National Aeronautics and Space Administration

National Aeronautics and Space Administration

Release Date December 3, 2009
NNH10ZDA002O

Announcement of Opportunity

SOLAR PROBE PLUS INVESTIGATIONS

Notices of Intent Due Date: **January 11, 2010**
Proposal Due Date: **March 26, 2010**

OMB Approval Number 2700-0085

ANNOUNCEMENT OF OPPORTUNITY
SOLAR PROBE PLUS INVESTIGATIONS
NNH10ZDA002O

FOREWORD

[Bold text changed through Amendment 2 on February 18, 2010]

The National Aeronautics and Space Administration (NASA) Science Mission Directorate (SMD) is releasing this Announcement of Opportunity (AO) to solicit Principal Investigator (PI)-led instrument science investigations and Observatory Scientist investigations for the Solar Probe Plus (SPP) mission.

Although each PI-Managed instrument science investigation cost is not capped, the total cost for all the investigations selected is approximately **$180M** in Real Year (RY) dollars **for Phases A through D**, not including contributions. **Additional funding of approximately $70M RY is available for Phases E and F which includes a future solicitation for a Guest Investigator (GI) program.** The mass of the total payload is also constrained to not exceed 40 kg, because the current SPP mission concept uses the largest available evolved expendable launch vehicle (EELV). SPP is planned for launch no later than 2018.

This AO is based on SMD's Standard PI-Led Mission AO. Proposers should be aware that changes have been made in this AO from the language in the Standard PI-Led Mission AO to address the unique requirements of instrument science investigations that differ from those of full mission investigations.

This AO incorporates a large number of changes relative to previous instrument science investigation AOs released under the Living With a Star (LWS) program including both policy changes and changes to proposal submission requirements. All proposers must read this AO carefully, and all proposals must comply with the requirements, constraints, and guidelines contained within this AO.

ANNOUNCEMENT OF OPPORTUNITY
SOLAR PROBE PLUS INVESTIGATIONS
NNH10ZDA002O

TABLE OF CONTENTS

1. Description of Opportunity 1
1.1 Introduction 1
1.2 NASA Safety Priorities 1

2. AO Objectives 2
2.1 NASA Strategic Goals 2
2.2 Living With a Star Program Goal and Objectives 3
2.3 SPP Mission Definition 3
2.4 SPP Mission Goals and Objectives 4
2.5 SPP Mission Design 5
2.5.1 SPP Mission Outline 5
2.5.2 Candidate Instruments for the SPP Payload 6
2.5.3 SPP Science Working Group 6
2.6 Scope of this SPP Investigations AO 6
2.6.1 SPP Instrument Science Investigations 7
2.6.2 SPP Observatory Scientist Investigations 7
2.6.3 Requirements Regarding the Scope of this AO 7

3. Proposal Opportunity Period 8

4. Policies Applicable to this AO 8
4.1 NASA Management Policies 8
4.1.1 NASA Flight Program and Project Requirements 8
4.1.2 NASA Project Management 9
4.1.3 Mission Category and Payload Risk Classification 9
4.1.4 Remediation, Termination, or Cancellation 10
4.2 Participation Policies 10
4.2.1 Eligibility to Participate in this AO 10
4.2.2 Constraints on Investigations that are Candidates for Selection 11
4.2.3 Responsibility of Principal Investigator for Implementation 11
4.2.4 NASA Concurrence for Replacement of Key Management Team Members 11
4.3 Cost Policies 11
4.3.1 PI-Managed Investigation Cost 11
4.3.2 Total Investigation Cost 12
4.4 Data Policies 12
4.4.1 Data Analysis 12
4.4.2 Data Rights 12
4.4.3 Delivery of Data to Archive 12
4.5 Project Management Policies 13
4.5.1 Independent Verification and Validation 13
4.5.2 Earned Value Management Plan 14
4.5.3 Cost Analysis Data Requirement 14

5. Requirements and Constraints 14
5.1 Science Requirements for Instrument Science Investigations 14
5.1.1 Scope of Proposed Investigation 14
5.1.2 Traceability of Proposed Investigation 14
5.1.3 Investigation Science Objectives and Requirements 15
5.1.4 Baseline and Threshold Science 15
5.2 Technical Requirements for Instrument Science Investigations 16
5.2.1 Complete Instrument Science Investigation 16
5.2.2 Accepted Management Processes and Practices 16
5.2.3 New Technologies/Advanced Developments 17
5.2.4 Use of Radioactive Material 17
5.2.5 Deviations from Recommended Payload Requirements 17
5.3 Mission Accommodation Requirements for Instrument Science Investigations 18
5.3.1 Schedule Requirements 18
5.3.2 Instrument Accommodations in Concept Spacecraft 18
5.3.3 Description of NASA-Provided Spacecraft 20
5.3.4 Science Operations 23
5.3.5 Mission Timeline 23
5.4 Management Requirements for Instrument Science Investigations 24
5.4.1 Principal Investigator 24
5.4.2 Instrument Project Manager 25
5.4.3 Management and Organization Experience and Expertise 25
5.4.4 Risk Management 26
5.4.5 Compliance with Procurement Regulations by NASA PI Proposals 26
5.5 Requirements for the Observatory Scientist Investigation 27
5.6 Science Team, Co-Investigators, and Collaborators Requirements 28
5.6.1 Science Team 28
5.6.2 Co-Investigators 28
5.6.3 Collaborators 29
5.7 Small Business Participation and Education and Public Outreach 29
5.7.1 Small Business Participation 29
5.7.2 Education and Public Outreach 30
5.8 Cost Requirements 30
5.8.1 Investigation Cost Definitions and Constraints 30
5.8.2 Cost Estimating Methodologies and Cost Reserve Management 30
5.8.3 Work Breakdown Structure 31
5.8.4 Master Equipment List 31
5.8.5 Full Cost Accounting for NASA Facilities and Personnel 31
5.8.6 Contributions 32
5.9 Non-U.S. Participation Requirements 33
5.9.1 Overview of Non-U.S. Participation 33
5.9.2 General Guidelines Applicable to Non-U.S. Proposals and Proposals including Non-U.S. Participation 34
5.9.3 Agreements with Selected Non-U.S. Participants 35
5.9.4 Export Control Guidelines Applicable to Non-U.S. Proposals and Proposals including Non-U.S. Participation 36

5.10 Additional Proposal Requirements 36
5.10.1 Letters of Commitment 36
5.10.2 Export Controlled Material in Proposals 37

6. Proposal Submission Information 38
6.1 Preproposal Activities 38
6.1.1 Preproposal Conference 38
6.1.2 Notice of Intent to Propose 38
6.1.3 Teaming Interest 39
6.1.4 Acquisition Home Page and Program Library 39
6.1.5 Point of Contact for Further Information 40
6.2 Proposal Preparation and Submission 40
6.2.1 Structure of the Proposal 40
6.2.2 Certifications 40
6.2.3 Submission of Proposals 40
6.2.4 Electronic Submission of Proposal Summary Information 41

7. Proposal Evaluation, Selection, and Implementation 42
7.1 Overview of the Proposal Evaluation and Selection Process 42
7.1.1 Evaluation Process 42
7.1.2 Categorization and Steering Process 43
7.1.3 Selection Process 44
7.2 Evaluation Criteria 44
7.2.1 Overview of Evaluation Criteria 44
7.2.2 Scientific Merit of the Proposed Investigation 46
7.2.3 Scientific Implementation Merit and Feasibility of the Investigation 47
7.2.4 Feasibility of the Instrument Investigation Implementation, Including Cost Risk 48
7.2.5 Scientific Implementation Merit and Feasibility of the Proposed Plans for Providing Independent Input to the SWG 49
7.2.6 Suitability of the Proposer for the Observatory Scientist Position 50
7.3 Selection Factors 50
7.4 Implementation of Selected Proposals 51
7.4.1 Notification of Selection 51
7.4.2 Award Administration and Funding 51
7.4.3 Contribution of Instrument Investigations to Mission Key Decision Points 52
7.5 Opportunity for Debriefing of Nonselected Proposers 52
7.6 Process for Appeals 52
7.6.1 Agency Procurement Ombudsman 52
7.6.2 Protests 53

8. Conclusion 53

ANNOUNCEMENT OF OPPORTUNITY
SOLAR PROBE PLUS INVESTIGATIONS
NNH10ZDA002O

APPENDICES

Appendix A: General Instructions and Provisions..... A-1

Appendix B: Requirements for Proposal Preparation.....B-1

Appendix C: Glossary of Terms and Abbreviations. C-1

Appendix D: Program Library D-1

Appendix E: Requirements for Subsequent Phases E-1

Appendix F: Compliance Checklist F-1

Appendix G: Requirements Crosswalk..... G-1

Appendix H: Certifications H-1

ANNOUNCEMENT OF OPPORTUNITY
SOLAR PROBE PLUS INVESTIGATIONS
NNH10ZDA002O

1. Description of Opportunity

1.1 Introduction

The National Aeronautics and Space Administration (NASA) issues this Announcement of Opportunity (AO) for the purpose of soliciting proposals for (i) instrument science investigations to fly on the Solar Probe Plus (SPP) mission and (ii) the SPP Observatory Scientist investigation. All SPP instrument science investigations proposed in response to this solicitation must support the goals and objectives of the SPP mission (Section 2.4), must be implemented by Principal Investigator (PI)-led investigation teams (Section 5.4.1), and must be implemented through the provision of complete instrument investigations (Section 5.2.1). Individual instruments or suites of instruments may be proposed. The SPP Observatory Scientist investigation must be implemented by a PI who will meet the requirements of the Observatory Scientist (Section 5.5).

Proposals to this AO will be selected through a single-step process for a Phase A study only, with options for Phase B and further development Phases leading to launch, operations, and science results. NASA reserves the right to make tentative selections pending the outcome of Phase A studies (see Appendix A, Section II). Investigations that are not approved to continue into Phase B, for whatever reason, will receive no further funding.

This AO presents the requirements and constraints that apply to proposals submitted in response to this AO for both SPP instrument science investigation proposals and for SPP Observatory Scientist investigation proposals. Appendix B contains additional requirements for the format and content of proposals. Appendix E lists some of the Program Library documents that specify requirements that will apply to selected instrument science investigations. Many of these documents provide requirements for investigations selected for implementation.

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.

2. AO Objectives

2.1 NASA Strategic Goals

The 2006 *NASA Strategic Plan* contains subgoal 3B, "understand the Sun and its effects on Earth and the solar system," and the *Science Plan for NASA's Science Mission Directorate (SMD) 2007-2016* (hereinafter referred to as the *Science Plan*) also contains this goal for NASA's Heliophysics program. The *Science Plan* expands this subgoal into three science and exploration objectives:

- Open the frontier to space environment prediction: understand the fundamental physical processes of the space environment from the Sun to Earth, to other planets, and beyond to the interstellar medium;
- Understand the nature of our home in space: understand how human society, technological systems, and the habitability of planets are affected by solar variability and planetary magnetic fields; and,
- Safeguard the journey of exploration: develop the capability to predict the extreme and dynamic conditions in space in order to maximize the safety and productivity of human and robotic explorers.

These objectives are expanded in the *Science Plan* into targeted outcomes that are shown in Table 1.

Table 1. Targeted outcomes as a function of science and exploration objectives from the *Science Plan for NASA's Science Mission Directorate 2007-2016*.

Science and Exploration Objectives	**Targeted Outcomes**
Open the frontier to space environment prediction	Measure magnetic reconnection at the Sun and Earth
	Determine the dominant processes and sites of particle acceleration
	Identify key processes that couple the Sun to Earth's atmosphere to the heliosphere and beyond
Understand the nature of our home in space	Understand how solar shocks and disturbances propagate to Earth
	Identify how space weather effects are produced in near-Earth space
	Discover how space plasmas and planetary atmospheres interact
	Identify modifications of Earth's atmosphere by solar variability
Safeguard the journey of exploration	Determine extremes of the variable radiation and space environments at Earth, Moon, and Mars
	Nowcast solar and space weather, forecast "All-Clear" periods for explorers near Earth

By analyzing the connections among the Sun, solar wind, planetary space environments, and the galaxy, heliophysics attempts to explain the fundamental physical processes that occur throughout the universe. Further information on NASA's strategic goals may be found in NASA Policy Directive (NPD) 1001.0, the *2006 NASA Strategic Plan*, and the *Science Plan* that are available in the Program Library (see Appendix D for the Program Library).

2.2 Living With a Star Program Goal and Objectives

The *Science Plan* describes the Living With a Star (LWS) Program as a program that emphasizes the science necessary to understand those aspects of the connected Sun and space environment that affect life and society. The ultimate goal is to provide a predictive capability to understand the system almost to the point of predictability, of space weather conditions at Earth as well as the interplanetary medium. The goal of the LWS Program, as defined in the *LWS Program Commitment Agreement* (*PCA)*, is to seek to understand how and why the Sun varies, how planetary systems respond, and how the variability and response affect human activities.

The LWS Program objectives in the *LWS PCA* are based upon these goals and are as follows:

1. Understand solar variability and its effects on the space and Earth environments with an ultimate goal of a reliable predictive capability of solar variability and response.
2. Obtain scientific knowledge relevant to mitigation or accommodation of undesirable effects of solar variability on humans and human technology on the ground and in space.
3. Understand how solar variability affects hardware performance and operations in space.

The *Science Plan* and the *LWS PCA* describe the SPP mission as having a major contribution to objectives 1 and 3 and a supporting contribution to objective 2. The heliophysics roadmap, *Heliophysics the Solar and Space Physics of a New Era: Recommended Roadmap for Science and Technology 2009-2030*, also describes the LWS program objectives. The *Science Plan*, *LWS PCA*, and heliophysics roadmap may be found in the Program Library.

2.3 SPP Mission Definition

SPP will be an extraordinary and historic mission, exploring what is arguably the last region of the solar system to be visited by a spacecraft, the Sun's outer atmosphere or corona. The SPP mission will explore this inner region of the heliosphere in great detail and through direct sampling of field and plasma observations to understand the physical processes that produces the solar wind, the very source of space weather.

At times of lower solar activity, the solar wind is bimodal, consisting of a dominant quasi-steady high-speed wind that originates in open-field polar coronal holes and a

variable, low-speed wind that originates around the equatorial streamer belt. As solar activity increases, this orderly bimodal configuration of the corona and the solar wind breaks down, the polar holes shrink, and streamers appear at higher and higher heliographic latitudes. At these times, the bimodal wind structure is replaced by a complex mixture of fast flows from smaller coronal holes and transients, embedded in a slow-to-moderate-speed wind from all latitudes. The energy that heats the corona and drives the wind derives from photospheric motions and is channeled, stored, and dissipated by the magnetic fields that emerge from the photosphere and structure the coronal plasma. Several fundamental plasma physical processes — waves and instabilities, magnetic reconnection, turbulence — operating on a vast range of spatial and temporal scales are believed to play a role in coronal heating and solar wind acceleration.

The SPP Observatory will travel closer to the Sun (9.5 R_S) than any other spacecraft and will repeatedly obtain direct in-situ coronal magnetic field and plasma observations in the region of the Sun that carries the solar wind and creates space weather. Its seven year prime mission lifetime will permit observations to be made over a significant portion of a solar cycle. Direct sampling of plasma observations that cannot be accomplished in any other way will allow heliophysicists to verify and discriminate between a broad range of theory and models that describe the Sun's coronal magnetic field and the heating and acceleration of the solar wind. SPP's journey to the Sun holds the promise of many more unanticipated discoveries — new mysteries to challenge humankind's ever-expanding knowledge of our home in the universe.

2.4 SPP Mission Goals and Objectives

The goal of the SPP mission is to determine the structure and dynamics of the Sun's coronal magnetic field and to understand how the corona is heated and accelerated to produce the solar wind. Several preconcepts for a SPP mission have been studied in the past several decades. Most recently, the National Research Council's (NRC) decadal survey in solar and space physics (*The Sun to the Earth -- and Beyond: A Decadal Research Strategy in Solar and Space Physics, NRC, 2003)* recommended implementation of a SPP mission "as soon as possible," and *Heliophysics the Solar and Space Physics of a New Era: Recommended Roadmap for Science and Technology 2009-2030* states that SPP "will provide critically needed data." Most recently, a SPP Science and Technology Definition Team (STDT) was convened to develop the goals and objectives for the SPP mission and to develop a mission preconcept that meets the science goals and objectives. The STDT found that the current mission design, with its repeated near-Sun passes, offers significant advantages in both technical implementation and science return compared to previous mission preconcepts. Its report, *Solar Probe Plus: Report of the Science and Technology Definition Team (2008)* can be found in the Program Library. Four science objectives flow from this goal and their associated science questions are shown in Table 2.

Table 2. SPP Science objectives and science questions based on the *Solar Probe Plus: Report of the Science and Technology Definition Team (2008)*

Science Objectives	Science Questions
Determine the structure and dynamics of the magnetic fields at the sources of the fast and slow solar wind	How does the magnetic field in the solar wind source regions connect to the photosphere and the heliosphere?
	How do the observed structures in the corona evolve into the solar wind?
	Is the source of the solar wind steady or intermittent?
Trace the flow of energy that heats the solar corona and accelerates the solar wind	How is energy from the lower solar atmosphere transferred to, and dissipated in, the corona?
	What coronal processes shape the nonequilibrium velocity distribution observed throughout the heliosphere?
	How do the processes in the corona affect the properties of the solar wind in the heliosphere?
Explore mechanisms that accelerate and transport energetic particles	What are the roles of shocks, reconnection, waves, and turbulence in the acceleration of energetic particle?
	What are the source populations and physical conditions necessary for energetic particle acceleration?
	How are energetic particles transported radially across magnetic field lines from the corona to the heliosphere?
Explore dusty plasma phenomena in the near-Sun environment and their influence on the solar wind and energetic particle formation	

2.5 SPP Mission Design

The subsections below present the results of the current mission implementation concept that is referred to in Section 2.4 and can achieve the scientific goals described in Section 2.4. The sections below include a description of the mission trajectory and a concept payload.

