for the generation and archiving of derived data products.

Requirement PEA-tbd-15. A schedule-based end-to-end data management plan, including approaches for data retrieval, validation, preliminary analysis, and archiving shall be described. The 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 plan shall identify the formats and standards to be used, selected from the published list of approved PDS Standards. 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. This supersedes Requirement B-23 in Appendix B of the SALMON-3 AO.

5. PROPOSAL PREPARATION AND SUBMISSION

5.1 Proposal Content Requirements

Requirement PEA-tbd-16. Proposal content must 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 key 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).

Requirement PEA-tbd-17. All proposers must answer the key 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.

Requirement PEA-tbd-18. All proposals must identify any export-controlled material in the proposal as instructed in Sections 5.9.3 of the SALMON-3 AO; in addition, (a) the export-controlled material must be printed in a red font or enclosed in a red box as described in the required statement in Requirement 99, and (b) an electronic version of the proposal, in PDF format, with the export-controlled material redacted but otherwise identical to the full unredacted version, must be included on the proposal CD-ROM.

5.2 Proposal Submission Requirements

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.

Requirement PEA-tbd-19. The proposal must be received electronically through NSPIRES no later than the time deadline on the proposal due date given in Section 8 of this PEA. Proposal CD-ROMs must be received at the address given in the SALMON-3 AO no later than the CD-ROM due date given in Section 8 of this PEA.

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

Non-U.S. participation requirements are fully described in section 5.8 in the SALMON-3 AO.

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.

5.4 Questions

In order to make sure that all proposers receive the same information, all questions concerning the content provided in this appendix, or in the documents available through the SIMPLEx

Library, should be sent to the Email address for the point of contact that is listed in Section 8 of this PEA. Responses that are helpful and informative to proposers will be posted on the website also listed in Section 8 of this PEA.

The deadline for receipt of questions is 14 days before the proposal due date listed in Section 8 of this PEA. Answers will be provided no later than 10 days before the proposal due date.

6. PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

6.1 Scientific/Technical Evaluation Factors

Proposals will be evaluated according to the evaluation criteria set forth in Section 7.2 of the SALMON-3 AO with the following exception: all proposals will be reviewed by a science peer review panel, but only those proposals that score well in that science panel will be reviewed by the technical/management/cost panel. 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 in both the Intrinsic Science, Exploration, or Technology Merit of the Proposed Investigation and the Experiment Science, Exploration, or Technology Implementation Merit of the Proposed Investigation.

For the panel evaluating the third evaluation criterion; Technical, Management, and Cost (TMC) Feasibility of the Investigation Implementation, including Cost Risk, Factors C-1 and C-3 are amended to incorporate the guidance on technical risk describe in Sections 2.4.1 and 4.6.1 including ground tests and analysis that have been completed or are planned for Phase A/B in the assessment of the technical maturity to TRL 6. They are also amended to not require or assess the adequacy of backup plans to ensure success of the investigation when systems having a TRL less than 6 are proposed.

The review panel evaluating the third evaluation criterion – technical, management, and cost (TMC) feasibility of the proposed investigation, including cost risk – will also provide comments to NASA regarding the extent to which the proposed SmallSats might affect the primary mission launch and operations. These comments will not contribute to the TMC feasibility risk rating but will be considered by the selection official. The expectation is that the SmallSats will not affect the primary mission’s operations, and will require, at most, only a small step up in launch vehicle capability.

In addition to the evaluation criteria given in Section 7.2 of the SALMON-3 AO, the evaluation of the *TMC Feasibility of the Investigation Implementation, including Cost Risk* will also incorporate the guidance on technical risk described in this PEA’s Sections 2.4.1 and 4.6.1.

When appropriate, Form C, will include an assessment of proposed planetary protection provisions to avoid potential biological contamination (forward and backward) that may be associated with the mission.

6.2 Selection Process

After the review by the AO Categorization and Steering Committees, the final evaluation results will be presented to the Division Director for PSD, who will make the selection.

