Astrophysics Explorers Program
2023 Astrophysics Probe Explorer (APEX) AO Q&A

Change Log		
Revision	**Date**	**Description of Changes**
	01/18/22	**Draft AO Q&As**
01	01/18/22	Posted Q&As 1-6
02	02/24/22	Posted Q&As 7-9
03	02/28/22	Posted Q&A 10
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12	04/11/23	Posted Q&As 56-57
13	05/09/23	Posted Q&As 58-65
14	05/16/23	Posted Q&A 66
15	07/10/23	Posted Q&As 67-71
	7/31/23	**Final AO issued**
16	08/04/23	Posted Q&As 72-75, Amended Q&A 13
17	08/29/23	Posted Q&A 76-93
18	09/28/23	Posted Q&A 94, Amended Q&A 91

Additions are in bold and/or *italicized* text and deletions are struck through in amendments.

Please Note: Questions 1 to 71 were submitted in response to the release of the Draft AO for the 2023 Astrophysics Probe Explorers acquisition.

Q-1 For the 2023 Probe AO mission themes, is there a specific wavelength cut-off for exclusion or inclusion in order to meet the definition of a far infrared or X-ray probe? For example, can a far-infrared mission also include a mid-infrared instrument, so long as the far-infrared instrument is responsive to the objectives outlines in the Decadal Survey?

A-1 The only criteria with regards to the Probe AO mission themes are responsiveness to the 2020 Decadal Survey in Astronomy and Astrophysics, *Pathways to Discovery in Astronomy and Astrophysics for the 2020s* as provided in Sections 7.5.3.2 through 7.5.3.4. It is up to the proposer to argue that responsiveness. The Astrophysics Division will not use a wavelength to determine responsiveness, instead the standard process of external peer review will be used to evaluate responsiveness.

Q-2 The 2023 Probe AO community announcement notes that 'Participation by NASA Centers must be consistent with NASA's Center Roles policies.' Does this mean that GSFC and JPL can act as lead centers or are other centers included as well?

A-2 Center roles are found in the NASA Center Roles document, which is not publicly available. With the most recent 2022 update to the NASA Center Roles document, the Science Mission Directorate (SMD) has changed the definitions of what is considered small/medium/large missions for the purposes of the competition roles. This adjustment is based on applying inflation from 2016, when the levels were first established, to FY2023. The new language reads:

"For purposes of mission and instrument competition roles, the following definitions apply (figures are in FY23 dollars):

- Small Mission: a mission for <$225M, without launch vehicle or Mission Directorate Unallocated Future Expenses (MD-UFE). Examples: Earth Venture Class, SMEX.
- Medium Mission: between a small and large mission. Examples: MIDEX, Earth System Explorers
- Large Mission: a mission for >$600M, without launch vehicle or MD-UFE. Examples: Discovery, New Frontiers."

SMD made no changes in this update to the mission sizes that Centers can propose to. Those roles continue to be the following:

Small, Medium and Large Missions: GSFC and JPL
Small and Medium Missions: ARC and MSFC
Small Missions Only: LaRC
No Lead Mission proposal role of any scale: AFRC, GRC, JSC, KSC and SSC

Q-3 The 2023 Probe AO community announcement is ambiguous about whether or not a NASA Center's participation is required and/or expected. Is it acceptable for a mission to be proposed, for example, with only an educational/non-profit PI and an industry partner providing the mission project management, systems engineering, and so on?

A-3 The 2023 Probe AO is an open competition, and there is no requirement for NASA (Center) participation. The hypothetical example described in the question would be compliant with the AO.

Q-4 The 2023 Probe AO is based on the Science Mission Directorate Standard AO template, with an Explorer-like timeline at least for the initial stages. Would the European Space Agency (ESA) be willing to make an early, significant, commitment to an unspecified Probe if the request came from NASA Headquarters directly?

A-4 ESA cannot partner with individual proposers, only with NASA. For that reason, ESA does not participate as a partner in proposals to NASA AO competitions. Generally European member states (plus the Japan Aerospace Exploration Agency and other space agencies) partner with proposers on NASA AO competitions.