2.5.1 SPP Mission Outline

SPP targets an orbit nearly in the ecliptic plane at the start of the mission and then makes many near-Sun passes at increasingly lower perihelia. The baseline mission provides for 24 perihelion passes inside 0.16 AU (35 R_S), with 19 passes occurring within 20 R_S of the Sun. The first near-Sun pass begins three months after launch, at a heliocentric distance of 35 R_S. Over the next several years, successive Venus Gravity Assist (VGA) maneuvers gradually lower the perihelion to ~9.5 R_S, by far the closest that any spacecraft has ever come to the Sun. The SPP Observatory completes the first portion of its mission with three passes around the Sun at ~9.5 R_S, and each pass is separated by 88 days. With a launch occurring no later than 2018, the SPP prime mission will begin near the end of

solar cycle 24 and will end after the predicted maximum of cycle 25 in 2025. During these ~7 years of prime mission operations, the SPP Observatory will spend a total of 961 hours inside 20 R_S, 434 hours inside 15 R_S, and 30 hours inside 10 R_S, sampling the solar wind in all its modalities (slow, fast, variable, transient) as it evolves with rising solar activity toward an increasingly complex structure.

2.5.2 Candidate Instruments for the SPP Payload

Instrument science investigations and the associated flight hardware proposed for the SPP mission must address the scientific objectives given in Section 2.4.

A candidate reference set of measurements (from instrument science investigations), as described in the 2008 SPP STDT report, have been identified as being of highest priority.

Table 3. Candidate reference set of measurements and candidate reference instrument complement identified in the *Solar Probe Plus: Report of the Science and Technology Definition Team (2008)*

Investigation that Provides a Capability	**Reference Instrument**
Making magnetic field measurements	Magnetometer
Analyzing solar wind ions	Fast Ion Analyzer
Analyzing solar wind electrons	Fast Electron Analyzer
Observing plasma waves	Plasma Wave Instrument
Analyzing energetic particles	Energetic Particle Instrument
Analyzing ion composition	Ion Composition Analyzer
Observing the solar hemisphere	Hemispheric Imager
Measuring neutron/gamma-rays	Neutron/Gamma Ray Spectrometer
Analyzing coronal dust	Coronal Dust Detector

2.5.3 SPP Science Working Group

The SPP Science Working Group (SWG) will provide scientific input for the SPP mission. The SPP SWG will work with the LWS Program and SPP Project offices during the formulation and development phases to maximize the effectiveness of engineering trades and to ensure that the proposed science investigations remain feasible. The SPP SWG will contribute to the development of the Level I science requirements for the SPP project. The SPP SWG will be chaired by the SPP Project Scientist, and the membership will include the SPP Observatory Scientist, the PIs of the selected SPP instrument science investigations, and any other scientists that NASA may appoint.

2.6 Scope of this SPP Investigations AO

This SPP Investigations AO solicits proposals for (i) SPP instrument science investigations that are consistent with the SPP mission described in the 2008 SPP STDT report and (ii) a SPP Observatory Scientist investigation.

2.6.1 SPP Instrument Science Investigations

This AO solicits complete instrument science investigations. The term "complete" encompasses all appropriate mission phases (see Section 4.1) from project initiation (Phase A) through mission operations and deep data archiving (Phase F), this includes analysis and publication of data in the peer-reviewed scientific literature, delivery of the data to the community during the mission, and delivery of the data to an appropriate NASA data archive/closeout (Phase F). "Instrument science investigation" refers to investigations encompassing requirements described in Sections 5.1 through 5.4.

2.6.2 SPP Observatory Scientist Investigations

This AO solicits a SPP Observatory Scientist investigation. Subject to the receipt of proposals of adequate merit, it is envisioned that only one SPP Observatory Scientist investigation will be selected; the PI of the selected Observatory Scientist investigation is designated the SPP Observatory Scientist. The SPP Observatory Scientist will be responsible for performing a science investigation that will focus on the goals and objectives of the SPP mission and for providing independent input to the SPP SWG. "Observatory Scientist investigation" refers to an investigation encompassing requirements defined in Section 5.5.

2.6.3 Requirements Regarding the Scope of this AO

All proposals must satisfy these requirements.

A single proposal can be either for an instrument science investigation or an Observatory Scientist investigation. Proposals cannot address both an instrument science investigation and the Observatory Scientist investigation in a single proposal.

A SPP instrument science investigation may involve one or more instruments.

<u>Requirement 1.</u> Proposals submitted in response to this solicitation shall be for either an SPP instrument science investigation or for an SPP Observatory Scientist investigation.

In order to provide an independent assessment of the scientific performance of the SPP mission as formulated and developed, the PI of the selected Observatory Scientist investigation may not be a team member (*e.g.*, PI or Co-I) of any selected instrument science investigation.

<u>Requirement 2.</u> Proposals submitted in response to this solicitation shall be delivered no later than the Proposal Submittal Deadline given in Section 3. Proposals shall be delivered to the Address for Submittal of Proposals given in Section 6.2.3.

<u>Requirement 3.</u> Proposal submission shall be accompanied by electronic submission of proposal summary data no later than the Proposal Submittal Deadline following the instructions for submission of proposal summary data provided in Section 6.2.4.

3. Proposal Opportunity Period

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

AO Release Date.....December 3, 2009
Preproposal Conference.....See Section 6.1.1
Notice of Intent to Propose Deadline.....January 11, 2010
Proposal Submittal Deadline at 4:30 p.m. Eastern Time.....March 26, 2010
Selections announced (target).....Fall 2010

4. Policies Applicable to this AO

4.1 NASA Management Policies

The following policies impose requirements on the SPP mission, for which planning may need to be considered and described as part of the proposal process.

4.1.1 NASA Flight Program and Project Requirements

Proposals selected in response to this AO will be implemented in accordance with NASA mission management processes as defined by NASA Procedural Requirements (NPR) 7120.5D NID[1], *NASA Space Flight Program and Project Management Requirements*, NPR 7123.1, *NASA Systems Engineering Processes and Requirements*, and the *SPP Instrument Provider Mission Assurance Requirements (MAR)* document. The project management processes are Formulation, Approval, Implementation, and Evaluation. The processes are subdivided as follows:

Formulation is divided into:

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

Approval is the Confirmation process for transitioning into follow-on phase.

Implementation is divided into:

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

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

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

A Key Decision Point (KDP) occurs when the mission is approved to begin the next phase of a project; KDPs are defined in NPR 7120.5D. For instrument science investigations selected as a result of this AO, selected investigators will contribute to deliverables required for the SPP mission at each KDP. They are defined in NPR 7123.1, Chapter 5. The entrance and exit criteria for each milestone are defined in NPR 7123.1, Appendix G. An example of instrument investigation deliverables at KDPs is provided in NPR 7123.1, Section E.

4.1.2 NASA Project 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 instrument development; NASA will exercise essential oversight to ensure that the implementation is responsive to NASA requirements and constraints. NASA requirements and constraints are spelled out in NPR 7120.5D, the *Solar Probe Plus Project Instrument Provider Mission Assurance Requirements (MAR)*, and other NASA requirements documents available in the NASA Online Directives Information System (NODIS) (http://nodis.hq.nasa.gov/) and in the Program Library. To that end, the Associate Administrator for SMD has established a LWS Program Office at the NASA Goddard Space Flight Center (GSFC) to be responsible for project oversight. The LWS Program Manager at GSFC reports to the Heliophysics Division Director at NASA Headquarters. Additional details about the program office staffing, structure, and goals can be found in the *LWS Program Plan*, available in the Program Library.

NPR 7120.5D defines project management responsibilities. It contemplates that project management is assigned to a specific organization for implementation. The SPP project office at Johns Hopkins University/Applied Physics Laboratory (JHU/APL) will carry out the project management responsibilities defined in NPR 7120.5D. The LWS Program Office at GSFC will retain the Independent Technical Authority (ITA).

The *Solar Probe Plus Project Instrument Provider MAR* document, available through the Program Library, will apply to all selected instrument science investigations.

4.1.3 Mission Category and Payload Risk Classification

NPR 7120.5D, *NASA Space Flight Program and Project Management Requirements*, establishes guidelines for categorizing NASA missions based on the estimated total mission cost and mission priority level. The mission categorization guidelines are given in Section 2.1.5 and Table 2-1 of NPR 7120.5D.

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 requirements for each class are specified in Appendix B of NPR 8705.4.

The *SPP Formulation Authorization Document* (FAD) defines the SPP project, including all instruments as a Category 1 mission (per NPR 7120.5D) in risk class B (per NPR 8705.4).

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 objectives will be regarded as a descope of the investigation. NASA will review any such descoped set of achievable science objectives to ensure that the investigation remains at or above the Threshold Science Requirements (see Section 5.1.4 of this AO). A descope made necessary by an instrument's or the project's inability to remain within budget or schedule, or failure at any time during development and implementation to maintain a level of science return at or above the Threshold Science Requirements, can result in investigation cancellation accompanied by appropriate contract action, which may involve termination.

The proposal to this AO must include a commitment by the PI for the PI-Managed investigation cost, schedule, and scientific performance of the investigation. If, at any time, the cost, schedule, or scientific performance commitments made in the proposal appear to be in peril, the investigation will be subject to termination or cancellation.

Failure of the PI to maintain reasonable progress within committed schedule and cost, and/or failure to operate within other applicable constraints, may be cause for NASA to convene a termination review. NASA may call for a termination review any time an excursion above the agreed upon investigation cost in Phase A through Phase F 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, would better enable the 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 investigation cancellation and/or contract termination.

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., 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.

NASA contracts for the services of outside, non-Governmental organizations for support in evaluating proposals (see Section 7.1.1). 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.

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

4.2.2 Constraints on Investigations that are Candidates for Selection

Only those investigations that propose to meet cost, schedule, and spacecraft constraints identified in this AO and that demonstrate sufficient margins, reserves, and resiliency to ensure investigation success within committed cost and schedule, will be considered for selection.

4.2.3 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. This responsibility, however, will be exercised with essential NASA oversight to ensure that the implementation is responsive to the requirements and constraints of the SPP Project and LWS Program.

4.2.4 NASA Concurrence for Replacement of Key Management Team Members

Any replacement of key management team members (including, but not limited to, the PI and Project Manager) requires concurrence by NASA.

4.3 Cost Policies

4.3.1 PI-Managed Investigation Cost

PI-Managed Investigation Cost is defined as the funding that the SPP project will be expected to provide to the PI's implementation team 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 instrument.

Examples of costs to be included in the PI-Managed instrument science investigation cost, unless contributed, are: development activities (*e.g.*, instrument development, spacecraft accommodations, management, software, testing, ground support equipment); subcontracting costs, including fees; science Co-Is and all other personnel required to conduct the investigation, analysis of data and publication of results, and delivery of data in an acceptable format to an approved archive; insurance; any investigation-specific costs (including science operations); and all labor, including contractor and Civil Servant (NASA and non-NASA).

[Bold text changed through Amendment 2 on February 18, 2010]

There is no cost cap per instrument in this AO; however, the budget resources for all selections are limited to approximately **$180M RY for Phases A through D**. **Additional funding of approximately $70M RY is available for Phases E and F which includes a future solicitation for a Guest Investigator (GI) program.** The level of funding available for each selected proposal will be decided on a case-by-case basis and will be capped at that level. Since NASA must be able to select multiple SPP investigations within the available budget, proposers are encouraged to keep their budget requirements low.

4.3.2 Total Investigation Cost

Total Investigation Cost is defined as the PI-Managed investigation cost (see Section 4.3.1), plus any additional costs that are contributed or provided in any way other than through the SPP project (see Section 5.8.6). The total investigation cost will define the total value of the baseline investigation.

4.4 Data Policies

4.4.1 Data Analysis

The PI will be responsible for analysis of the investigation data necessary to complete the proposed science objectives and for timely publication of initial scientific results in refereed scientific journals, as part of their mission operations (Phase E) or postmission (Phase F) activities.

4.4.2 Data Rights

The LWS Program seeks to provide data to a broad community of users that will combine the different data sets from other LWS missions to obtain a better understanding of Sun-Earth interactions. The data will be treated as a public resource and will be made available for public access as soon as is practical. The expected life cycle of mission data is detailed in the *Heliophysics Science Data Management Policy* (see Program Library). The policies in the *Heliophysics Science Data Management Policy* will be applied to the SPP mission.

In accordance with the SMD requirement for open data and related software, starting after the initial check out and calibration period of approximately one month, research quality data and any specialized software required for its basic analysis will be made available by the investigators to the international community through a project-approved web site with no more than a two month delay from the time of its acquisition (in the case of data) or the completion and verification for its use (in the case of software). Once the calibrated data are made accessible, NASA intends to provide support for extended data analysis through an appropriate Guest Investigator (GI) program.

4.4.3 Delivery of Data to Archive

During Phases A and B, NASA and the PI teams working in the context of the SPP SWG will decide on uniform format(s) for data and standards for analysis software. They will

also decide on the location(s) of the data analysis and archiving center(s). Strong consideration will be given to the accessibility and usability of the data for users outside the SPP project.

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.

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, as given in the *Heliophysics Science Data Management Policy*. The data must include, at a minimum, the basic description of the data using the SPASE (Space Physics Archive Search and Extract) Data Model (referenced in the *Heliophysics Science Data Management Policy*). Description of the SPASE data model must provide adequate detail to assess the appropriate uses of and access routes to the data. Preparation of such descriptions will be of aid to the Heliophysics Virtual Observatories, which act as integrating data portals to the community.

All down linked data will be maintained in the SPP Mission Operations Center (MOC) data system for 30 days after receipt from the spacecraft in order to ensure that it is transmitted to, recovered, and processed by the instrument science investigation teams. The MOC will provide "after-the-fact" time-annotated spacecraft housekeeping data and ancillary data products for instrument science investigations including attitude, ephemeris, and time reference correlation data.

Each instrument Science Operations Center (SOC) will include a science data capability to ensure the availability of their data and metadata (calibrations, instrument and data descriptions, observation timelines, etc.) to the broader science community throughout the prime mission operations.

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

4.5 Project Management Policies

4.5.1 Independent Verification and Validation

The NASA Chief Safety and Mission Assurance Officer has the authority to select software projects to which Independent Verification and Validation (IV&V) is to be applied, as outlined in NPD 2820.1, *NASA Software Policy*. The selection of projects is based on prioritized recommendations from the Agency's IV&V Board of Directors. Proposal teams are encouraged to contact the Chief for Plans and Programs at the NASA IV&V Facility to gain a preliminary understanding of the potential level of safety and

mission critical software that their instruments will contain and the associated instrument system software risks. If the SPP project is selected to receive IV&V services, the costs for these services will be covered within the overall mission allocation and need not be included in the proposed PI-Managed investigation cost. Selected science instrument investigations will have to spend instrument investigation funds only to provide required data and information to the IV&V facility. The Chief for Plans and Programs at the NASA IV&V Facility is Christina Moats (Telephone: 304-367-8340; E-mail: christina.d.moats@nasa.gov).

4.5.2 Earned Value Management Plan

Instrument investigations that exceed dollar value thresholds defined in NPR 7120.5D, Appendix F, Section 3.1(c)(6), will be required to meet the EVM requirements specified for each threshold dollar value.

4.5.3 Cost Analysis Data Requirement

NASA has established a Cost Analysis Data Requirement (CADRe) in NPR 7120.5D, Section 4.5.2.c (3), that will apply to the SPP project and be flowed to the 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 investigation cost. Selected investigations will have to spend project funds only to collect existing documentation and transmit it to the CADRe support contractor at selected major milestones and then to review the completed CADRe for completeness and accuracy.

5. Requirements and Constraints

This section provides general requirements for proposals. Sections which apply only to instrument science investigation proposals (Sections 5.1, 5.2, 5.3, and 5.4) or Observatory Scientist investigation proposals (Section 5.5) are marked in the section title. If unmarked, then requirements apply to all proposals (Sections 5.6 through 5.10). Supplemental requirements on standard proposal content and format are provided in Appendix B.

5.1 Science Requirements for Instrument Science Investigations

5.1.1 Scope of Proposed Investigation

A goal is understood to describe a broad purpose of an investigation, while an objective is understood to describe a more narrowly focused part of a strategy to achieve a goal.

<u>Requirement 4.</u> Proposals shall describe a science investigation with goals and objectives that address the Solar Probe Plus mission science objectives described in Section 2.4.

5.1.2 Traceability of Proposed Investigation

Each instrument science investigation is intended to perform focused science investigations that conclude with papers published in peer-reviewed archival journals, as

well as deposition of appropriately reduced and calibrated data in designated data archives (see Section 4.4.3)

Requirement 5. Proposals shall clearly state the relationship between the science objectives, the data to be returned, and the instrument or instrument suite to be used in obtaining the required data (see Appendix B, Section D, for additional detail).

Requirement 6. Proposals shall include a plan to calibrate, analyze, publish, and archive the data returned, and proposals shall demonstrate, analytically or otherwise, that sufficient resources have been allocated to carry out that plan within the proposed investigation cost.

5.1.3 Investigation Science Objectives and Requirements

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

Requirement 7. Proposals shall state the specific science 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 will permit achievement of these objectives (see Appendix B, Section E, for additional detail).

Requirement 8. Proposals shall describe the proposed instrumentation including a discussion of each instrument and the rationale for its selection.

5.1.4 Baseline and Threshold Science

The Baseline Science Mission and the Threshold Science Mission are defined in NPR 7120.5D. These definitions as applied to instrument science investigations are defined as follows:

> The “Baseline Science Investigation” is the investigation that, if fully implemented, would achieve the full science objectives proposed for the investigation.
>
> The “Threshold Science Investigation” is the investigation that would accomplish the minimum subset of Baseline Science Investigation science objectives sufficient to justify the proposed cost of the investigation. The threshold science requirements set the science floor for the proposed investigation.

The differences between the Baseline Science Investigation and the Threshold Science Investigation provide resiliency to potential cost and schedule growth in the proposed development and implementation plan. A descope is any alteration of an investigation that renders it unable to accomplish one or more of the Baseline Science Investigation

science objectives, but allows accomplishment of all Threshold Science Investigation science objectives.

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

Requirement 9. Proposals shall specify only one Baseline Science Investigation and only one Threshold Science Investigation.

Requirement 10. Proposals shall not include any descopes or other risk mitigation actions that result in the investigation being unable to achieve the Threshold Science Investigation objectives.