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). For this SIMPLEx selection, these factors also include the likelihood that the proposed SmallSat can be accommodated on the primary mission.

After award, NASA's Program Office will conduct the Preliminary Design Reviews and the Associate Administrator for SMD will make the down-selection(s) decision based on technical and science merit and programmatic factors. This down-selection will serve as KDP-C.

6.3 Implementation Activities

Proposal selection and award will be implemented according to the guidelines set forth in Section 7.4 of the SALMON-3 AO.

6.3.1 Principal Investigator-led Team Masters Forum

One step toward successful execution of PI-led missions is to ensure that PI-led mission management teams receive the instruction necessary to enable them to better execute their missions for NASA. SMD has established a 1 day PI-led Team Masters Forum for newly selected PI-led mission management teams. The purpose of the PI-led Team Masters Forum is to facilitate knowledge sharing in areas that are deemed necessary to successfully execute PI-led SMD science missions. Course attendance by the leaders of newly selected PI-led mission management teams (PI, Project Manager, Project Scientist, and Project Systems Engineer) and the NASA Headquarters Program Scientist and Program Executive (where assigned) is required as soon as practical after proposal selection.

6.3.2 Award Administration and Funding of Investigations

Oversight management responsibilities have been assigned to the Planetary Missions Program Office (PMPO) at the NASA Marshall Space Flight Center. The responsibilities of the PMPO will include oversight of SmallSat development; coordination of Government-furnished services, equipment, and facilities; coordination of the selected team with potential platforms for integration; and contract management for selected investigations.

It is anticipated that the Program Office will provide funding to each selected investigation; to perform a Phase A/B design study is to be initiated as soon as possible after notification of selection. NASA Centers will receive funding via intra-agency funding mechanisms. In order to place Phase A/B awards in place, Statements of Work (SOWs) certified cost and pricing data, and small business subcontracting plans will be required for the Phase A/B design studies.

Proposals are not required to include SOWs, cost and pricing data for Phase A/B design 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, cost and pricing data, and small business subcontracting plans 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 detailed tasks for Phase A/B, as well as general task statements for Phases C through F. SOWs will include the following as a minimum: Scope of Work, Deliverables (including science data), and Government Responsibilities (as applicable). SOWs need not be more than a few pages in length.

Each Phase A/B contract will contain a priced option for a Bridge Phase, to be exercised upon investigations down-selected to proceed into Phase C. The Bridge Phase option will allow work to be continued uninterrupted under the contract after a Step-2 down-selection decision is made. The Bridge Phase is intended to cover a four-month period of Phase C effort to provide program continuity while negotiations are completed to modify the contract to include Phases 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 down-selection process to continue beyond the Phase A/B design study. The Bridge Phase option will allow the Government to continue work under the contract after a Step-2 down-selection 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 down-selected during following Step 2.

6.3.3 Conduct of the Phase A/B Preliminary Design Study

The Phase A/B preliminary design studies are intended to provide NASA with more definitive information in order to assess the cost, risk, and feasibility of the investigations, as well as a detailed plan for the conduct of any optional student collaboration, before final selection for implementation. The design studies will each culminate in a Preliminary Design Review to be conducted by the Program Office 12 months following the establishment of the initial contracts.

The PI will provide in the Phase A/B Preliminary Design Review 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/B Preliminary Design Review Report the allocation of the proposed cost reserves among the appropriate WBS elements. The PI-Managed Mission Cost will not increase by more than 20% from that in the Step-1 proposal to that in the

Phase A/B Preliminary Design Review Report, and, in any case, will not exceed the Cost Cap. The NASA review at the PDR will include all investigation facets. Risk reduction that has been accomplished during Phase A/B will be closely reviewed.

Each investigation's Phase A/B Preliminary Design Review Report must conclude with a commitment by the PI for the cost, schedule, and scientific performance of the investigation. For each Step-2 selection, and unless otherwise stated in the selection letter, the selected investigation's cost will be set at the Phase A/B Preliminary Design Review Report's proposed cost.