Q-5 Could the Science Mission Directorate Standard AO template be modified to allow for a larger group of 'interested scientists' to sign on to a mission, perhaps growing their involvement as time goes on to become full Collaborators or Co-Is? Currently, the standard AO discourages large teams, but some mechanism to allow early involvement without penalty could increase opportunities.

A-5 The Science Mission Directorate Standard AO discourages large teams in order to ensure there is a robust pool of potential peer reviewers. NASA encourages proposers to describe plans for expanding the science team after selection through open and inclusive processes.

Q-6 Will NASA be organizing any meetings/workshops to facilitate discussions of Probes in general to make sure potential Principal Investigators can have their ideas heard and potentially give people a chance to join teams?

A-6 NASA will not be organizing workshops along these lines. Potential organizers of such workshops are welcome to submit a proposal for NASA support to the Topical Workshops, Symposia, and Conferences program element (Appendix F.2) of ROSES.

Q-7 Our organization is funded to develop an instrument that may be relevant to the mission objectives mentioned in the Astrophysics Probe community announcement

and which could easily be adapted for space. How can we make NASA decision makers aware of our project? How can we make applicants aware of our project?

A-7 NASA does not maintain a list of people for potential participants to contact. However, there is an Astrophysics Probe Teaming Interest webpage available at .

Organizations may express an interest in teaming with other organizations on Astrophysics Probe proposals by filling out the form on the webpage. This is not a list of organizations who are capable of teaming but is simply a list of those organizations that have asked to be included in this list. Proposing organizations are not required to team with any organization on this list. ***NASA does not endorse any of these organizations and does not accept responsibility for their capabilities or actions***.

Q-8 If ESA member nations are interested in providing contributions to a Probe, will Headquarters facilitate discussions in some way? For example, can HQ provide a list of people for Probe Pis to contact in each country to discuss possible member nation contributions?

A-8 NASA Headquarters will not be facilitating discussions. As a practical matter, contributions to NASA's PI-led, AO-initiated proposed missions are often initiated by science collaborators in another country seeking funding from their national funding agency, rather than by US proposers reaching out directly to foreign funding agencies.

As noted in response to Q-6, potential Probe proposers are welcome to submit a proposal for NASA support to the Topical Workshops, Symposia, and Conferences program element (Appendix F.2) of ROSES. As noted in A-7, there is an Astrophysics Probe Teaming Interest webpage available at .

Q-9 Is there any maximum duration from the start of phase B until the launch readiness date?

A-9 It is anticipated that the launch readiness date will be no later than 9 years after release of the final AO. Phase B starts at the Step-2 down-selection, which is expected to be approximately 2.5 years after the final AO release.

Q-10 Why is the cost cap $1B for the Astrophysics Probe when the Decadal Survey calls for a $1.5B cost cap?

A-10 The Decadal Survey recommends a $1.5B mission cost cap. The Astrophysics Probe AO will have a $1B PI-Managed cost cap. As stated in the Community Announcement, the PI-Managed mission cost cap does not include the launch vehicle, nor does it include the NASA held reserves. Together, these elements equate to a $1.5B mission cost cap.

The $1B PI-managed mission cost cap is an increase over the Astrophysics Probe studies. The studies had a $1B cost target including launch vehicle (but not including NASA held reserves).

Q-11 In the answer to Q-10, it is noted that launch vehicles are not part of the PI Managed Cost Cap (PIMCC). Given that launch vehicle (LV) costs were assumed to be $150M in 2018 dollars for the probe studies, wouldn't the PIMMC still be below the recommended amount in the Decadal Survey in 2023 dollars when inflation is taken into account?

A-11 Here is the Probe costing information that was used. The Decadal Survey probe studies were done at $1B cost cap including LV @ $150M in Fiscal Year 2018 dollars. Using the NASA New Start Inflation Index, $850M in Fiscal Year 2018 dollars = $950M in Fiscal Year 2023 dollars. So $1B PIMCC is an increase of $50M in Fiscal Year 2023 dollars over the probe studies done for the Decadal Survey.

Q-12 The probe studies done for the Decadal Survey assumed that the Probe would be a NASA Class B mission. Is this assumption still correct?

A-12 No, the Probe mission will be a Class C mission. The definition of a Class C mission can be found in NPR 8705.4A, which can be found at https://nodis3.gsfc.nasa.gov/.