5.2 Technical Requirements for Instrument Science Investigations

5.2.1 Complete Instrument Science Investigation

The term "complete" encompasses all appropriate mission phases (see Section 4.1.1) from project initiation (Phase A) through mission operations (Phase E), which must include analysis and publication of data in the peer reviewed scientific literature, delivery of the data to an appropriate NASA data archive, and closeout (Phase F). The term "Instrument Science Investigation" is defined as a science investigation including instruments proposed to fly as part of the science payload on the SPP mission.

Requirement 11. Proposals submitted in response to this AO shall be for complete instrument science investigations requiring flight on the SPP mission.

Requirement 12. Proposals shall describe the proposed instrument(s) and the rationale for each instrument.

Requirement 13. Proposals of multiple instruments (suites) shall describe the rationale for the suite of instruments.

Requirement 14. Proposals shall describe the proposed instrument operations concept assuming the baseline SPP mission design.

Requirement 15. Proposals shall describe the instrument or instruments accommodation requirements within the planned Concept Spacecraft bus described in Section 5.3.

Requirement 16. Proposals of multiple instruments shall provide science, technical, and cost information for each instrument sufficient to allow for separate evaluation and selection.

5.2.2 Accepted Management Processes and Practices

The documents NPR 7120.5D and NPR 7123.1 delineate activities, milestones, and products typically associated with formulation and implementation of projects; it should be used as a requirements document in defining an investigation team's management

approach. The implementing organizations are free to propose their own processes, procedures, and methods for managing their investigations; however, they must be consistent with the principles of NPR 7120.5D. Any deviations from NPR 7120.5D will require a waiver during formulation.

Requirement 17. Proposals shall describe the development approach for implementing the proposed investigation within schedule and cost constraints, including a project schedule consistent with the mission schedule provided in Section 5.3.1.

Requirement 18. 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).

5.2.3 New Technologies/Advanced Developments

This AO solicits instrument science investigations to fly on the SPP mission, not technology development projects. Proposed investigations are generally expected to have mature technologies, specifically all technologies at a Technology Readiness Level (TRL) of 6 or higher at the start of Phase C. (TRLs are defined in NPR 7120.8, *NASA Research and Technology Program and Project Management Requirements*, Appendix J). Proposals with a limited number of less mature technologies are permitted, as long as they contain a plan for maturing all technologies to the end of TRL 6 no later than KDP-C (Mission Confirmation) and adequate backup plans in the event that the technologies cannot be matured as planned.

Requirement 19. Proposals that use technologies currently at less than TRL 6 shall include a plan for technology maturation and a backup plan (see Appendix B, Section F, for additional detail).

5.2.4 Use of Radioactive Material

The proposed use of radioactive materials of any quantity and any isotope onboard the SPP mission, including radioisotope power sources, radioisotope heater units, or radioactive calibration sources for science instruments, is not permitted.

5.2.5 Deviations from Recommended Payload Requirements

SPP instrument science investigations selected are required to meet the requirements for safety, reliability, and mission assurance in the *Solar Probe Plus Project Instrument Provider Mission Assurance Requirements (MAR)* document (see Program Library).

Requirement 20. Proposals shall indicate any expected deviations from the recommended requirements in the *Solar Probe Plus Project Instrument Provider MAR* document and from the payload class specified in Section 4.1.3.

5.3 Mission Accommodation Requirements for Instrument Science Investigations

5.3.1 Schedule Requirements

The SPP mission will launch no later than 2018. In the planning schedule (which may be revised during Phase A), instruments will begin I&T with the spacecraft in August 2016. Proposals must plan to ensure on time delivery of the instruments. The planning schedule for the Solar Probe Plus mission is shown in Table 4 and should be the basis for the schedules proposed in the investigations.

Table 4. Schedule for Solar Probe Plus Mission

Start Phase A (KDP-A)	December 2009
Start Phase B (KDP-B)	**July 2011**
Preliminary Design Review/ Nonadvocacy Review	January 2014
Start Phase C (KDP-C / Confirmation)	July 2014
Critical Design Review	November 2015
Flight Instrument delivery	August 2016
Observatory Integration and Test	August 2016
Launch	August 2018
Start Phase E (KDP-E)	September 2018
Start Phase F (KDP-F)	September 2025
End Phase F	**September 2026**

[Bold text changed through Amendment 1 on January 12, 2010]

<u>Requirement 21.</u> Proposals shall propose an instrument delivery date that meets the schedule in Table 4 and supports all milestones.

5.3.2 Instrument Accommodations in Concept Spacecraft

A preliminary engineering evaluation has been performed to determine the physical resources available to the SPP science payload. The document *Solar Probe Plus Mission Engineering Study Report, March 2008*, can be found in the Program Library. Table 5 provides a guideline of instrument resource availability consistent with the concept spacecraft capabilities. Proposals will be evaluated in the context of the maximum payload resources available as shown in Table 5.

Table 5. Payload Resources

	Mass (kg) with contingency	Science Ops Power (W)	Peak Data Rate (kbps)
Maximum Payload Resources *	40.0	43.2	123.2

* Does not include Data Processing Unit (DPU) which is accounted for in the spacecraft resource allocations.

Proposals must separately and clearly identify (1) estimated allocation for each instrument resource, including the basis of the estimate, and (2) adequate contingency for each resource along with a rationale based on requirements uncertainty, design maturity, flight heritage, and risk. Investigators are responsible for the design, qualification, and

delivery of any components required by their instruments, including, but not limited to, elements such as radiation shielding, support booms, armatures, intra-instrument harnessing, thermal blankets, covers, or operational heaters. However, the spacecraft provider will provide the science boom for the magnetometer and plasma-wave search coils, and the data processing unit (DPU). The characteristics of payload-provided structures will be coordinated between the spacecraft vendor and investigator. Proposed instruments and resource requirements will be reviewed for compatibility with the spacecraft and launch vehicle interfaces during Phase A studies. Ultimately, interfaces and resource allocations will be documented in Interface Control Documents (ICDs) between the instruments and the spacecraft. Volume will be constrained to the volume under the heat shield.

Requirement 22. Proposals shall identify estimated allocation for each instrument resource, including the basis of the estimate for each proposed instrument.

Requirement 23. Proposals shall identify adequate contingency for each resource along with a rationale based on requirements uncertainty, design maturity, flight heritage, and risk for each proposed instrument.

It should also be noted that the SPP orbit presents significant environmental hazards for the spacecraft and payload. Proposals must provide analysis and a concept for sensors and electronic components, including margins, which demonstrates instrument compatibility and robustness with respect to the mission environment. At a minimum, instruments must be designed to preclude permanent damage and mitigate operational outages due to single event effects (SEE) and single event upsets (SEU) related to high-energy particles and due to internal and deep dielectric charging. Payload providers will be required to verify through design analysis that sensors and electronic components will not incur permanent damage or create discharge hazards that could impact the spacecraft or payload health as a result of instrument component internal charging phenomena.

Requirement 24. Proposals must provide analysis and a concept for sensors and electronic components, including margins, which demonstrates instrument compatibility and robustness with respect to the mission environment.

The spacecraft and instrument interfaces and performance envelopes indicated in this AO are preliminary and should be expected to evolve after the science investigations are selected, the instruments and spacecraft are further defined, and design trade-offs are made. Therefore, successful proposers should expect to revise their designs, as needed, to meet different spacecraft and mission requirements and specifications. Any significant update to the mission specifications in this AO will be posted as amendments or clarifications at the Web location where this AO is posted. For evaluation purposes, proposals will be judged against the amended interface and performance specifications provided at the above Web site.

Proposals may reflect changes to the concept payload, concept spacecraft interfaces, or other spacecraft characteristics, as necessary, in order to achieve their proposed science

goals. However, any changes to the nominal payload resources or concept spacecraft characteristics needed by a proposed payload must be clearly indicated and justified in the proposal.

Requirement 25. Proposals shall indicate and justify any changes to the nominal payload resources or concept spacecraft characteristics.

Requirement 26. Proposals shall describe any deployed structures or components required by their instruments.

Requirement 27. Proposals shall describe the thermal control design and the associated thermal control hardware for all their proposed instrument components.

Requirement 28. Proposals shall identify any special thermal interface requirements.

5.3.3 Description of NASA-Provided Spacecraft

The SPP spacecraft is three-axis-stabilized (see Figure 1). Its most prominent feature is the Thermal Protection System (TPS), a large flat ceramic-coated carbon–carbon (C-C) shield that is 2.7 m in diameter, with associated structure used to attach the shield to the spacecraft. The TPS protects the bus and payload within its umbra during solar encounters. The instruments are mounted either directly to the bus, on a stand-off bracket near the fairing attachment, or on a science boom extended from the rear of the spacecraft. The science boom also carries a Solar Horizon Sensor (SHS) for backup attitude safing during the solar encounters. Three deployable C-C plasma-wave antennas are mounted 120 degrees apart on the side of the bus. These antennas will partially protrude beyond the umbra during solar encounters. The hexagonal bus carries the spacecraft subsystems and provides an efficient mechanical structure to handle launch loads and integrate with the launch vehicle.

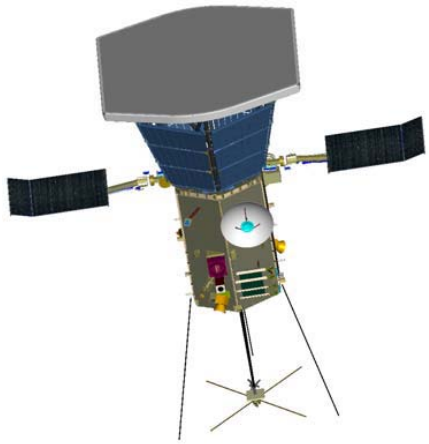


Figure 1. SPP Spacecraft Concept.

Requirement 29. Proposal shall describe the volume, placement, and field of view of all proposed instruments.

The spacecraft will provide a dedicated, redundant DPU for the instruments. The DPU provides the primary command and data handling interface between the spacecraft and payload, some internal data processing resources, and distribution of regulated low-voltage power to instruments.

Interfaces to instruments are expected to be RS-422 serial links, however, higher speed serial data links (low voltage differential signaling (LVDS), typically) can be accommodated, if required. The mass and power required for the DPU will be carried on the spacecraft side of the interface.

Requirement 30. The proposal shall describe any instrument-unique interfaces or capabilities required of the DPU. If common DPU capabilities are specified for a group of instruments, the proposal must provide data sufficient to allow for a separate cost and technical evaluation of the proposed capabilities for each instrument in that group.

Requirement 31. Proposals must include any required electronics on the instrument side of the interface. A proposal to provide electronics for a group of instruments must provide sufficient data to allow a separate cost and technical evaluation of the proposed electronics for each instrument in that group.

Power is provided by two separate solar array systems. The primary solar arrays will be used outside 0.25 AU. Inside 0.25 AU, the primary arrays will be folded inside the TPS umbra, and the spacecraft will be powered by the secondary solar arrays. At the start of a solar encounter, at 0.25 AU, the secondary panels will be fully extended outside the TPS; as the spacecraft approaches the Sun, they will be partially retracted behind the TPS to maintain constant temperature and power output. A lithium-ion battery is included as a secondary power source to handle transient loads and to power the spacecraft during launch and ascent until the primary solar arrays are deployed.

The guidance and control subsystem is redundant and includes the capability to command the 0.9 Newton attitude control thrusters throughout the mission to ensure that the TPS remains facing the Sun and shielding the instruments. The primary spacecraft propulsion subsystem is a blow-down monopropellant hydrazine subsystem.

The telecommunications subsystem consists of a high-gain antenna (HGA), which is the primary antenna for Ka-band science data downlink, and two low-gain antennas (LGAs). The HGA is gimbaled and mounted on an arm that extends it beyond the umbra for Earth-pointing. Within 0.59 AU, the HGA is stowed within the TPS umbra. The X-band communication through the LGAs is provided as backup for periods when Ka-band communication is not available. Science data collected during the solar encounters will be stored on the redundant solid state recorders (SSRs) for subsequent downlink via the HGA once the spacecraft is farther from the Sun than 0.59 AU. To avoid thermal damage to the HGA, no real-time science data downlink is planned inside 0.25 AU.

Investigators are responsible for the design, qualification, and delivery of any components required by their instruments, including, but not limited to, elements such as radiation shielding, support booms, armatures, intra-instrument harnessing, thermal blankets, covers, or operational heaters. An exception is that the spacecraft provider will provide the science boom for the magnetometer and plasma-wave search coils. The design of instruments that require structures or components extending beyond the umbra shall be tightly controlled by the spacecraft to prevent excess heat loads into the bus. The characteristics of these structures will be coordinated between the SPP project office at JHU/APL and the Investigation Team. Proposed instruments and resource requirements will be reviewed for compatibility with the spacecraft and launch vehicle interfaces during Phase A. Ultimately, interfaces and resource allocations will be documented in Interface Control Documents (ICDs) between the instruments and the spacecraft.

Requirement 32. Proposals shall identify the requirements for instrument's alignment accuracy knowledge relative to the spacecraft coordinate system.

The spacecraft and instruments will select materials and processes that conform to NASA Reference Publication 1124, "*Outgassing Data for Selecting Spacecraft Materials,"* as a guide for materials selection (available through Program Library). Instruments must be designed to be compatible with hydrazine and hydrazine propellant byproducts.

Instrument providers must specify cleanliness requirements and state the measures needed to achieve their requirements during integration and testing (I&T), launch site processing, and on-orbit operations. I&T is expected to take place in a Class 100,000 clean-room environment.

Requirement 33. Proposals shall specify cleanliness requirements and state the measures to achieve their requirements during I&T, launch site processing, and on-orbit operations. This shall include any requirements related to sensitivity to hydrazine and hydrazine propellant byproducts.

Requirement 34. Proposals shall describe any required doors and door mechanisms needed to minimize contamination onto sensitive surfaces. Proposals shall describe necessary prelaunch (T-0) purge connection and purge flow rates.

The spacecraft design and externally exposed instrument components shall minimize electrostatic disturbances in the vicinity of the spacecraft. Most external surfaces must be electrically conducting and grounded to the spacecraft single-point ground (negative ground). The bias voltage of any external conducting surface shall not exceed 10 V to enable the measurement of electric and magnetic fields near the Sun. Instrument doors or other hinged or shafted devices must provide a DC resistance to the spacecraft structure of less than 2.5 milliohms.

Requirement 35. Proposals shall describe instrument-specific electrostatic accommodation requirements.

Solar Probe Plus is intended to measure electrical and magnetic fields near the Sun. The spacecraft systems will be required to meet electromagnetic compatibility (EMC), electromagnetic interference (EMI), and magnetic cleanliness requirements like those in other missions with similar instruments such as STEREO and Radiation Belt Storm Probes (RBSP). The baseline concept includes EMI/EMC and magnetic cleanliness mitigations that are anticipated to be used, and EMI/EMC testing and verification activities will be included in the project cost and schedule.

Requirement 36. Proposals shall describe instrument-specific EMI/EMC and magnetic cleanliness requirements.

Final requirements will be established during Phase A.

5.3.4 Science Operations

Instrument science investigations must have science operation capability. The Science Operations Center (SOC) included in each instrument proposal must transmit data from/to the Mission Operations Center (MOC), plan scientific observations, generate instrument command timelines, and perform science data analyses. The SOC must also be solely responsible for the health and safety of the instrument. Investigation Teams will provide training materials for the flight operations team and all required personnel on the hardware and software for instrument science operations. Proposers are reminded to include the cost of instrument health and safety oversight during the mission operations phase in their proposals. Details of the SPP science operations will be defined by the selected science teams. The investigation team must plan the schedule and staffing of the SOC according to the instrument needs during the SPP mission timeline.

Each investigator should provide 1 year of data analysis beyond prime mission operations at a funding level equal to a year of data analysis during the prime mission to complete the data analysis and the deep data archiving.

Requirement 37. Proposals shall describe a science operations capability that includes a SOC and plan the schedule and staffing of the SOC according to the instrument needs during the Mission Timeline as described in the Section 5.3.5.

5.3.5 Mission Timeline

5.3.5.1 Launch

The baseline mission design calls for SPP to be launched no later than 2018. Candidate launch vehicle and upper stage are described in Section 3.1.7 of the *SPP Mission Engineering Study Report* (available in the Program Library). The *SPP trajectory file* is also in the SPP Program library.

During launch, the instruments are expected to be in power-off state.

5.3.5.2 Baseline Mission Trajectory

The baseline trajectory uses seven Venus flybys and no deep-space maneuvers to reach a minimum perihelion of 9.5 R_S in 6.4 years, as shown in Figure 3.1-1 of the *SPP Mission Engineering Study Report* (available in the Program Library). From launch to the end of mission, the baseline trajectory consists of 24 solar orbits whose perihelia gradually decrease, from 35 R_S down to 9.5 R_S. The baseline mission will end after three orbits at the minimum perihelion of 9.5 R_S.

During cruise, instrument teams are expected to plan for checkouts and calibrations to ensure that the hardware and software will perform as expected after arrival. SPP will also collect and telemeter science data during the cruise phase of the mission. As a part of normal operations, and to maintain proper navigation, weekly 8-hour contacts will be conducted. During this time, a reasonable portion of the available bandwidth will be dedicated to additional science telemetry. The amount of available science data sent to the ground per week varies from 22 Megabits near aphelion to 1.2 Gigabits when the spacecraft is able to operate at its maximum data rate of 45 kilobits per second.

5.3.5.3 Solar Encounters

Figure 3.1-4 of the *SPP Mission Engineering Study Report* (available in the Program Library) shows a solar encounter trajectory with perihelion at 9.5 R_S. The time duration within 20 R_S is 57 hours.

The perihelion velocity with respect to the Sun will approach 200 km/s. Trajectories of other perihelion orbits are similar, with a greater distance and a slower speed.

Instruments will be powered on, configured, checked out, and calibrated prior to the collection of science data; nominally this will occur after launch and during commissioning. Initial observations will be made by all instruments to verify observing modes, data quality, and processing performance.

5.3.5.4 Mission Schedule Requirements

<u>Requirement 38.</u> Proposals shall describe the instrument status and unique needs during all phases of the Mission Timeline.

5.4 Management Requirements for Instrument Science Investigations

5.4.1 Principal Investigator

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

Regardless of the number of instruments proposed, instrument science investigations must be led by a single PI who is responsible for managing the selected investigation and interfacing with the Project Office.