NASA cannot guarantee that the proposed funding profile can be accommodated within the PSD's budget. A funding profile for the selected investigation will be negotiated during Phase C.

6.3.4 Down-selection of Investigations

The SMD Associate Administrator will make down-selection decisions based on the evaluation of the Phase A/B Preliminary Design Review Reports and on programmatic considerations. The criteria for evaluating the Phase A/B Preliminary Design Review Report are as follows:

1. Scientific merit of the proposed investigation, only in the case the science objectives have substantially changed from the initial proposal;
2. Science implementation merit and feasibility of the investigation;
3. Technical, management, and cost feasibility of the investigation implementation, including cost risk; and
4. Quality of plans for small business subcontracting plans and optional student collaboration, if proposed.

Any substantial changes to science contained in the Phase A/B Preliminary Design Review 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/B. This requested information will need to be included in the Phase A/B Preliminary Design Review Report and will be considered at the time of down-selection for flight.

At the conclusion of Phase B, it is anticipated that the Selecting Official will continue one or two investigations into the subsequent phases of mission development for flight and operation. The target date for this continuation decision (i.e. "Down-Selection") is given in Section 8.

An investigation may be down-selected to enter Phase C or may be down-selected for a funded Extended Phase A/B so they can retire one or more risks before they are allowed to proceed to Phase C. There is no guarantee that an investigation down-selected for an Extended Phase A/B will be approved to enter Phase C, even if all risks have been retired during the Extended Phase A/B. 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.

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/B design study. 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 Phase A/B Preliminary Design Review 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 terminate without further expense to NASA. Every investigation team will be offered a debriefing of the evaluations of its Phase A/B Preliminary Design Review Report.

6.3.5 International Agreements

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

7. SALMON-3 Specifications and Exceptions

7.1 SALMON-3 Required Specifications for PEA

The SALMON-3 AO requires that PEAs make certain specifications.

- Section 2.4 of the SALMON-3 AO states that the PEA will specify the specific goals and objectives of the sponsoring Mission Directorate for that proposal opportunity. For this PEA, those goals and objectives are specified in Section 2.
- Section 2.4 of the SALMON-3 AO states that the PEA will specify the funding available for selected investigations. For this PEA, the available funding is specified in Section 4.5.1.
- Sections 3 and 6.2.3 of the SALMON-3 AO state that each PEA will specify a due date for electronic submission of proposals and a due date for receipt of proposal CD-ROMs, 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, and that specific schedules and due dates be included in each PEA. For this PEA, the due date for electronic submission and the due date for receipt of CD-ROMs are specified in Section 8, requirements and constraints are specified in Section 4, the sponsoring mission directorate and division is specified in Section 1, the type of MO is specified in Section 4.2, the cost guidelines are discussed in Section 4.5.1, and the schedule constraint is specified in Section 4.5.2.