The PI must be prepared to recommend instrument(s) termination when, in her/his judgment, the minimum subset of science objectives identified in the proposal as the Threshold Science Investigation (Section 5.1.4) is not likely to be achieved within the committed cost and schedule.

Requirement 39. Proposals shall designate one, and only one, PI as the individual in charge of the proposed investigation.

5.4.2 Instrument Project Manager

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

Requirement 40. Proposals shall identify a single Instrument Project Manager (IPM) as the individual charged with the responsibility for overseeing the technical and programmatic implementation of the proposed investigation.

Requirement 41. Proposals shall clearly define the respective roles of the PI and IPM.

5.4.3 Management and Organization Experience and Expertise

The qualifications and experience of the PI, IPM, Instrument Scientist (IS), Instrument Systems Engineer (ISE), 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 IPM 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, and past performance of the PI and of the implementing institutions will be assessed against the needs of the investigation.

Requirement 42. Proposals shall identify the management positions that will be filled by key management team members. These positions shall include, as a minimum, the PI, IPM, ISE, and, where appropriate, the IS and partner leads. For management positions for which key management team members are named (including the PI and IPM per Requirement 39 and Requirement 40), proposals shall describe the qualifications and experience of those team members who occupy those positions. For 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.

Requirement 43. 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.

5.4.4 Risk Management

Proposers must demonstrate clear understanding of specific risks inherent in the development 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, or any nontrivial modifications or upgrades of existing technologies proposed for the investigation; 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 44. Proposals shall define and discuss the major risks to the development and implementation of the proposed investigation.

Requirement 45. 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 Science Requirements and the Threshold Science Requirements (see Section 5.1.4) may provide some resiliency to potential cost and/or schedule growth in the proposed development and implementation of the investigation. One method of responding to such growth is to descope the investigation. A descope is any alteration of an investigation that renders it unable to accomplish one or more of the Baseline Science objectives. Any set of descopes, which still allows the investigation to satisfy the Threshold Science Requirements, may be proposed.

Requirement 46. If the proposed risk management approach includes potential descoping of instrument capabilities, the proposal shall include a discussion of the approach to such descopes, including savings of resources (mass, power, dollars, schedule, etc.) by implementing descopes, and the decision milestone(s) for implementing descopes.

Proposals that include international participation must address the risk resulting from any international contributions to the proposed mission (see Section 5.8.6, 5.9).

5.4.5 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). Additional instructions may be found in Procurement Information Circular (PIC) 05-15 at http://www.hq.nasa.gov/office/procurement/regs/pic.html.

Requirement 47. 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 detail).

This requirement applies to all proposals submitted by NASA Centers, including instrument science investigation proposals and Observatory Scientist investigation proposals.

5.5 Requirements for the Observatory Scientist Investigation

The SPP Observatory Scientist will carry out a science investigation that will focus on the goals and objectives of the SPP mission. The Observatory Scientist will serve on the SPP SWG and provide independent input (independent from the instrument PIs) to the SWG.

The Observatory Scientist will provide independent input to the SWG and the SPP project and contribute to the following tasks: (i) work with the SPP project during formulation and development of the SPP observatory in order to optimize the SPP science program within programmatic constraints; (ii) provide an independent assessment of the scientific performance of the SPP mission as formulated and developed; (iii) understand the SPP end-to-end system engineering effort and assist with key decisions and trades during the formulation and development of the SPP observatory in order to support the SPP SWG and the SPP project in optimizing the science productivity of the SPP mission; (iv) act as a community advocate for the SPP mission science goals and objectives, and (v) serve as a scientific advisor to the LWS Program, and the SPP project. The Observatory Scientist is expected to be a part time effort.

Requirement 48. Proposals for SPP Observatory Scientist investigation shall describe a science investigation with goals and objectives that address the Solar Probe Plus mission science goals and objectives described in Section 2.4.

Requirement 49. Proposals for the SPP Observatory Scientist investigation shall describe the strategy for carrying out the tasks specified in Section 5.5 including optimizing the science program within programmatic constraints, assessing the scientific performance of the mission, assisting in making key decisions and trades during formulation and development, and advocating for the mission science goals. Proposals shall describe other contributions that can be made to the SPP mission by providing independent input to the SPP SWG and SPP project and shall describe the strategy for carrying out those contributions.

Requirement 50. Proposals for SPP Observatory Scientist investigation shall include the following:

i. Description of the experience and expertise of the PI in the area of solar and heliospheric research, including a relevant publication record and any relevant activity in the heliophysics field.
ii. Description of the PI's leadership qualities, including a description of the ability, competence, commitment, and performance of the PI in leading similar efforts. Some examples of desirable attributes that may document leadership qualities include previous successful experience in a leadership role for space-based investigations, position of PI or Co-I of a heliophysics investigation, and chairpersonship of science committees, working groups, or mission definition teams.

iii. Description of the PI's organizational abilities with examples of prior organizational responsibilities, especially as they may lead to confidence in the PI's probability of success in executing the tasks assigned to the Observatory Scientist.

In order to provide independent input to the SPP SWG and project and to provide an independent assessment of the scientific performance of the SPP mission as designed and developed, the PI of the selected Observatory Scientist investigation may not be a team member (*e.g.*, PI or Co-I) of any selected instrument science investigation. If NASA selects an Observatory Scientist who is proposed as a team member for a selected instrument science investigation, NASA will not select that individual as a PI or Co-I of the instrument science investigation (see Appendix A, Section II, for authority to make partial selections).

Requirement 51. Proposals for SPP Observatory Scientist investigation, where the PI is proposed as a team member of an instrument science investigation, shall clearly state that the PI will forgo the opportunity to be a team member on the instrument science investigation in order to serve as SPP Observatory Scientist.

Note that Requirement 47 applies to all proposals submitted by NASA Centers, including instrument science investigation proposals and Observatory Scientist investigation proposals.

5.6 Science Team, Co-Investigators, and Collaborators Requirements

5.6.1 Science Team

Requirement 52. Proposals shall clearly define the science team necessary to successfully conduct the science investigation.

5.6.2 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 instrument science 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 53. 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 54. Proposals shall identify the funding source for each Co-I. If funded by NASA, costs shall be included in the PI-Managed instrument science investigation cost. If contributed, the costs shall be included in the Total Instrument Investigation Cost.

5.6.3 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-Investigator or another category of team member.

Requirement 55. Proposals shall identify and designate all collaborators.

5.7 Small Business Participation and Education and Public Outreach

5.7.1 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, which offer subcontracting possibilities exceeding $500,000 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), HUB Zone (HBZ) small business, women-owned small business (WOSB), Historically Black College and University (HBCU), and Other Minority Institution (OMI) entities to the maximum practicable extent.

Requirement 56. Proposals shall include a small business subcontracting plan (see Appendix B, Section I.1 for additional detail).

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 will 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.

5.7.2 Education and Public Outreach

Among NASA's strategic goals are 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 SPP mission will have a robust and exciting core Education and Public Outreach (E/PO) program. However, E/PO plans are not a consideration in the selection of proposals to this AO. Therefore, E/PO plans are not needed at this time for either instrument science investigators or Observatory Scientist investigators. Detailed plans for E/PO programs are neither required nor permitted in proposals. At a later date, NASA will define the SPP core E/PO program and solicit participation in an appropriate manner.

Requirement 57. Proposals shall not designate an E/PO lead and proposals shall not include a plan for a core E/PO program.

5.8 Cost Requirements

5.8.1 Investigation Cost Definitions and Constraints

[Bold text changed through Amendment 2 on February 18, 2010]

The AO does not establish a cap on the PI-Managed Investigation Cost that may be proposed. The total cost to NASA of all investigations selected through this AO for all phases is constrained to approximately **$180M RY dollars for Phases A through D. Additional funding of approximately $70M RY is available for Phases E and F which includes a future solicitation for a Guest Investigator (GI) program.**

Investigations selected under this AO will have their PI-Managed Investigation Cost capped at the cost proposed in response to this AO.

Requirement 58. Proposals shall include the proposed PI-Managed Investigation Cost and the proposed Total Investigation Cost in all required AO cost tables (see Appendix B, Section H, for required AO cost tables).

Requirement 59. No more than 25% of the proposed costs may be spent prior to the SPP mission KDP-C (Mission Confirmation).

5.8.2 Cost Estimating Methodologies and Cost Reserve Management

Proposals may use estimates derived from models or cost estimating relationships from analogous missions (see Appendix B, Section H, for additional detail).

Requirement 60. Proposals shall identify the methodologies (cost models, cost estimating relationships of analogous missions, etc.) and rationale used to develop the proposed cost.

Requirement 61. 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 unencumbered cost reserves on the PI-Managed Investigation Cost is measured as a percentage against the cost to complete through Phases A/B/C/D. The numerator is the amount of unencumbered cost reserves, not including funded schedule reserve. The denominator is the PI-Managed investigation cost to complete Phases A-D, including the cost of technical design margin, including funded schedule reserve, not including cost reserve.

Adequate unencumbered cost reserves are a minimum of 25%. 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 Mission Confirmation), and KDP-D (at the end of Phase C), and KDP-E (at the start of Phase E, generally 30 to 90 days after launch).

Requirement 62. Proposals shall justify the adequacy of the proposed cost reserves, given that the proposed cost is not allowed to increase beyond the cost proposed at any time. Proposals shall comply with the requirement for unencumbered cost reserves against the cost to complete and shall demonstrate an approach to maintaining required unencumbered cost reserves through subsequent development phases and operations phases.

5.8.3 Work Breakdown Structure

Requirement 63. Proposals shall provide a Work Breakdown Structure (WBS) that conforms to the standard prescribed in Appendix G of NPR 7120.5D. Costs for most elements shall be specified to WBS Level-2. Exceptions are the costs of elements which 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 detail). The WBS must provide adequate insight into each individual instrument.

5.8.4 Master Equipment List

Requirement 64. Proposals shall include a Master Equipment List (MEL) summarizing individual instrument element components to support validation of proposed mass estimates, design heritage, and cost (see Appendix B, Section J.7, for additional detail).

5.8.5 Full Cost Accounting for NASA Facilities and Personnel

Proposal budgets from NASA Centers, whether as the proposing organization or as a supporting organization, are to include, within the PI-Managed Investigation Cost, all costs that will be paid out of the resulting award. NASA Civil Service direct labor, travel, and other direct costs are to be included within the PI-Managed Investigation Cost, consistent with current Agency full cost practice. Demand service pools are to be included within the proposed PI-Managed Investigation Cost.

For the purpose of calculating the full cost of NASA provided services for proposals submitted in response to this AO, the CM&O burden should be applied only to NASA

provided labor, including Center civil servants and on-site contractors; this cost must be included in the PI-Managed Investigation Cost.

Other costs which are not paid with LWS Program funds such as Corporate General and Administrative (G&A) estimates, the CM&O burden on off-site contracts (pass-through dollars) and other cost elements, and allocated service pools should not be included within the cost proposal nor within the PI-Managed Investigation Cost.

Requirement 65. Proposals including costs for NASA Centers shall conform to the full cost policy stated in Section 5.8.5. Each of the elements of the NASA Center costs (direct labor, travel, other direct costs, demand service pools) shall be separately identified.

Any NASA funded item(s) or services considered as contributed costs must be separately funded by a non-SMD effort complementary to the proposed investigation.

Requirement 66. If any NASA funded item(s) or services are considered as contributed costs, the proposal shall identify the funding source(s).

Any non-NASA Federal Government elements of proposals must follow the appropriate agency accounting standards for full cost. If no standards are in effect, the proposers must follow the *Managerial Cost Accounting Concepts and Standards for the Federal Government* as recommended by the Federal Accounting Standards Advisory Board and available in the Program Library.

Requirement 67. Proposals including costs for non-NASA Federal Government agencies shall follow the applicable accounting standards.

5.8.6 Contributions

Contributions from sources other than the LWS Program and other SMD programs, U.S. or non-U.S., are welcome. These may include, but are not limited to, labor, services, and/or contributions to the instrument complement or the spacecraft, subject to the following exceptions and limitations: (i) contributions of non-U.S. nuclear power sources are prohibited. Such contributions will not be counted against the PI-Managed Investigation Cost, but they must be included in the calculation and discussion of the Total Investigation Cost (Section 4.3.2).

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).

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 68. If a proposal includes one or more contributions, the proposal shall identify all contributions, the organizations providing the contributions, and the organizations providing the funding for the contributions; the costs for the contributions shall be clearly identified within the Total Instrument Investigation Cost.

Requirement 69. 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.

Letters of Commitment are required from each organization responsible for a contribution (for U.S. organizations, see Section 5.10.1.1 and Requirement 78; for non-U.S. contributing organizations, see Section 5.9.2 and Requirement 72).

The requirement for institutional Letters of Commitment for contributions does apply to contributed support for Co-Investigators; institutional Letters of Commitment are required with the proposal for contributed Co-Investigator support. The requirement for personal statements of commitment from contributed Co-investigators is given in Section 5.10.1.1 and Requirement 78.

A contributed item that is essential for the success of the proposed investigation and/or is in the critical path of investigation 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 (see Appendix B, Section H, for additional detail).

Requirement 70. 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 coping with potential failures of proposed cooperative arrangements.

5.9 Non-U.S. Participation Requirements

5.9.1 Overview of Non-U.S. Participation

NASA solicits research proposals from both U.S. and non-U.S. sources (see NFS 1835.016-70).

NASA's policies for international cooperation in space research projects may be found in NPD 1360.2A, *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, are expected to arrange for non-U.S. financing for their portion of the research.

5.9.2 General Guidelines Applicable to Non-U.S. Proposals and Proposals including Non-U.S. Participation

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

Requirement 71. 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.

Requirement 72. 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 5.10.1.1. 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 must sign these Letters of Commitment.

Contributions from non-U.S. sources offer benefits, but also represent complexity and risk to a project.

Requirement 73. 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.

Mitigation may include, but is not limited to, descoping the contributed items and/or holding reserves to develop the contribution directly. Note that reserves held for this purpose will be considered by NASA to be encumbered. When no mitigation is possible, this must be explicitly acknowledged. In addition to budget and technical risk, non-U.S. contributions introduce schedule risk for implementing 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 selection.

Any proposed non-U.S. participation must be described at the same level of detail as that of U.S. partners, including the provision of technical, schedule, and management data. 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 74. 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 75. Proposals with non-U.S. participation shall include a table listing: (i) non-U.S. participants (individuals, institutions), (ii) roles and responsibilities, (iii) funding organization, (iv) approximate value of contribution and method for estimating value, and (v) cross-reference to any Letters of Commitment in the proposal appendix. Proposals with non-U.S. participation must clearly describe the flow of design requirements (potentially controlled information) and hardware between U.S. and non-U.S. participants. This description may take the form of a flowchart. See Section J.4 of Appendix B.

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

It is the policy of NASA to establish formal agreements with non-U.S. partners in cooperation on flight missions. It is usually not possible for NASA to conclude an international agreement prior to the Preliminary Non-Advocate Review (PNAR). Additionally, in some cases, interim agreements may be put in place until a more permanent arrangement is reached.

Requirement 76. If applicable, proposals shall show how Phase A can be completed in the absence of an international agreement.

5.9.4 Export Control Guidelines Applicable to Non-U.S. Proposals and Proposals including Non-U.S. Participation

Requirement 77. Non-U.S. proposals and domestic 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 detail).

5.10 Additional Proposal Requirements

5.10.1 Letters of Commitment

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

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 resource 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).

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.

5.10.1.1 Letters of Commitment for Contributions

An institutional Letter of Commitment for a contribution must contain the required elements described in Section 5.10.1.

Requirement 78. 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.

The requirement for Letters of Commitment from non-U.S. organizations offering contributions is given in Section 5.9.2 and Requirement 72.

5.10.1.2 Letters of Commitment for Major Partners

Major partners are the organizations, other than the proposing organization, responsible for providing science leadership, project management, system engineering, major hardware elements, science instruments, integration and test, 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 detail).

An institutional Letter of Commitment for a major partner must contain the required elements described in Section 5.10.1.

Requirement 79. 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.

5.10.1.3 Personal Letters of Commitment

No personal Letter of Commitment is required for Co-investigators or other proposal team members in the proposal. A proposal team member is defined to be any individual 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 (see Appendix B, Section A.3, for instructions).

Requirement 80. 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.

5.10.2 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.

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. citizens, who are not lawful permanent residents of the U.S., to review proposals submitted in response to this AO. In order to enable proper evaluation of proposals, any export-controlled information subject to ITAR must be marked with a notice to that effect.

Requirement 81. 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."

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

6. Proposal Submission Information

6.1 Preproposal Activities

6.1.1 Preproposal Conference

A Preproposal Conference will be held in the Washington, DC, area prior to the NOI due date stated in Section 3. Further information, including date, location, and logistics, will be available at the SPP Acquisition Homepage (see Section 6.1.4) prior to the Preproposal Conference.

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

The purpose of this conference will be to address questions about the proposal process for this AO. Questions should be sent to the SPP Program Scientist at the address given in Section 6.1.5. 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 SPP Acquisition Homepage listed in Section 6.1.4 approximately two weeks after this event. Additional questions and answers subsequent to the conference will also appear in this location, if necessary. Questions may be submitted until 14 days before the proposal due date given in Section 3.

6.1.2 Notice of Intent to Propose

To assist the planning of the proposal evaluation process, NASA strongly encourages all prospective proposers to submit a Notice of Intent (NOI) to propose, before the NOI submittal deadline specified in Section 3. Material in a NOI is deemed confidential and will be used for NASA planning purposes only. Submission of a NOI is not required for the submission of a proposal to this solicitation. Those who submit NOIs will receive any

SPP Program updates or AO amendments that may occur, up to the time of the proposal submittal deadline (see also Section 6.1.4).

A 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 E-mail at nspires-help@nasaprs.com for assistance.

The following information (to the extent that it is known by the NOI due date) is requested for the NOI:

(a) Name, address, telephone number, fax number, E-mail address, and institutional affiliation of the PI.

(b) Full names and institutional affiliations of each known Co-I. If any Co-Is or other 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) A brief statement (150 words or less) for each of the following:

(i) science objectives of the proposed Investigation;

(ii) identification of new technologies that may be employed as part of the investigation, including but not limited to NASA-developed technologies.

(d) The name of the organizational lead from each organization (industrial, academic, nonprofit, and/or Federal) included in the proposing team, and the organization's role in the proposed investigation, as may be known at the time of the NOI.

6.1.3 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 SPP Teaming Interest page of the SPP Acquisition Homepage (see address given in Section 6.1.4) have expressed interest in teaming with other organizations on SPP Investigation 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 Acquisition Home Page and Program Library

The SPP Investigations Acquisition Homepage, available at http://lws.larc.nasa.gov/solarprobe/, will provide updates and any AO addenda during the SPP AO solicitation process. It will provide links to the Program Library, information about the preproposal conference, a list of potential teaming partners, and questions and answers regarding the AO.

The SPP Program Library provides additional regulations, policies, and background information on the SPP Project. Information on the Program Library is contained in

Appendix D. The Program Library is accessible at SPP Investigations Acquisition Homepage at http://lws.larc.nasa.gov/solarprobe/.

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

6.1.5 Point of Contact for Further Information

Inquiries about this AO may be directed to the SPP Program Scientist:

Dr. Madhulika Guhathakurta
Solar Probe Plus Program Scientist
Heliophysics Division
Science Mission Directorate
National Aeronautics and Space Administration
Washington, DC 20546-0001
Telephone: (202) 358-1992
E-mail: madhulika.guhathakurta@nasa.gov

6.2 Proposal Preparation and Submission

6.2.1 Structure of the Proposal

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

Requirement 82. 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 three 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 83. The original signed proposal and 50 paper copies, each of which contains an attached, clearly labeled CD-ROM that contains electronic proposal files (see Appendix B), shall be delivered to the following address by the proposal submittal deadline specified in Section 3. [Partially repeats Requirement 2]

SPP Investigations AO
Science Mission Directorate
NASA Research and Education Support Services
Suite 200
500 E Street, SW
Washington, DC 20024-2760
Tel: (202) 479-9030

NASA will notify proposers that their proposals have been received. Proposers who have not received this confirmation within two weeks after submittal of their proposals should contact the SPP Program Scientist at the address given in Section 6.1.5

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 to 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 Central Contractor Registry (CCR).

Requirement 84. 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 shall indicate their commitment to the proposed investigation through NSPIRES (see Requirement 80).

The same proposal summary information must be submitted on the Electronic Cover Page as is in Section A of the proposal. The Electronic Cover Page may be submitted either before or after the proposal is submitted, as long as the Electronic Cover Page is submitted no later than the proposal due date given in Section 3. This means that the Electronic Cover Page may be finalized after the proposal is completed to ensure that the Electronic Cover Page has identical information as Section A of the proposal.

Alternatively, the Electronic Cover Page may be submitted first and a printout of the Electronic Cover Page may be included in Section A of the proposal.

Requirement 85. The Electronic Cover Page shall contain information that is identical to the information contained in Section A of the proposal.

Requirement 86. The Electronic Cover Page shall be submitted in NSPIRES by an authorized organizational representative (AOR) of the proposing organization, and it shall be submitted by the proposal submittal deadline specified in Section 3. [Partially repeats Requirement 3]

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 submitting 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. 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 to be submitted as part of a proposal.

Compliant proposals will be evaluated against the criteria specified in Section 7.2 by panels of individuals who are peers of the proposers. Instrument science investigation proposals will be evaluated by more than one panel (*e.g.*, a science panel and a technical/management/cost panel); each panel will evaluate proposals against different criteria. Observatory Scientist investigation proposals will be evaluated by only one panel (*e.g.*, the science panel).

In the case of investigations that propose to provide suites of instruments, the scientific merit; scientific implementation merit and feasibility of the proposed investigation; and the technical, management, and cost (TMC) of each instrument will be evaluated in addition to the overall suite.

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 right to accept in whole or in part, or to reject.

Proposers should be aware that, during the evaluation and selection process, NASA may request clarification of specific points in a proposal; if so, such a request from NASA and the proposer's response must be in writing. In particular, before finalizing the evaluation of the feasibility of the instrument investigation implementation (see Section 7.2.4), NASA will request clarification on specific, potential major weaknesses in the feasibility of instrument investigation implementation that have been identified in the proposal. NASA will request such clarification uniformly from all proposers. The ability of proposers to provide clarification to NASA is extremely limited, as NASA does not intend to enter into discussions with proposers. A typical limited response is to direct NASA's attention to pertinent parts of the proposal without providing further elaboration.

7.1.2 Categorization and Steering Process

An *ad hoc* categorization subcommittee of the SMD AO 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 for the Science Mission Directorate, will convene to consider the peer review 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 which are recommended for rejection for the particular opportunity under consideration, whatever the reason.

After categorization, the Program Scientist may request a payload accommodation assessment of the highly ranked proposals to aid in developing a recommendation for selection of an integrated science payload that addresses the AO objectives (Section 2). The accommodation study will be led by the LWS Program Office and may involve the participation of the mission prime contractor (Section 7.4). The accommodation assessment may include Category I, II, and III investigations.

A sitting panel of the SMD AO Steering Committee will then review the results of the evaluations and categorizations. The AO Steering Committee will conduct an independent assessment of the evaluation and categorization processes regarding their compliance to established policies and practices, as well as the completeness, self-consistency, and adequacy of all supporting materials.

7.1.3 Selection Process

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

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

NASA reserves the right to select only a portion of a proposer's investigation and/or to invite his/her participation with other investigators in a joint investigation. In that case, all affected proposers will be given the opportunity to accept or decline such a partial acceptance and/or participation with other investigators (see Appendix A, Section II).

7.2 Evaluation Criteria

7.2.1 Overview of Evaluation Criteria

The evaluation criteria, which are defined more fully in the following sections, will be used to evaluate proposals as described in Section 7.1.1.

For proposals for instrument(s) investigations, the evaluation criteria are:

- The scientific merit of the proposed investigation (Section 7.2.2);
- The scientific implementation merit and feasibility of the proposed investigation (Section 7.2.3); and
- The technical, management, and cost (TMC) feasibility of the proposed approach for instrument investigation implementation, including cost risk (Section 7.2.4).

In the case of investigations that propose to provide suites of instruments, the scientific merit; the scientific implementation merit and feasibility; and the technical, management, and cost (TMC) feasibility of <u>each</u> instrument will be evaluated in addition to the overall suite.

For proposals for the Observatory Scientist, the evaluation criteria are:

- The scientific merit of the proposed investigation (Section 7.2.2);
- The scientific implementation merit and feasibility of the proposed plans for providing independent input to the SWG (Section 7.2.5); and
- The suitability of the proposer for the Observatory Scientist position (Section 7.2.6).

The proposal categorizations, discussed in Section 7.1.2, will be based on these criteria. For categorization of instrument science investigation proposals, scientific merit is weighted approximately 40%, scientific implementation merit and feasibility is weighted approximately 30%, and TMC feasibility, including cost risk, is weighted approximately 30%. For categorization of Observatory Scientist investigation proposals, scientific merit is weighted approximately 40%, scientific implementation merit and feasibility of the proposed plans for the SWG is weighted approximately 30% and the suitability of the proposer for the Observatory Scientist position is weighted approximately 30%.

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

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

For instrument science investigations, the third criterion, technical, management, and cost feasibility, 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 within available resources.
Medium Risk	Problems have been identified, but are considered within the proposal team's capabilities to correct within available resources with good management and application of effective engineering resources. Mission design may be complex and resources tight.
High Risk	One or more problems are of sufficient magnitude and complexity as to be deemed unsolvable within the available resources.

7.2.2 Scientific Merit of the Proposed Investigation

The information provided in a proposal will be used to assess the intrinsic scientific merit of the proposed investigation. Scientific merit will be evaluated for the Baseline Science and the Threshold Science. The factors for scientific merit include the following:

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

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

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

7.2.3 Scientific Implementation Merit and Feasibility of the Investigation

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

- Factor B-1. Merit of the instruments and mission design for addressing the science goals and objectives. This factor includes the degree to which the proposed investigation will address the goals and objectives; the appropriateness of the selected instruments and mission design for addressing the goals and objectives; the degree to which the proposed instruments and mission can provide the necessary data; and the sufficiency of the data gathered to complete the scientific investigation.
- Factor B-2. Probability of technical success. This factor includes the maturity and technical readiness of the instruments; the adequacy of the plan to develop the instruments within the proposed cost and schedule; the robustness of those plans, including recognition of risks and mitigation plans for retiring those risks; the likelihood of success in developing any new technology that represents an untested advance in the state of the art; the ability of the development team - both institutions and individuals - to successfully implement those plans; and the likelihood of success for both the development and the operation of the instruments within the mission design.
- Factor B-3. Merit of the data analysis plan. This factor includes the merit of plans for data analysis, and data archiving to meet the goals and objectives, to result in the publication of science discoveries in the professional literature, and to preserve data of value to the science community. Considerations in this factor include an 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, and reporting scientific results in refereed journals, and assessment of the proposed plan for the timely release of the data to the public domain for enlarging its science impact.
- Factor B-4. Science resiliency. This factor includes both developmental and operational resiliency. Developmental resiliency includes the approach to descoping the Baseline Science Mission to the Threshold Science Mission in the event that development problems force reductions in scope. Operational resiliency

includes the ability to withstand adverse circumstances, the capability to degrade gracefully, and the potential to recover from anomalies in flight.

- Factor B-5. Probability of science team success. This factor will be evaluated by assessing the experience, expertise, and organizational structure of the science team and the mission design in light of any proposed instruments. The role of each Co-Investigator will be evaluated for necessary contributions to the proposed investigation; the inclusion of Co-Is who do not have a well defined role may be cause for downgrading of the proposal.

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

7.2.4 Feasibility of the Instrument Investigation Implementation, Including Cost Risk

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

- Factor C-1. Adequacy and robustness of the technical plan. This factor includes assessment of implementation elements such as: the overall investigation observation plan within the planned mission design; the instrument design and design margins; the impact of the instrument on the planned spacecraft design, the impact of the instrument on payload resources, the impact of the proposed location of the instrument on the spacecraft and other instruments; and 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 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 Science Investigation.
- Factor C-2. Adequacy and robustness of the cost plan and schedule. This factor includes assessment of proposal elements such as cost and cost risk, the adequacy of the approach, the methods and rationale used to develop the estimated cost, the discussion of cost risks, the subcontracting plan, and the team’s understanding of the scope of work (covering all elements of the investigation, including contributions). Proposals will be evaluated for the adequacy of the cost reserves and whether proposals with inadequate cost reserves demonstrate a thorough understanding of the cost risks. This factor also includes assessment of proposal elements such as the relationship of the work to the project schedule, the project element interdependencies, the associated schedule margins, and an assessment of the likelihood of launching by the proposed launch date. Also evaluated under this

factor are the proposed cost and schedule management tools to be used on the project.

- Factor C-3. Adequacy of the management approach, including the capability of the management team. This factor includes: the adequacy of the proposed organizational structure; the management approach; the roles, qualifications, and experience of the PI, PM, other named key management team members, and implementing organization, 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, 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.
- Factor C-4. Adequacy of the risk management approach. The adequacy of the proposed risk management approach will be assessed, as will any risk mitigation plans for new technologies, any long-lead items, and the adequacy and availability of any required manufacturing, test, or other facilities. The approach to any proposed descoping of investigation capabilities will be assessed against the proposed Baseline Science Investigation. The plans for managing the risk of contributed critical goods and services will be assessed, including the commitment of partners and contributors, as documented in Letters of Commitment and the adequacy of contingency plans for coping with the failure of a proposed cooperative arrangement or contribution.
- Factor C-5. Technical readiness. This factor includes the plans for the development and use of new technology and the adequacy of backup plans to ensure success of the investigation when technologies having a TRL less than TRL 6 are proposed. The maturity and technical readiness of the instrument complement 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 evaluation will result in narrative text, including specific major and minor strengths and weaknesses, as well as an appropriate risk rating for the feasibility of instrument investigation implementation.

7.2.5 Scientific Implementation Merit and Feasibility of the Proposed Plans for Providing Independent Input to the SWG

The information provided in an Observatory Scientist investigation proposal will be used to assess the scientific implementation merit and feasibility of the proposed plans for providing independent input to the SWG. The factors for scientific implementation merit and feasibility of the proposed plans for providing independent input to the SWG include the following:

- Factor D-1. Merit and feasibility of the proposed strategy for carrying out the tasks of the Observatory Scientist. This factor will be evaluated by assessing the

strategy for optimizing the science program within programmatic constraints, assessing the scientific performance of the mission, assisting in making key decisions and trades during formulation and development, and advocating for the mission science goals. This factor will be evaluated by assessing the strategy for other contributions that can be made to the SPP SWG and SPP project.

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

7.2.6 Suitability of the Proposer for the Observatory Scientist Position

The information provided in an Observatory Scientist proposal will be used to assess the suitability of the PI for the Observatory Scientist position. The factors for suitability of the PI for the Observatory Scientist position include the following:

- Factor E-1. Demonstrated experience and expertise in the area of solar and heliospheric research as evidenced by a relevant publication record and by any relevant activity in the heliophysics field.
- Factor E-2. Demonstrated leadership qualities. The ability, competence, commitment, and performance of the PI in leading similar efforts will be evaluated to assess her/his skills and stature among scientific peers, as a gauge of her/his effectiveness in organization, management, and negotiations.
- Factor E-3. Demonstrated organizational abilities. This factor will be evaluated by assessing the PI's prior organizational responsibilities. This factor includes an assessment of the PI's probability of success in executing the tasks assigned to the Observatory Scientist.

This evaluation will result in narrative text, including specific major and minor strengths and weaknesses, as well as an appropriate adjectival rating for suitability for the position of Observatory Scientist.

7.3 Selection Factors

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

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

The Selection Official 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, and maintaining a programmatic and scientific balance across SMD. While SMD develops and evaluates its program strategy in close consultation with the scientific

community through a wide variety of advisory groups, the SMD program is an evolving activity that ultimately depends upon the most current Administration policies and budgets, as well as program objectives and priorities that can change quickly based on, among other things, new discoveries from ongoing missions.

The overriding consideration for the final selection of instrument science investigation proposals submitted in response to this AO will be to maximize scientific return and minimize implementation risk while advancing NASA's science goals and objectives within the available budget for this program. Therefore, the proposed PI-Managed Instrument Investigation Cost will be considered in the final selection of investigations through this AO. For Observatory Scientist investigation proposals, life-cycle cost will be considered in the final selection.

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. The formal notification will also include instructions for scheduling a debriefing at which any issues noted during the evaluation that may require attention during development will be discussed, as well as instructions for attending the Project Initiation Conference.

7.4.2 Award Administration and Funding

The LWS Program Office is located at, and managed by, NASA's GSFC for NASA's SMD. JHU/APL has been designated as the mission prime contractor for the SPP mission and will provide mission implementation services. Science investigations will be contracted either from NASA directly or as subcontracts through JHU/APL. Throughout the lifetime of the project, science formulation and selection remains a NASA responsibility.

Contract award 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 put awards in place, Statements of Work (SOWs) and cost and pricing data will be required.

Proposals are <u>not</u> required to include SOWs and cost and pricing data. These will be required <u>only</u> for investigations that are selected. 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 management teams to provide SOWs and cost and pricing data in as timely a manner as possible. The process of awarding contracts cannot begin until SOWs and cost and pricing data 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 Phases A – 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.

For Phase A contracts that exceed $650K in Phase A, the contractor will be required to provide cost and pricing data to support the cost estimate, in the format specified in NPR 5800.1, *Grant and Cooperative Agreement Handbook*, Section A, Exhibit A, and to certify the costs proposed for the contract in accordance with FAR 15.406-2.

Contracts will be for a Phase A study with options for Phase B and further development Phases leading to launch, operations, and science results. Investigations that are not approved to continue into Phase B, for whatever reason, will receive no further funding.

7.4.3 Contribution of Instrument Investigations to Mission Key Decision Points

The SPP project will follow the Key Decision Point gates as described in NPR 7120.5D. PIs will be expected to contribute to project documentation at each mission KDP. If, at any time, the cost, schedule, or scientific performance commitments appear to be in peril, the investigation will be subject to termination or cancellation.

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

Director of the Contract Management Division
Office of Procurement
NASA Headquarters
Washington, DC 20546-0001
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 20546-0001
USA

8. Conclusion

The SPP mission represents a challenging way for NASA to accomplish important scientific exploration, as well as to generate opportunities to enhance education and engage the public in the excitement of science discoveries. NASA invites both the U.S. and international science communities to submit proposals for SPP investigations in response to this Announcement.

Richard R. Fisher
Director
Heliophysics Division

Edward J. Weiler
Associate Administrator
for Science Mission Directorate

APPENDIX A

GENERAL INSTRUCTIONS AND PROVISIONS
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 5.9 shall also apply.

V. TREATMENT OF PROPOSAL DATA

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

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

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

VI. STATUS OF COST PROPOSALS

Submission of cost or pricing data, as defined in FAR 15.401, is required if the combined Phase A and Bridge Phase costs exceed $650,000. Cost or pricing data will also be required for proposals for subsequent mission phases. The investigator's institution agrees that the cost proposal submitted in response to the Announcement is for proposal evaluation and selection purposes, and that, following selection and during negotiations leading to a definitive contract, the institution may be required to resubmit or execute all certifications and representations required by law and regulation.

VII. LATE PROPOSALS

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

VIII. SOURCE OF SPACE INVESTIGATIONS

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

IX. DISCLOSURE OF PROPOSALS OUTSIDE THE GOVERNMENT

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

X. EQUAL OPPORTUNITY

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

XI. PATENT RIGHTS

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

b. For any NASA contract resulting from this solicitation awarded to a small business firm or nonprofit organization, the clause at FAR 52.227-11, Patent Rights -- Retention by the Contractor (Short Form), (as modified by NFS 18-52.227-11) shall apply.