- Section 4.1.2 of the SALMON-3 AO states that each PEA will specify the program-specific safety, reliability, and quality assurance requirements document. Document DISC-RQMT-002, *Solar System Exploration Program Safety and Mission Assurance Guidelines and Requirements*, is provided in the SIMPLEx Library.
- Sections 4.1.2 and 7.4.3 of the SALMON-3 AO state that each PEA will designate the program office and associated NASA Center. This designation is in Section 2.4 of this PEA.
- Section 4.2.1 of the SALMON-3 AO states that the PEA will identify any organizations, other than Cornell Technical Services and The Aerospace Corporation, used for evaluation services. No other organizations will be used.
- Section 4.2.1 of the SALMON-3 AO states that The Aerospace Corporation may be subject to either Partial Limitation or no limitation regarding participation in this PEA. Clarification that The Aerospace Corporation has no limitation is in Section 4.1 of this PEA.
- Section 4.2.1 of the SALMON-3 AO states that Cornell Technical Services may be subject to either Full Limitation or no limitation regarding participation in this PEA. Clarification that Cornell Technical Services is under Full Limitation is in Section 4.1 of this PEA.
- Sections 4.3.1 and 5.7.1 of the SALMON-3 AO state that each PEA will specify additional costs to be included in, and any cap on, the PI-Managed Mission Cost. For this PEA, that information is specified in Section 4.5.5.
- Section 4.3.2 of the SALMON-3 AO states that each PEA will specify additional costs to be included in the Total Mission Cost. For this PEA, that information is specified in Section 4.5.5.
- Section 4.3.3 of the SALMON-3 AO states that the PEA will specify any additional costs to be included in Enhanced PI-Managed Mission Cost. For this PEA, that information is specified in Section 4.5.
- Section 4.3.4 of the SALMON-3 AO states that each PEA will specify any constraints on funding profile, selection date, and launch readiness date. For this PEA, those constraints are found in Section 4.5.
- Section 5.1 of the SALMON-3 AO requires that each PEA identify the permitted categories of missions of opportunity. Section 4.2 of this PEA states that the only permitted category is Small Complete Mission of Opportunity (SCMO).
- Sections 5.1.1 and 5.1.2 of the SALMON-3 AO state that the PEA will specify particular dates, policies, and constraints for Partner Missions of Opportunity (PMO) and New Missions with Existing Spacecraft (NMES). As the PMO and NMES categories are not permitted in this PEA, these issues are moot, and therefore the information is not included in this PEA.
- Sections 5.1.3 and 5.3.8 of the SALMON-3 AO state that the PEA will identify any NASA-provided launch services. For this PEA, the plans for access to space are discussed in Section 4.5.3.
- Section 5.1.3 of the SALMON-3 AO states that the PEA will specify launch date and access to space constraints for Small Complete Missions (SCM). For this PEA, the plans for access to space and launch dates are discussed in Sections 3, 8, and Appendix A.
- Section 5.2.5 of the SALMON-3 AO states that the PEA will specify requirements for Science-Exploration-Technology Enhancement Options (SEO). Section 4.5.7 of this PEA provides the information.

- Section 5.3.1 of the SALMON-3 AO states that each PEA will provide a determination as to whether a two-step competitive process will be used. This PEA states in Section 4.5.2 that a two-step process will be used.
- Section 5.3.2 of the SALMON-3 AO states that the PEA may broaden the allowable platforms beyond spacecraft. This PEA specifies that various options for platforms allowed.
- Section 5.3.4 of the SALMON-3 AO states that the PEA may specify the mission category or the payload risk classification that will be applied to selected investigations. This PEA does specify the payload risk classification in section 2.4.1.
- Section 5.3.5 and Appendix B, Section F.4 of the SALMON-3 AO state that the PEA may supersede Requirements 35 and B-46 and specify a deadline for technology maturation other than TRL 6 by PDR. This PEA clarifies these requirements in section 4.6.1.
- Section 5.3.6 of the SALMON-3 AO states that the PEA will state whether a Technology Demonstration Opportunity (TDO) is encouraged, whether the cost is within or outside the PIMMC and any other additional requirements and constraints. In this PEA that information is provided in Section and 4.6.1.
- Section 5.3.7 of the SALMON-3 AO states that a PEA may offer Technology Infusion Opportunities, and, if so, will provide guidelines for infusion of NASA-developed technologies. In this PEA that information is provided in Section 4.6.1.
- Section 5.3.8 of the SALMON-3 AO states that the PEA will specify whether a charge to the PI-Managed Mission Cost will be levied for the expected NASA launch vehicle monitoring functions and advisory services for non-NASA launch services. No such charge shall be levied.
- Section 5.3.10 of the SALMON-3 AO states that the PEA will state whether the proposed use of radioactive materials is permitted. This information is provided in Section 4.6.5.
- Section 5.4.5 of the SALMON-3 AO states that schedule requirements are provided in the PEA. In this PEA the schedule requirements are in Sections 4.5.2 and 4.6.
- Section 5.6.1 of the SALMON-3 AO states that the PEA will specify whether an Education Program Plan or Communications and Outreach Program Plan is required. This PEA states in Section 4.5.6 that neither is needed in the proposal.
- Section 5.6.2 of the SALMON-3 AO states that the PEA may state that proposals may define a Student Collaboration (SC) that is a separate part of the proposed investigation. This PEA does not so state, and makes the further clarification in Section 4.5.5.
- Section 5.7.2 of the SALMON-3 AO states that the PEA will specify the required minimum unencumbered cost reserves percentages for Phases A/B/C/D and for Phases E and F. This information is provided in Section 4.5.1 of this PEA.
- Section 5.7.5 of the SALMON-3 AO states that the PEA will provide the applicable CM&O burden rate. This is provided in Section 4.5.4 of this PEA.
- Section 5.7.6 of the SALMON-3 AO states that the PEA may specify constraints on contributions. Section 5.3 of this PEA describes constraints on non-U.S. contributions. In addition, this PEA is sponsored by SMD and it does not permit contributions of funding from NASA SMD programs other than the funding offered through this PEA.
- Section 5.8.2 of the SALMON-3 AO states that the PEA may specify exemptions to the requirement that proposed non-U.S. contribution essential to the success of the proposed investigation be described at the same level of detail as those of U.S. partners. This PEA makes no such exemptions.

- Section 5.9.4 of the SALMON-3 AO states that the address for delivery of any package containing the classified appendix will be provided in the applicable PEA. This address is: Chief, NASA Headquarters Security Office, Suite 1M40, 300 E Street SW, Washington, DC 20546.
- Section 6.1.1 of the SALMON-3 AO states that each PEA will state whether a Preproposal Conference will be held and whether it will be held in person or via web/teleconference. This information is in Sections 3 and 8 of this PEA.
- Section 6.1.2 of the SALMON-3 AO states that each PEA will state whether a Notice of Intent (NOI) to propose is required, and if so, will specify a due date. This information is in Sections 3 and 8 of this PEA.
- Section 6.1.5 of the SALMON-3 AO discusses the PEA-specific acquisition homepage and program library. URLs for, and links to, these resources are given in Section 8.
- Section 6.1.6 of the SALMON-3 AO states that PEA-specific point-of-contact will be specified in each PEA. For this PEA, this information is provided in Section 8.
- Section 6.2.1 of the SALMON-3 AO states that Appendix A and Appendix B of the SALMON-3 AO are binding unless amended in the PEA. This PEA makes no amendments to Appendix A, and requirements superseding certain requirements in Appendix B are contained in Sections 5.1, 5.2, and 5.3.
- Section 7.1 of the SALMON-3 AO states that the PEA will identify the Selection Official. This PEA identifies the Selection Official in Section 6.2.
- Section 7.1.1 of the SALMON-3 AO states that the PEA may request 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. For this PEA, as stated in Section 6.1, clarifications in both criteria will be requested.
- Section 7.4.2 of the SALMON-3 AO states that the PEA will state whether a PI-led Team Masters Forum is planned. A PI-led Team Masters Forum is planned in this PEA.

7.2 Exceptions to General SALMON-3 Requirements

This PEA contains the following exceptions to the SALMON-3 proposal preparation and submission requirements described in the SALMON-3 AO.

- Section 4.2 of this PEA lists specific requirements, or parts of requirements, in Sections 5.1 and 5.2 of the SALMON-3 AO that are moot for purposes of the PEA.
- Section 4.2.1 of this PEA provides Risk Classification requirements that supersede those in Section 5.3.4 of the SALMON-3 AO.
- Section 4.6.8 of this PEA provides data analysis policies and supersedes Section 4.4.2 of the SALMON-3 AO.
- Section 4.6.8.3 of this PEA provides data archiving policies and supersedes Section 4.4.3 of the SALMON-3 AO; in particular Requirement I-17 in this PEA supersedes Requirement B-23 of Appendix B.
- Section 4.6.7 of this PEA provides End-of Mission requirements that supersede those in Section 5.3.13 of the SALMON-3 AO.