XII. RIGHTS IN DATA

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

XIII. SMALL AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING

a. Offerors are advised that NASA is subject to statutory goals to allocate a fair portion of its contract dollars to SDB concerns, HBCUs, and OMIs, as these entities are defined in 52.219-8 and 52.226-2 of the FAR. Offerors are encouraged to assist NASA in achieving these goals by using best efforts to involve these entities as subcontractors to the fullest extent consistent with efficient performance of their investigations.

b. Offerors are advised that, by law, NASA prime contracts resulting from this solicitation which offer subcontracting possibilities, exceed $500,000, and are with organizations other than small business concerns, the clause at FAR 52.219-9 shall apply. Accordingly, offerors awarded contracts for Phase A concept studies that exceed $500,000 are required to submit small business subcontracting plans consistent with the FAR, covering the study phase only, unless they adequately demonstrate that subcontracting opportunities are not reasonably available in the performance of these concept studies. Failure to do so will make the offeror ineligible for award. These plans should be submitted for negotiation after selection in conjunction with contract execution.

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

XIV. WITHDRAWAL OF PROPOSALS

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

APPENDIX B

REQUIREMENTS FOR PROPOSAL PREPARATION

INTRODUCTION

The following requirements apply to preparation of proposals in response to this Announcement of Opportunity (AO). While the body of the AO specifies the general policies and requirements for preparing proposals, as well as for implementing investigations proposed in response to this opportunity, Appendix B contains the specific requirements for the format and content of the proposals. In the event of apparent conflicts between this Appendix and the policies and requirements specified within the body of the AO, the latter takes precedence.

GENERAL REQUIREMENTS

The following expands requirements in the AO, in particular Requirement 82 and Requirement 83.

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. All parts of a proposal, including photographs and/or colored graphics, shall be printed on recyclable white paper. 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). Cardboard stock and loose-leaf binders are prohibited; plastic covers and spiral bindings are acceptable.

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 printed on 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 Proposal Summary Information Export controlled material statement (Section 5.10.2) Optional Restriction on Use statement (see Appendix A, Section V)	1 None 0.5 0.5
B	Fact Sheet	2
C	Table of Contents	None
D E	Science Instrument Investigation or Observatory Scientist Investigation Science Implementation	25 + 8 pages / additional instrument
F G	Investigation Implementation Schedule Foldout Management	15 + 3 pages/additional instrument (none on Schedule Foldout)
H	Cost and Cost Estimating Methodology Cost Table B3	8 + 1 page/additional instrument (none on Table B3)
I	Small Business Subcontracting Plan	3
J J.1 J.2 J.3 J.4 J.5 J.6 J.7 J.8 J.9 J.10 J.11	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 Master Equipment List (MEL) Heritage Relevant Experience and Past Performance List of Abbreviations and Acronyms List of References (optional)	 None None None None None None None None None None 5

Requirement B-4. Proposals shall conform to the page limits specified in the *Proposal Structure and Page Limits* table. 8 extra page(s) each is (are) allotted for each separate science instrument in the Science Section (Sections D and E), 3 extra page(s) each is (are) allotted for each separate instrument in the Investigation Implementation and Management Sections (Sections F and G). One additional page is allotted for each separate instrument in the Cost Section (Section H). Every side of a page upon which printing appears will count against the page limits and, unless specifically exempted (*e.g.*, Requirement B-33 and Requirement B-44), each foldout page will count against the page limits as appropriate for its area (*e.g.*, a two-page foldout counts as two pages, *etc.*).

Requirement B-5. One copy of every proposal shall bear on its cover sheet the original signatures of the Principal Investigator and an official of the PI's institution who is authorized to commit its resources (see Section A of this appendix). This "original" copy shall be printed on a single side of each page, and it shall be bound in a manner (*e.g.*, with a binder clip, with a rubber band, in an accordion folder, etc.) that allows it to be disassembled easily for reproduction in the event that NASA needs additional copies. The number of printed "review" copies specified in Section 6.2.3 of this AO shall be submitted with the original copy; two-sided printing is required for the review copies.

Requirement B-6. A CD-ROM containing up to three searchable PDF files of the proposal, limited to the main proposal, all tables, and all applicable appendices (see Section J of this appendix), as well as EXCEL files of tables (see Requirement B-46 and Requirement B-58) shall be attached to the original and to each review copy.

A. GRAPHIC COVER PAGE AND PROPOSAL SUMMARY INFORMATION

A.1 HARDCOPY PROPOSAL

The following expands requirements in the AO, in particular Requirement 82.

Requirement B-7. A Graphic Cover Page and Proposal Summary Information, prepared as directed below, shall preface every proposal. These pages will not be counted against the page limits.

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 (unless these signatures appear on the Proposal Summary Information), and

- A 0.5 inch (13 mm) high by 2 inch (51 mm) long space in the upper right corner of the page for NASA to place the proposal number and the copy number.

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).

Requirement B-9. The Proposal Summary Information shall include the following information and only the following information. This information shall be identical to the information entered into the Electronic Cover Page in NSPIRES (see Requirement B-10). Including a printed copy of the completed NSPIRES Electronic Cover Page in the proposal will satisfy this requirement. These pages will not be counted against the page limits.

- The signature of the PI and the authorizing official (unless these signatures appear on the Graphic Cover Page);
- Section I:
  - The Principal Investigator's (PI's) full name, E-mail address, phone number, and mailing address;
  - The proposal's full title, proposed start date, and proposed end date;
- Section II:
  - The date submitted;
- Section III:
  - The legal name of the proposing organization;
  - The common name ("doing business as" name) of the proposing organization;
  - The Division/Department/Center of the proposing organization;
  - The mailing address of the proposing organization;
- Section IV:
  - The proposal point-of-contact's (POC's) name, E-mail address, and telephone number (proposal POC may be the PI);
- Section V:
  - The following text, verbatim:

> Certification of Compliance with Applicable Executive Orders and U.S. Code
>
> By submitting the proposal identified in the Graphic Cover Sheet/Proposal Summary Information in response to this Announcement of Opportunity, the Authorizing Official of the proposing organization (or the individual proposer, if there is no proposing organization) as identified on the cover of this proposal:
> • certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
> • agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
> • confirms compliance with all provisions, rules, and stipulations set forth in the three Certifications contained in this AO (namely: (i) the Assurance of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs; (ii) the Certification Regarding Debarment,

Suspension, and Other Responsibility Matters Primary Covered Transactions; and (iii) Certification Regarding Lobbying).

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

  - The name, E-mail address, and phone number of the authorized official who signed the proposal's cover page;
- Section VI:
  - For every proposal team member, their name, E-mail address, phone number, organization name, and team member role (exactly one role per team member) chosen from the following list (note that these are the only roles permitted by NSPIRES; other named key personnel, such as project scientist or project systems engineer, should use the most appropriate role from this list):

List of Team Member Roles
Principal Investigator
Co-investigator
Co-I/Institutional PI
Collaborator
Project Manager
Industry Partner
International Partner
Other Professional
Postdoctoral Associate
Graduate/Undergraduate Student

- Section VII:
  - Proposal summary (not to exceed 300 words); NASA intends to enter the summaries of all investigation proposals selected for its various programs into a publicly accessible database; proposal summaries shall not contain proprietary or confidential information that the submitters wish to protect from public disclosure;
- Section VIII:
  - Answers to the following questions:
    - Is proprietary/privileged information included in this application? – Answer Yes or No;
    - Does this project involve activities outside the U.S. or partnership with non-U.S. collaborators? – Answer Yes or No;
    - Are NASA civil servant personnel participating as team members on this project (include funded and unfunded)? – Answer Yes or No.
    - Does this project have an actual or potential impact on the environment? – Answer Yes or No.
    - Does this project have the potential to affect historic, archeological, or traditional cultural sites (such as Native American burial or ceremonial grounds) or historic objects (such as an historic aircraft or spacecraft)? – Answer Yes or No.

- Section IX:
  - Short title of proposal (the investigation's acronym or short nickname);
  - Type of institution;
  - List all science team members, key institutional representatives, and other science participants in this investigation, both requesting funding and not requesting funding, who do not appear in Section VI or on the proposal's electronic cover page as a proposal team member. 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). (*N.b.*, this is requested to aid NASA in avoiding conflicts of interest for proposal reviewers.)
  - List investigation type (instrument investigation, Observatory Scientist);
  - For instrument investigations, indicate single instrument or suite;
  - Statement of contributions to development or operations (but not science) by any non-U.S. partner. Identify the non-U.S. partner(s), the non-U.S. funding agency/agencies, and the approximate value of the non-U.S. contributions, if any;
  - PI-Managed Mission Cost in real year dollars (RY$) from Table B3;
  - Total Mission Cost in real year dollars (RY$) from Table B3;
  - Provide NASA Personnel FTE Information; enter FTE totals by budget year in the following format: Year 1, FTE Total for Year 1, Year 2, FTE Total for Year 2, Year 3, FTE Total for Year 3, etc. (Example: FY07, 3.2, FY08 2.40, FY09, 1.3)
  - Answers to the following questions:
    - This proposal contains information and/or data that are subject to U.S. export control laws and regulations, including Export Administration Regulations (EAR) and International Traffic in Arms Regulations (ITAR). – Answer Yes or No;
    - The export-controlled material (EAR and/or ITAR) has been identified in this proposal. – Answer Yes or No or N/A;
    - The proposer acknowledges that the inclusion of such material in this proposal may complicate the Government's ability to evaluate the proposal. – Answer Yes or No or N/A;

A.2 ELECTRONIC COVER PAGE (NSPIRES Submission)

The following expands requirements in the AO, in particular Requirement 85 and Requirement 86.

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

Requirement B-10. 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 Electronic Cover Page shall be completed and submitted online. The electronic submission of the Electronic Cover Page alone does not satisfy the deadline for proposal submission. Electronic submission of the Electronic Cover Page in NSPIRES need not be completed until after the proposal is finalized, but must be completed before the proposal submittal deadline specified in Section 8 of this AO.

Requirement B-11. The same proposal summary information shall be submitted on the Electronic Cover Page as is in Section A of the proposal. In particular, the list of proposal team members and the proposed costs must be identical.

Note that proposers have several options for meeting Requirement B-10 and Requirement B-11: (i) proposers may first finalize, copy, and submit the hardcopy proposal, including the Proposal Summary Information, and then complete and submit the Electronic Cover Page in NSPIRES; (ii) proposers may first complete and submit the Electronic Cover Page in NSPIRES and then print it out for inclusion in the hardcopy proposal; or (iii) any other order for completing and submitting both the Proposal Summary Information in the hardcopy proposal and the Electronic Cover Page via NSPIRES. Both Requirement B-10 and Requirement B-11 require that the Proposal Summary Information and the Electronic Cover Page contain identical data and that they are both received by NASA prior to the proposal deadline, no matter what order they are completed and submitted.

A.3 PROPOSAL TEAM MEMBER COMMITMENT THROUGH NSPIRES

The following expands requirements in the AO, in particular Requirement 84.

Every proposal team member (*i.e.*, every individual identified on the NSPIRES proposal cover page) must indicate his/her commitment to the proposed investigation through NSPIRES prior to proposal 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 84.

A proposal team member will receive an E-mail from NSPIRES indicating that he/she has been added to the proposal by the PI. The proposal team member should log into NSPIRES. Once logged in, the proposal team member should follow the link in the "Reminders and Notifications" section of his/her NSPIRES home page, titled "Need <role> confirmation for proposal <title> for Solicitation <<solicitation number>>." On the "Team Member Participation Confirmation" page, the proposal team member should read language about the Organizational Relationship, then click the "Continue" button.

If the contact information then displayed on the "Team Member Profile" screen is out of date, the proposal team member should update this information later using the "Account Mgmt" link in the NSPIRES navigation bar across the top. Prior to making that update, however, the team member should follow the on-screen prompts to identify the

organization through which he/she is participating on this proposal. Click the "Link Relationship" button to the right side of the "Organizational Relationship" banner. Select the organization from the "Link Proposal to an Association" part of the page. If the correct organization is not displayed here, try using the "Add Association" button to add the organization to this list. Then click the "Save" button at the bottom of the page. If the team member cannot find the organization when searching in the "Add Association" area (*i.e.*, the organization is not registered), type in the formal name in the space provided (or select "Self" if appropriate). Once the organization is selected and the "Save" button is clicked, there is a confirmation page that allows the team member to edit that relationship if it was chosen incorrectly. Click "Continue."

Note that 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. If the address information is accurate (or once it has been edited to be accurate), the proposal team member may log out of NSPIRES.

NSPIRES will send an E-mail to both the team member and the PI confirming that the commitment was made and the organization was identified. The PI may additionally monitor the status of proposal team member commitments by examining the "Relationship Confirmed" column on the Team Member page of the NSPIRES proposal cover page record.

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 82.

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 objectives (including the importance of the science to the program science goals);
- Investigation overview;
- Instrument complement;
- Investigation management and participating organizations (including teaming arrangements, as known);
- Schedule summary;
- The proposed PI-Managed Investigation Cost in real year dollars (RY$) from Table B3; and

- The proposed Total Cost, including a breakdown of any contributed costs by contributing organization, in real year dollars (RY$) from Table B3.

C. TABLE OF CONTENTS

The following expands requirements in the AO, in particular Requirement 82.

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 INVESTIGATION

The following expands requirements in the AO, in particular Requirement 1 and Requirement 4 through Requirement 13.

1. Scientific Background, Goals, and Objectives.

Requirement B-15. This section shall describe the goals and objectives of the investigation; the compelling nature of the investigation; and the investigation's value to advancing the Solar Probe Plus Mission goals and objectives.

2. Science Requirements.

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 scientific 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.*, energy resolution, spatio-temporal resolution, elemental and charge state resolution, coverage, pointing accuracy, measurement precision, measurement limitations, geometric factor, 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 scientific objectives, as well as the expected results, shall be described. How the science products and data obtained will be used to fulfill the scientific requirements shall be demonstrated and supported by quantitative analysis. These descriptions shall constitute the Baseline Science Investigation.

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

3. Threshold Science Investigation.

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

E. SCIENCE IMPLEMENTATION

The following expands requirements in the AO, in particular Requirement 4 through Requirement 16 and Requirement 52 through Requirement 55.

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, 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 systems to technology readiness level (TRL) 6 at 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 systems 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 effects, such as radiation and contamination, on each instrument's measurement capabilities as a function of mission time.

Requirement B-20. Proposals for multiple instruments shall justify each instrument at a level of detail sufficient to permit evaluation of each instrument on its own merits.

Requirement B-21. The following information shall be provided for each science 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; and
- Instrument thermal control capability.

2. Data Sufficiency.

Requirement B-22. This section shall discuss the quality and quantity of data to be generated by each instrument, as they relate to the proposed science investigation goals and objectives. The flow-down from science investigation goals to measurement objectives and instrument performance shall be stated clearly and supported by quantitative analysis.

3. Science Mission Profile.

Requirement B-23. This section shall discuss the science 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 planned mission design for SPP and operations plan should be apparent from this discussion.

4. Data Plan.

Requirement B-24. 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 appropriate NASA data archive 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. Proposals shall identify how they plan to satisfy the policies in Section 4.4 from the standpoint of hardware, software, personnel, and cost.

5. Science Team.

Requirement B-25. This section shall identify each key member (*i.e.*, one whose participation is essential to the success of the investigation) of the science team and his/her role and responsibilities. Resumes or curriculum vitae of science team members shall be included as appendices to the proposal (see Section J.3 of this appendix). The role of each co-investigator (Co-I) shall be explicitly defined, the necessity of that role shall be justified, and the funding source (NASA or contributed) for the PI and each Co-I shall be noted. Nonfunded members of the science team shall be identified in the proposal as collaborators (see Section 5.6.3 of this AO). The role of collaborators may be defined and justified.

F. INVESTIGATION IMPLEMENTATION

The following expands requirements in the AO, in particular AO Requirement 14 through Requirement 38.

1. General Requirements.

Requirement B-26. Instrument Contingencies and Margins: This section shall summarize contingencies and margins of all instrument resources. For proposals for more than one instrument, the mass, telemetry, and power and reserves and margins must be identified separately for all the necessary components of each instrument in case only an individual instrument is selected from the proposed suite (see below for definitions of contingency and margin). Discuss the allocation of reserves and margin to the instrument and/or suite.

Requirement B-27. For the driving requirements derived from the Functional Requirements, this section shall provide estimates of implementation performance and design margins with respect to the required performance. At a minimum, it shall provide estimates of implementation performance and design margins with respect to the required performance for the following:

- Mass;
- Power;
- Data Storage; and
- Any other driving requirements.

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 be 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-28. 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.

2. Development Approach.

Requirement B-29. This section shall describe the development approach. This description shall include, at a minimum, the following items:

- Systems engineering approach (*e.g.*, plans, tools, processes for requirements, interfaces, and configuration management);
- Mission assurance approach, including (i) fault tolerance and fault management, (ii) product assurance, and (iii) reliability (*e.g.*, use or non-use of redundancy, requirements for burn-in of parts, requirements for total operating time without failure prior to flight, *etc.*);
- Identification of instrument to spacecraft interfaces;
- Design maturity and heritage of instrument elements by reference to Appendix 10, Heritage, of the proposal (see Section J of this appendix);
- Essential trade studies that are to be conducted;
- Approach to management and closure of action items, hardware discrepancies, test anomalies, etc.; and
- Approach for handling special processes.

3. New Technologies/Advanced Developments.

Requirement B-30. This section shall describe any proposed new technologies and/or advanced developments and the approaches that will be taken to reduce their associated risks. If no advanced development is required, the justification for TRL 6 or above shall be clearly demonstrated. These descriptions shall address, at a minimum, the following topics:

- Identification and justification of the TRL for each proposed new development and/or advanced development at the time the proposal is submitted (for *TRL definitions*, see NPR 7120.8, *NASA Research and Technology Program and Project Management Requirements*, Appendix J, in the Program Library);
- Rationale for combining the TRL values of subsystems to derive the full system TRL as proposed;
- Rationale for the stated TRL value of a system that is an adaptation of an existing system of known TRL;

- The proposed approach for maturing each of the identified items to a minimum of TRL 6, defined as "system/subsystem model or prototype demonstration in a relevant environment, space, or ground" by the end of Phase B (include discussion of simulations, prototyping, systems testing, life testing, etc., as appropriate);
- An estimate of the resources (manpower, cost, and schedule) required to complete the technology 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.

4. Assembly, Integration, Test, and Verification.

Requirement B-31. 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-32. 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.

5. Schedule.

Requirement B-33. A project schedule foldout covering all phases of the investigation shall be provided. 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 7120.5D. The schedule foldout and accompanying narrative 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;
- Schedule critical path identification; and
- Funded schedule reserve, with indications of appropriate reserves associated with major milestones and deliverables.

6. Radiation Environment effects.

Requirement B-34. This section must address how the instrument design and planned instrument operations addresses the expected radiation environment. The proposal must discuss the expected operation of the instrument in the radiation environment. The proposal must address planned mitigation of the radiation environment effects and describe how the science goals will be achieved in the expected environment.

7. Impact on Planned Spacecraft Design

Requirement B-35. This section must address how the proposed instrument(s) design, location, field of view, etc. impact the planned spacecraft design, as described in Section 5.3

G. MANAGEMENT

The following expands requirements in the AO, in particular Requirement 18, Requirement 39 through Requirement 46, Requirement 70, and Requirement 73

Requirement B-36. This section shall describe the investigator's proposed management approach. The management organization (including an organization chart) and decision-making process shall be described, and the teaming arrangement and team communications shall be discussed. The organization chart should clearly indicate how the investigation team is structured. The names of the primary team members, their organization, and their reporting relationship in the program shall be provided.

Requirement B-37. 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 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. 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-38. This section shall describe 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 cost risks are in this list, they should be described here and then discussed in Section H (see Requirement B-43). The management strategies for control, allocation, and release of technical margins, cost reserves, and schedule reserves shall be described. The approach to any potential descopes, including savings of resources (mass, power, dollars, schedule, etc.) by implementing descopes, and the decision milestone(s) for implementing descopes shall be discussed. Specifically, this description shall identify 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 them. When contracts are required, the acquisition strategy, including any incentive strategy, shall be described.

Requirement B-39. 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-40. 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, given that the proposed cost is not allowed to increase beyond the cost cap during Phase A or at any later time. 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 58 through Requirement 70.

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-41. This section shall include the estimated cost of the proposed investigation. The estimated cost shall encompass all proposed activities, including all applicable mission phases, flight systems, ground systems, contributions, any other AO-specific activities, 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-42. This section shall include a description of the methodologies used to develop the 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-43. This section shall include a discussion of cost risks.

Requirement B-44. This section shall provide a foldout cost table, Table B3, which will not be counted against the page limit. Table B3 shall identify the proposed cost required in each mission phase and in each fiscal year; the costs shall be in real year dollars (RY$). The top portion of Table B3 shall contain cost data relevant to the PI-Managed Investigation Cost. The lower portion shall contain cost data for contributions. The rows in Table B3 shall be the NASA standard WBS elements, as defined in NPR 7120.5D. The WBS must provide adequate insight into each individual instrument. The columns in Table B3 shall be grouped and subtotaled by mission phase and shall be labeled with the appropriate fiscal years. Fiscal years that span more than one mission phase shall be split into two columns by mission phase. The final columns total is in real year dollars (RY$). Proposers shall use their own forward pricing rates to translate between real year dollars (RY$) and fiscal year 2010 dollars (FY10$). For organizations that are without approved forward pricing rates, proposers may use the NASA inflation/deflation indices in Table B4 to translate between real year dollars (RY$) and fiscal year 2010 dollars (FY10$).

Requirement B-45. For an individual instrument proposal, one Table B3 is required. For proposals with more than one instrument, one Table B3 is required for each instrument and one Table B3 is required that shows the total cost for all instruments. For example, if three instruments are proposed, then there must be four versions of Table B3, of which one will show the total cost if all instruments are selected as proposed. The other three tables must address the cost of each instrument as if it were selected separately. An explanation should be provided with each Table B3, for an individual instrument in a suite, noting whether there are any performance changes or design changes if only the single instrument is selected.

Requirement B-46. Table B3 shall be provided additionally in EXCEL format on each CD submitted with the proposal.

I. SMALL BUSINESS SUBCONTRACTING PLAN

The following expands requirements in the AO, in particular Requirement 56

1. Small Business Subcontracting Plan

Requirement B-47. This section shall include one of the following, as applicable: (i) demonstration that the offeror is a small business concern, or (ii) small business subcontracting plans meeting the requirements in Section 5.7.1, Appendix A, and referenced parts of the FAR.

J. APPENDICES

Requirement B-48. The following additional information is required to be supplied with the proposal as Appendices and, as such, will not be counted within the specified page limit. No other appendices are permitted.

1. Table of Proposal Participants

The following expands requirements in the AO, in particular Requirement 79.

Requirement B-49. 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 (real year dollars 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, integration and test, science operations, and other major elements of the proposed investigation, as defined by the proposer.

2. Letters of Commitment.

The following expands requirements in the AO, in particular Requirement 72, Requirement 78, and Requirement 79.

Requirement B-50. Letters of commitment signed by an institutional official authorized to commit the resources of the respective institution or organization shall be provided from (i) all organizations offering contributions of goods and/or services on a no-exchange-of-funds basis, including all non-U.S. organizations providing hardware, software, or Co-I services (both U.S. and non-U.S.) to the investigation, and, (ii) 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 5.10.1 of this AO.

3. Resumes.

The following expands requirements in the AO, in particular Requirement 39 through Requirement 42 and Requirement 52 through Requirement 55.

Requirement B-51. This section shall include resumes or curriculum vitae for the PI, IPM, IS, ISE, all Co-Is identified in the science section, and for any key project personnel who are named in the proposal. 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, IPM, IS (if named), and ISE (if named). 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.

4. Summary of Proposed Program Cooperative Contributions.

The following expands requirements in the AO, in particular Requirement 68 through Requirement 70 and Requirement 73 through Requirement 75.

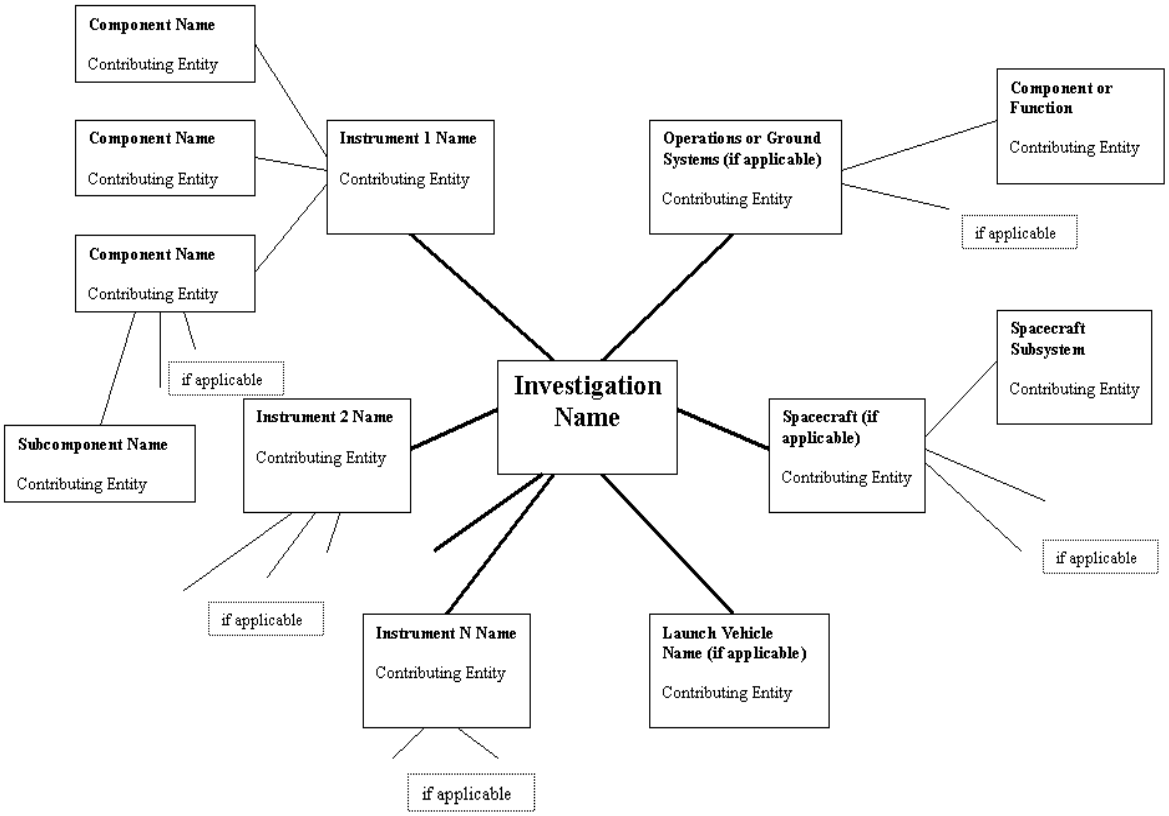
Cooperative contributions are defined to be those that are to be provided to the proposed investigation from a U.S. or non-U.S. partner on a no-exchange-of-funds basis. In order to aid NASA in conducting an equitable assessment of risks, this section shall include (a) an "exploded diagram" of the investigation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

a. An “exploded diagram” of the investigation.

Requirement B-52. 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 should not be shown:

i. If there are no cooperative contributions of spacecraft, launch vehicle or services, or ground operations or facilities, these boxes should not be shown on the diagram at all.
ii. Scientific collaborations, such as joint data analysis that do not involve contribution of flight hardware or other critical items, should not be shown.
iii. U.S. or non-U.S. goods and services obtained by contract using NASA funds are not cooperative contributions and are also not to be shown.

SAMPLE EXPLODED DIAGRAM



b. A supporting table of collaborative contributions.

Requirement B-53. 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 5.8.6 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 5.8.6 of this AO; and
vi. Cross reference to letters of commitment, as required in Section 5.8.6 (and references therein) of this AO.

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 77.

Requirement B-54. 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 120-130, *et seq*. and 15 CFR 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-55. Foreign nationals requiring access to NASA facilities and information systems will be required to comply with Homeland Security Presidential Directive HSPD-12 (see http://hspd12.nasa.gov/), where applicable. 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.

6. Compliance with Procurement Regulations by NASA PI Proposals.

The following expands requirements in the AO, in particular Requirement 47.

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). Additional instructions may be found in Procurement Information Circular (PIC) 05-15 at http://www.hq.nasa.gov/office/procurement/regs/pic.html.

Requirement B-56. For NASA Center proposals, this section shall include any descriptions, justifications, representations, indications, statements, and/or explanations that are required by the regulations.

7. Master Equipment List.

The following expands requirements in the AO, in particular Requirement 64.

Requirement B-57. This section shall include a Master Equipment List (MEL) summarizing all flight element subsystem components and individual instrument element components to support validation of proposed mass estimates, design heritage, and cost. A template for this MEL is included as Table B5.

Requirement B-58. The MEL shall be additionally provided in EXCEL format on each CD submitted with the proposal.

For each 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 and prototypes, required deliveries for simulators and testing, contingency allocations for individual components, and other component description/characteristics. Certain items (like electronic boxes and solar arrays) should include additional details, as applicable, to identify and separate individual elements.

8. Heritage.

The following expands requirements in the AO, in particular Requirement 60.

Requirement B-59. 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.

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.

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

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

9. Relevant Experience and Past Performance.

The following expands requirements in the AO, in particular Requirement 43.

In evaluating the proposal, NASA will consider the past performance of the major partner organizations. The evaluation of past performance will not be arithmetic; instead, the information deemed to be most relevant and significant will receive the greatest consideration. Relevant experience will be viewed as the demonstrated accomplishment of work, which is comparable or related to the objectives of the proposal. This includes space-based instrument development and investigations and associated development processes, including engineering processes, management processes, operations, data analysis, and delivery of data to the appropriate data archives. NASA will review the past performance information provided by the proposer. In addition, NASA may review the major team partners past performance on other NASA and/or non-NASA projects or contracts that provide insight into those institutions past performance on airborne or space-based instrument development and investigations and associated development processes, including engineering processes, management process, operations, data analysis, and delivery of data to the appropriate data archive. In conducting the evaluation, NASA reserves the right to use all information available.

Requirement B-60. This appendix shall describe *relevant* experience and past performance by the major team partners (organizations) in meeting the requirements of projects *similar* to the subject of the proposal. This may include space-based instrument development and investigations. The discussion of relevant experience and past performance shall include a description of each project; its relevance to the subject of the proposal; the proposed performance and the actual performance; the planned delivery schedule of data to the appropriate data archive and the actual delivery schedule of data to the appropriate data archive, the proposed cost and actual cost; the proposed schedule and actual schedule; an explanation of any differences between proposed performance, cost, and schedule and what was actually achieved; and points of contact for the past project's customer. If the customer for the past project was the United States Government, then the contract number must be included along with current technical point(s) of contact and phone number(s). For projects that are not yet complete, the current projected performance, cost, and schedule must be used in place of actual values. Projects that ended more than five years ago need not be included.

Proposers are cautioned that omissions or an inaccurate or inadequate response to this evaluation item will have a negative effect on the overall evaluation, and while NASA may consider data from other sources, the burden of providing relevant references that NASA can readily contact rests with the investigation team.

10. List of Abbreviations and Acronyms.

The following expands requirements in the AO, in particular Requirement 82.

Requirement B-61. This section shall provide a list of abbreviations and acronyms.

11. List of References (optional).

In addition to the above items, this section 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.

TABLE B1
EXAMPLE SCIENCE TRACEABILITY MATRIX

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

TABLE B2
EXAMPLE MISSION TRACEABILITY MATRIX

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

TABLE B3

TOTAL MISSION COST FUNDING PROFILE TEMPLATE

[New version added through Amendment 1 on January 12, 2010]

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

Total Mission Cost Funding Profile Template

FY costs in Real Year Dollars (RY$), Totals in Real Year Dollars (RY$)

WBS#	WBS Element	Phase A (FY2010-2011)			Phase B (FY 2011-2014)					Phase C/D (FY 2014-2018)				Phase E (FY2018-2025)				Phase F	RY$
		FY2010	FY2011	Total	FY2011	FY2012	FY2013	FY2014	Total	FY2014	FY...	FY2018	Total	FY2018	FY ...	FY2025	Total	FY2025	Total
01	Project Management																		
02	Systems Engineering																		
03	Safety & Mission Assurance																		
04	Science / Technology																		
05	Payload(s) List each instrument separately																		
5.1	Instrument 1																		
5.1.1	Instrument 1 component A																		
5.1.2	Instrument 1 component B																		
5.1.n	Instrument 1 component n																		
5.2	Instrument 2																		
5.2.1	Instrument 2 component A																		
5.2.2	Instrument 2 component B																		
5.2.n	Instrument 2 component n																		
5.x	Instrument X																		
5.x.1	Instrument X component 1																		
5.x.n	Instrument X component n																		
07	Mission Operations																		
09	Ground System(s)																		
10	Systems Integration & Testing																		
12	Reserves																		
	PI-Managed Investigation Cost																		
Contributions																			
	List by organization and WBS element																		
	Total Contributions																		
	Total Mission Cost																		

TABLE B4
NASA FY09 NEW START INFLATION INDEX
for use in FY10

Fiscal Year	2010	2011	2012	2013	2014	2015	2016	2017
Inflation Rate		2.4%	2.9%	3.0%	2.9%	2.8%	2.8%	2.9%
Cumulative Inflation Index	1.000	1.024	1.054	1.085	1.117	1.148	1.180	1.214

Use an inflation rate of 2.9% for years beyond 2017.

Note: Proposers shall use their own forward pricing rates. For organizations that are without forward pricing rates, proposers may use the NASA new start inflation index in Table B4 (see Appendix B, Section H).

TABLE B5
MASTER EQUIPMENT LIST

Table B5 MASTER EQUIPMENT LIST Template - Instrument Investigation X

Instrument 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												

Instrument *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												

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 full-time Federal Government employees 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 science investigation — The investigation that, if fully implemented, would accomplish the entire set of scientific objectives proposed for the investigation.

Baseline science objectives — The entire set of scientific 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 immediate 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 — An *ad hoc* subcommittee of the AO 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 for the Science 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 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 shall not be identified as a collaborator but shall be identified as a Co-Investigator or another category of team member.

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 spacecraft disposal (Phase F), including the analysis and publication of data in the peer reviewed scientific literature, delivery of the data to an appropriate NASA data archive, and, if applicable, extended mission operations or other science 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.

Descope — Any alteration of a investigation that renders it unable to accomplish one or more of the Baseline Science Mission scientific objectives.

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.

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.

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.

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.

Minimum science investigation — The investigation that would accomplish the minimum subset of Baseline Science Investigation scientific objectives sufficient to justify the proposed cost of the investigation.

Mission — Used interchangeably with investigation.

Mission Architecture — The summary level description of the over all 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.

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

Peer Review (n) — A gathering of experts in related disciplinary areas convened as a subcommittee of the AO Steering Committee 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 Investigation Cost — The funding that the Program sponsoring the AO will be expected to provide to the PI's implementation team 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 investigation as well. It also includes any costs that are required to be accounted for against the PI-Managed Investigation Cost even though the PI is not responsible for those costs (*e.g.*, NASA-provided telecom and network).

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 investigation meets its objectives within the resources committed to the project.

Project Office — An office established to manage a project.

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

Resiliency — The quality of a investigation to gracefully degrade from the Baseline Science Mission to the Minimum Science Mission 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 Enhancement Option (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.

Team — A group of investigators responsible for carrying out and reporting the results of an investigation or group of investigations.

Team Member — A participant in an investigation, including the Principal Investigator, a Co-Investigator, or any member of an investigation team. Team members are identified by role on the proposal's Electronic Cover Page.

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.

Total Investigation Cost — The PI-Managed Investigation Cost, plus any additional costs that are contributed or provided in any way other than through the Program sponsoring the AO.

Unencumbered reserve — Unexpended reserves that are not being held for an identified, but not yet realized, risk.

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.

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

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.

Launch Approval Engineering — 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, postflight 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 Phase E (post-launch) 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 Enhancement Option (SEO) activities.

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

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

Prelaunch GDS/Mission Operations Services (MOS) Development — Includes costs associated with development and acquisition of the ground infrastructure used to transport and deliver the telemetry and other data to/from the Mission Operations Center and the Science Operations Center. (For more information, refer to *NASA's Mission Operations and Communications Services* document in the Program 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.