8. SUMMARY OF KEY INFORMATION

Funding available	\$15-\$55 Million
Release Date	Month XX, 2018
Date for Preproposal Conference	Webex; see the SIMPLEx PEA additional information page at https://soma.larc.nasa.gov/SIMPLEx/ for exact date, time, agenda, and logistical information
Due Date for NOI (notice of intent to propose, required for this solicitation)	11:59 p.m. Eastern Time 60 days prior to proposal submission
Due Date for Receipt of Electronic Proposals in NSPIRES	Appendix A will provide schedules for specific primary mission opportunities. 11:59 p.m. Eastern Time prior to specific mission schedule
Due Date for Receipt of Proposal CD-ROMs	1 week after electronic submission
PEA-specific acquisition homepage for the SIMPLEx PEA	https://soma.larc.nasa.gov/SIMPLEx/
Selection Date for Competitive Phase A Studies	Periodic
Phase A/B Preliminary Design Review Reports Due	12 Months after Step 1 awards
Down-Selection Date	Within 3 Months after Phase A/B Preliminary Design Review Report delivery
Library for the SIMPLEx Investigation PEA	https://soma.larc.nasa.gov/SIMPLEx/programlibrary.html
Submission Medium	Electronic copies and CD-ROM submission required; see Section 6.2.3 and Appendix B of the SALMON-3 AO.
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	Ms. Doris Daou SIMPLEx Program Scientist Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Tel: 202-358-1686 Email: Doris.Daou@nasa.gov Dr. Carolyn Mercer SIMPLEx Program Executive Science Mission Directorate NASA Glenn Research Center Cleveland, OH 44140 Tel: 216-433-3411 Email: cm Mercer@nasa.gov

Appendix A – Flight Opportunities

Table A-1 lists the currently known flight opportunities that may host SIMPLEx missions as secondary payloads. Not all of these launches will include secondary payloads – selections will be made competitively based on this SIMPLEx solicitation.

NASA anticipates that there will be flight opportunities for launch to low earth orbit (500 to 800 km) and geostationary transfer orbits (GTO). SIMPLEx proposals may be submitted for these at any time.

*Note: The IMAP mission is currently being solicited by NASA’s Heliophysics Division. Details about the primary mission will be released once determined through the competitive process.

Table A-1. Listing of launch opportunities for SIMPLEx proposals.

Primary Mission	SIMPLEx Proposal Cut-off Date	Payload Integration /Launch Readiness Dates	Launch Site	Primary Payload Destination	Launch Orbit	Spacecraft Orbit at Separation						Allowed Elements					Potential Launch Vehicles
						Launch Flight Azimuth [degrees]	Characteristic Energy (C3) [km ² /s ²]	Hyperbolic Escape Velocity [km/s]	Separation Altitude [km]	Right Ascension of the Launch Asymptote (RLA)	Declination of the Launch Asymptote (DLA)	CubeSat Deployer	ESPA Ring	ESPA Grande	Propulsive ESPA ring	Radioactive elements	
LEO or GTO	On-going	On-going	Varies	N/A	LEO or GTO	Varies						Y	Y	Y	Y	N	
Lucy	1 July 2018	August 2021 / 16 October 2021	Cape Canaveral Air Force Station	Jupiter L4 and L5 Trojan Swarms	Helio-centric Escape	86.68	45.91	5.34	1641	16.94	8.46	Y	Y	N	N	N	Atlas V, Falcon 9, Antares, ...
Psyche	1 July 2018	June 2022 / August 2022	Cape Canaveral Air Force Station	(16) Psyche	Elliptic Helio-centric	TBD	14.53	3.81	TBD	72.96	1.78	Y	Y	N	N	N	Atlas V, Falcon 9, Antares, ...
IMAP*	TBA	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	N	Y	N	N	N	
EM-x	TBA	TBD	Kennedy Space Center	Lunar Orbit	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Y	N	N	N	N	SLS

SALMON-3 PEA tbd

Small Innovative Missions for Planetary Exploration (SIMPLEx)

END OF PEA