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

Part C.3: ABBREVIATIONS AND ACRONYMS

AA	Associate Administrator
AO	Announcement of Opportunity
AOR	Authorized Organizational Representative
ASRG	Advanced Stirling Radioisotope Generator
BOE	Basis of Estimate
CADRe	Cost Analysis Data Requirement
CBE	Current Best Estimate
C-C	Carbon-Carbon
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
DOE	Department of Energy
DPU	Data Processing Unit
DSN	Deep Space Network
EA	Environmental Assessment
EAR	Export Administration Regulations
E/PO	Education and Public Outreach
EBPOC	Electronic Business Point of Contact
EELV	Evolved Expendable Launch Vehicle
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EOL	End-of-Life
EVM	Earned Value Management
FAD	Formulation Authorization Document
FAQ	Frequently Asked Questions
FAR	Federal Acquisition Regulations
FASAB	Federal Accounting Standards Advisory Board
FFRDC	Federally Funded Research and Development Center
FONSI	Finding of No Significant Impact
FY	Fiscal Year
G&A	General and Administrative
GAO	Government Accountability Office
GDS	Ground Data System
GEO	Geosynchronous Orbit
GFE	Government Furnished Equipment
GFS	Government Furnished Service
GI	Guest Investigator
GSFC	Goddard Space Flight Center

HBCU	Historically Black Colleges and Universities
HBZ	HUB Business Zone
HGA	High Gain Antenna
HUB	Historically Underutilized Business
IAT	Integration, Assembly, and Test
ICD	Interface Control Document
IPM	Instrument Project Manager
IRD	Interface Requirements Document
IS	Instrument Scientist
ISE	Instrument System Engineer
I&T	Integration and Test
ITA	Independent Technical Authority
ITAR	International Traffic in Arms Regulations
IV&V	Independent Verification and Validation
JHU/APL	Johns Hopkins University/Applied Physics Laboratory
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
KDP	Key Decision Point
LGA	Low Gain Antenna
LVDS	Low Voltage Differential Signaling
LWS	Living With a Star
MAR	Mission Assurance Requirements
MEL	Master Equipment List
MEP	Mars Exploration Program
MMRTG	Multiple Mission Radioisotope Thermoelectric Generator
MOC	Mission Operations Center
MO&DA	Mission Operations and Data Analysis
MOS	Mission Operations Services
MOU	Memorandum of Understanding
NAICS	North American Industry Classification System
NASA	National Aeronautics and Space Administration
NASA-STD	NASA-Standard
NEN	Near-Earth Network
NEPA	National Environmental Policy Act
NFS	NASA FAR Supplement
NID	NASA Interim Directive
NISN	NASA Integrated Services Network
NLSA	Nuclear Launch Safety Approval
NODIS	NASA Online Directives Information System
NOI	Notice of Intent
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NRA	NASA Research Announcement
NRC	National Research Council
NRP	NASA Routine Payload

NSPIRES	NASA Solicitation and Proposal Integrated Review and Evaluation System
NSS	NASA Safety Standard
OMI	Other Minority Institution
OSTP	Office of Science and Technology Policy
PCA	Program Commitment Agreement
PDF	Portable Data Format
PDR	Preliminary Design Review
PI	Principal Investigator
PIC	Procurement Information Circular
PNAR	Preliminary Non-Advocate Review
P.L.	Public Law
PM	Project Manager
POC	Point of Contact
PS	Project Scientist
PSE	Project Systems Engineer
RBSP	Radiation Belt Storm Probes
RHU	Radioisotope Heater Unit
ROD	Record of Decision
ROM	Rough Order-of-Magnitude
RPS	Radioisotope Power System
RTG	Radioisotope Thermoelectric Generator
RY	Real Year
SAIC	Science Applications International Corporation
SALMON	Stand Alone Mission of Opportunity Notice
SB	Small Business
SC	Student Collaboration
SCaN	Space Communication and Navigation
SDB	Small Disadvantaged Business
SDVOSB	Service Disabled Veteran Owned Small Business
SE	System Engineer(ing)
SEE	Single Event Effect
SEO	Science Enhancement Option
SEU	Single Event Upset
SHS	Solar Horizon Sensor
SI	Système Internationale (metric system)
SMD	Science Mission Directorate
SN	Space Network
S/N	Signal-to-Noise
SOC	Science Operations Center
SOW	Statement of Work
SPP	Solar Probe Plus
SSR	Solid State Recorder
STDT	Science and Technology Definition Team
STEREO	Solar Terrestrial Relations Observatory
SWG	Science Working Group

TMC	Technical, Management, and Cost
TPS	Thermal Protection System
TRL	Technical Readiness Level
UARC	University Affiliated Research Center
URL	Uniform Resource Locator
U.S.	United States
U.S.C.	United States Code
VGA	Venus Gravity Assist
VOSB	Veteran Owned Small Business
WBS	Work Breakdown Structure
WOSB	Women Owned Small Business

APPENDIX D

SPP AO LIBRARY

SPP Acquisition Homepage: http://lws.larc.nasa.gov/solarprobe/.

SPP AO Library: http://lws.larc.nasa.gov/solarprobe/spmlib.html

1. *Solar Probe + Mission Engineering Study Report* (March 2008)

2. *Solar Probe +: Report of the Science and Technology Definition Team (STDT)* (November 2008)

3. *Thermal Design Considerations for the Solar Probe Electric Field Antenna Report* (March 2008)

4. *Solar Probe: Thermal Protection System Risk Mitigation Study* (January 2007)

5. Earth Orbit File (generated 4 June 2008)

6. Solar Probe Plus Trajectory (as of 4 June 2008)

7. *The Science Plan for NASA's Science Mission Directorate 2007 - 2016*

8. NPD 1001.0, The 2006 NASA Strategic Plan

9. NPR 8705.4, Risk Classification for NASA Payloads (Revalidated July 9, 2008)

10. NPR 7120.8, NASA Research and Technology Program and Project Management Requirements (February 5, 2008)

11. NASA Reference Publication 1124, Outgassing Data for Selecting Spacecraft Materials (June 1997)

12. NPD 1360.2A, Initiation and Development of International Cooperation in Space and Aeronautics Programs (April 16, 1999)

13. 22 CFR Parts120-130, "International Traffic in Arms Regulations" (1997)

14. 15 CFR Parts 730-774, "Export Administration Regulations" (2005 - 2008)

15. NPR 5800.1, Grant and Cooperative Agreement Handbook (October 19, 2000)

16. FAR 15.406-2, "Certificate of Current Cost or Pricing Data"

17. NPD 5101.32, Procurement (April 13, 2003)

18. Federal Acquisition Regulations (FAR)
The following parts of the Federal Acquisition Regulations are referenced in this AO.
FAR 33.101, "Protests Definitions"
FAR 52.233-2, "Service of Protest"

21. NASA FAR Supplement (NFS)
The following parts of the NASA FAR Supplement are referenced in this AO.
NFS 1852.233-70, "Protests to NASA"

22. *Solar Probe Plus Project Instrument Provider Mission Assurance Requirements (MAR)* (April 17, 2009)

23. *Living With a Star (LWS) Program Plan* (July 14, 2009)

24. Federal Accounting Standards Advisory Board (FASAB)

25. NPR 7120.5D NID, *NASA Space Flight Program and Project Management Requirements (NPR 7120.5D NID is the NASA Interim Directive (NID) for NPR 7120.5D. Effective September 22, 2009, NPR 7120.5D NID is the governing NPR until NPR 7120.5D is formally revised.)*

26. National Academy of Science's "Simpson Committee"

27. Heliophysics The Solar and Space Physics of a New Era, Recommended Roadmap for Science and Technology 2009-2030

28. NPR 7123.1, NASA Systems Engineering Processes and Requirements

29. LWS Program Commitment Agreement (PCA)

30. Example of Deliverables by KDPs

31. Table B3 Template

32. Table B5 Template

33. NASA Heliophysics Science Data Management Policy

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 investigations; 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 SPP AO Library (Appendix D)

NPR 7120.5D, *NASA Space Flight Program and Project Management Requirements*

NPR 7123.1, *NASA Systems Engineering Processes and Requirements*

Living With A Star (LWS) Program Commitment Agreement (PCA)

Living With a Star (LWS) Program Plan

Solar Probe Plus Project Instrument Provider Mission Assurance Requirements (MAR)

NASA Heliophysics Science Data Management Policy

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. Proposal received on time	Requirement 2
2. Original signature of authorizing official included	Requirement B-5
3. Electronic cover page and summary (NSPIRES submission) received on time	Requirement B-5
4. Proposal includes proposal summary information with content identical to electronic cover page	Requirement B-7 Requirement B-9
5. Correct number of copies each including a CD	Requirement 83
6. Meets page limits	Requirement B-4
7. Meets general guidelines (one volume original easy to disassemble, maximum 55 lines text/page, maximum 15 characters/inch --approximately 12 pt font)	Requirement B-1 Requirement B-2 Requirement B-3
8. Meets general requirements for format and completeness	Requirement 82
9. Required appendices included; no additional appendices	Requirement B-48
10. Budgets are submitted in required formats	Requirement B-44
11. All individual team members that are named on the cover page indicate commitment through NSPIRES	Requirement 80
12. All export controlled information has been identified	Requirement 81
Scientific (instrument science investigation only)	
13. Addresses solicited science research programs	Requirement 4
14. Requirements traceable from science to instruments	Requirement 5
15. Appropriate data archiving plan	Requirement 6
16. Baseline science investigation and threshold science investigation defined	Requirement 9
Technical (instrument science investigation only)	
17. Complete spaceflight investigation (Phases A-F) proposed	Requirement 11
18. Team led by a single PI	Requirement 39
19. Includes table describing non-U.S. participation	Requirement 75
20. Includes letters of commitment from funding agencies for non-U.S. participating institutions	Requirement 72
21. Includes letters of commitment from all U.S. organizations offering contributions	Requirement 78
22. Includes letters of commitment from all major partners	Requirement 79

APPENDIX G

REQUIREMENTS CROSSWALK

This Appendix contains an approximate crosswalk between proposal requirements in the AO and proposal requirements in Appendix B. Proposal requirements in Appendix B expand upon the proposal requirements in the AO and provide further definition on the structure 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 Requirement	**AO Section**	**AO Requirement Topic**	**Appendix B Requirement**
Requirement 1	2.6.3	Proposal scope	Requirement B-15
Requirement 2	2.6.3	Proposal deadline	
Requirement 3	2.6.3	Electronic deadline	
Requirement 4	5.1.1	Science scope	Requirement B-15
Requirement 5	5.1.2	Science traceability	Requirement B-17
Requirement 6	5.1.2	Data plan	Requirement B-22, Requirement B-24
Requirement 7	5.1.3	Measurement traceability	Requirement B-16, Requirement B-24
Requirement 8	5.1.3	Instrument rational	Requirement B-19, Requirement B-20, Requirement B-26
Requirement 9	5.1.4	Baseline investigation	Requirement B-16, Requirement B-18
Requirement 10	5.1.4	Descope threshold	Requirement B-18
Requirement 11	5.2.1	Complete investigation	Requirement B-15, Requirement B-16, Requirement B-19, Requirement B-22, Requirement B-23
Requirement 12	5.2.1	Instrument rationale	Requirement B-19
Requirement 13	5.2.1	Suite rationale	Requirement B-20
Requirement 14	5.2.1	Instrument operations concept	Requirement B-23, Requirement B-28
Requirement 15	5.2.1	Instrument accommodation	Requirement B-21
Requirement 16	5.2.1	Separability of instruments	Requirement B-20, Requirement B-26

Requirement 17	5.2.2	Development approach	Requirement B-29, Requirement B-31, Requirement B-32, Requirement B-40
Requirement 18	5.2.2	Management approach	Requirement B-36, Requirement B-40
Requirement 19	5.2.3	Technology readiness	Requirement B-30
Requirement 20	5.2.5	Payload deviations	Requirement B-35
Requirement 21	5.3.1	Delivery schedule	Requirement B-33
Requirement 22	5.3.2	Resource allocation	Requirement B-26
Requirement 23	5.3.2	Resource contingency	Requirement B-26, Requirement B-27
Requirement 24	5.3.2	Environmental compatibility	Requirement B-34, Requirement B-35
Requirement 25	5.3.2	Spacecraft changes	Requirement B-35
Requirement 26	5.3.2	Deployed structures	Requirement B-35
Requirement 27	5.3.2	Thermal control	Requirement B-35
Requirement 28	5.3.2	Thermal interface	Requirement B-35
Requirement 29	5.3.3	Instrument accommodation	Requirement B-19, Requirement B-35
Requirement 30	5.3.3	DPU accommodation	Requirement B-35
Requirement 31	5.3.3	Required electronics	Requirement B-35
Requirement 32	5.3.3	Alignment requirements	Requirement B-35
Requirement 33	5.3.3	Cleanliness requirements	Requirement B-35
Requirement 34	5.3.3	Doors and mechanisms	Requirement B-35
Requirement 35	5.3.3	Electrostatic accommodation	Requirement B-35
Requirement 36	5.3.3	Electromagnetic cleanliness	Requirement B-35
Requirement 37	5.3.4	Science operations	Requirement B-28
Requirement 38	5.3.5	Mission timeline	Requirement B-23, Requirement B-35
Requirement 39	5.4.1	Principal investigator	Requirement B-5, Requirement B-51
Requirement 40	5.4.2	Project manager	Requirement B-37, Requirement B-51
Requirement 41	5.4.2	PI and PM roles	Requirement B-37
Requirement 42	5.4.3	Qualifications of individuals	Requirement B-37, Requirement B-51
Requirement 43	5.4.3	Qualifications of institutions	Requirement B-37, Requirement B-60
Requirement 44	5.4.4	Risk identification	Requirement B-38

Requirement 45	5.4.4	Risk mitigation	Requirement B-38
Requirement 46	5.4.4	Descopes	Requirement B-38
Requirement 47	5.4.5	NASA PI proposals	Requirement B-56
Requirement 48	5.5	Obs. scientist science	Requirement B-15
Requirement 49	5.5	Obs. scientist strategy	Requirement B-36
Requirement 50	5.5	Obs. scientist qualifications	Requirement B-37
Requirement 51	5.5	Obs. scientist independence	
Requirement 52	5.6.1	Science team	Requirement B-25, Requirement B-51
Requirement 53	5.6.2	Co-investigator roles	Requirement B-9, Requirement B-25, Requirement B-51
Requirement 54	5.6.2	Co-investigator funding	Requirement B-25
Requirement 55	5.6.3	Collaborators	Requirement B-9, Requirement B-25, Requirement B-51
Requirement 56	5.7.1	Small business subcontracting plan	Requirement B-47
Requirement 57	5.7.2	E/PO	
Requirement 58	5.8.1	Cost tables	Requirement B-41, Requirement B-44, Requirement B-45
Requirement 59	5.8.1	Pre-Confirmation spending	Requirement B-41, Requirement B-44, Requirement B-45
Requirement 60	5.8.2	Cost methodologies	Requirement B-41, Requirement B-42, Requirement B-43, Requirement B-44, Requirement B-45, Requirement B-46, Requirement B-59
Requirement 61	5.8.2	Cost uncertainty	Requirement B-43
Requirement 62	5.8.2	Cost reserves	Requirement B-41, Requirement B-42
Requirement 63	5.8.3	Work breakdown structure	Requirement B-44
Requirement 64	5.8.4	Master equipment list	Requirement B-57, Requirement B-58
Requirement 65	5.8.5	Full cost accounting	Requirement B-41
Requirement 66	5.8.5	NASA contributions	Requirement B-41, Requirement B-44

Requirement 67	5.8.5	Applicable accounting standards	Requirement B-41
Requirement 68	5.8.6	Contribution identification	Requirement B-52
Requirement 69	5.8.6	Contribution value	Requirement B-53
Requirement 70	5.8.6	Contribution risk management	Requirement B-39, Requirement B-52
Requirement 71	5.9.2	Non-US cost plan	
Requirement 72	5.9.2	Non-US letters of commitment	Requirement B-50
Requirement 73	5.9.2	Non-US contribution risk management'	Requirement B-39, Requirement B-52
Requirement 74	5.9.2	Non-US contribution detail	Requirement B-19, Requirement B-21, Requirement B-52
Requirement 75	5.9.2	Non-US participation table	Requirement B-53
Requirement 76	5.9.3	International agreements	Requirement B-33
Requirement 77	5.9.4	ITAR requirements	Requirement B-54, Requirement B-55
Requirement 78	5.10.1	US contribution letters of commitment	Requirement B-50
Requirement 79	5.10.1	Major partner letters of commitment	Requirement B-49, Requirement B-50
Requirement 80	5.10.1	NSPIRES commitment for team members	Requirement B-12
Requirement 81	5.10.2	Export controlled proposal material	Requirement B-9
Requirement 82	6.2.1	Proposal format	Requirement B-1, Requirement B-2, Requirement B-3, Requirement B-4, Requirement B-5, Requirement B-6, Requirement B-7, Requirement B-8, Requirement B-9, Requirement B-12, Requirement B-13, Requirement B-14, Requirement B-48, Requirement B-58, Requirement B-61
Requirement 83	6.2.3	Proposal submission	Requirement B-5, Requirement B-6

Requirement 84	6.2.4	NSPIRES registration	Requirement B-12
Requirement 85	6.2.4	Electronic cover page	Requirement B-9, Requirement B-10, Requirement B-11
Requirement 86	6.2.4	Electronic submission	Requirement B-10

APPENDIX H

CERTIFICATIONS

Included for reference only. Submission of the signed proposal including Section V of the Proposal Summary Information certifies compliance with these certifications.

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

The *(Institution or organization on whose behalf this assurance is signed, hereinafter called "Applicant.")*

HEREBY AGREES THAT it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1972 (20 U.S.C. 1680 *et seq*.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 *et seq*.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives Federal financial assistance from NASA; and HEREBY GIVES ASSURANCE THAT it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of Federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of which the Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which it retains ownership or possession of the property. In all other cases, this assurance shall obligate the Applicant for the period during which the Federal financial assistance is extended to it by NASA.

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

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

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

A. The applicant certifies that it and its principals:

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

2. Have not within a three-year period preceding this application been convicted or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

3. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification;

4. Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

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

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

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department of agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Certification Regarding Lobbying

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

1. No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant;

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, or an employee of a Member of Congress in connection with this Federal grant, the undersigned shall complete Standard Form -- LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

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