Q-13 In the answer to Q-5, it is noted that NASA discourages large teams in order to ensure there is a robust pool of potential peer reviewers. If we have people we consider to be part of our science working group, because they have expressed support for the project and/or provided some ideas, but who do not expect to be directly funded as part of the proposal, must we list them as collaborators?

A-13 The science team should be the people who have committed to do specific pieces of the work to be evaluated. Collaborators are committed to realizing the proposed science investigation. Other scientists who merely benefit from the mission's existence, because they will do science with it, are "endorsers" not collaborators. In addition, other people who worked on the proposal, and are therefore biased also need to be identified. They should be listed in ~~the conflicted parties spreadsheet~~ *the NSPIRES NOI information about Other Individuals (item #3 under "Program Specific Data")*, according to what they did – contributed ideas, red-teaming etc.

Q-14 The Astrophysics Probe AO Community Announcement states that "The value of the contributions to the science payload may not exceed one-third (1/3) of the payload." How is the 1/3 metric defined since different partners define costs differently?

A-14 If a proposal includes one or more contributions, the proposal shall separately identify all contributions, including hardware as well as labor and services, the organizations providing the contributions, and the organizations providing the funding for the contributions; the costs for the contributions shall be separately identified. Values for all contributions of property and services must be established in accordance with applicable cost principles. Non-NASA contributions to the science instruments are not to exceed one-third (1/3) of the PI-Managed Instrument Cost. The "PI-Managed Instrument Cost" is defined as the sum of the costs assigned to elements 4.0 (Science) and 5.0 (Payload(s)) in the standard Work Breakdown Structure.

Q-15 The answer to Q-2 suggests that GSFC and JPL are the only NASA centers allowed to propose. It is not clear that there is sufficient Bid and Proposal (B&P) funding available at both GSFC and JPL to support a healthy number of proposals for each of the two mission types. What is being done to address this?

A-15 This is an open solicitation. As such, NASA HQ does not determine what organizations will propose. Any organization may propose, including a NASA Center (consistent with their Center role), another Federal agency, a Federally Funded Research and Development Center (FFRDC) or University Affiliated Research Center (UARC), industry, or academia may propose. By extending the proposal period and coordinating the schedule for other SMD AOs, NASA HQ has created space for additional proposals to be submitted.

Q-16 Are there any opportunities for early technology funding now in order to advance TRL of some key components on time to meet the probe timeline?

A-16 The Astrophysics Research and Analysis (APRA) element of the Research Opportunities in Space and Earth Science (ROSES) program is one NASA Astrophysics mechanism for advancing Technology Readiness Level (TRL). APRA investigations may advance technologies anywhere along the full line of readiness levels, from TRL 1 through TRL 9. The Strategic Astrophysics Technology (SAT) element of ROSES is another mechanism for advancing TRL. SAT supports the maturation of key technologies for potential infusion in spaceflight missions to enable implementation of Astrophysics strategic missions. The SAT program is designed to support the maturation of technologies whose feasibility has already been demonstrated (i.e., TRL 3), to the point where they can be incorporated into NASA flight missions (TRL 6–7). Pis are encouraged to propose to the appropriate program. Note that NASA has been investing in Probe-enabling technologies under SAT for several years as part of an intentional strategy of having a rapid Probe AO following the release of the Decadal Survey.

Q-17 How would a contribution of a launch by a foreign partner be treated? Would it be allowed? Would it allow increasing the PIMCC?

A-17 As stated in the community announcement, NASA will provide standard launch services on a single launch vehicle outside the cost capped PIMMC. No other access to space option will be available in this AO.

Q-18 Would it be possible for the launch services information summary to include LV mass capability to low inclination Low Earth Orbit (LEO)? Ideally this would be in the form of a plot of LV PL mass capability to orbit inclinations down to 0 degrees over a range of altitudes from about 400 to 1,000 km and would allow for heavy payloads.

A-18 NASA intends to publish a Draft Launch Services information summary document in the Program Library at the time of Draft AO release. The performance curves in the document will include options for LEO 0 deg, 5 deg and 10 deg inclination in addition to higher, more typical inclined launch orbits. Note that consistent with the community announcement, the standard launch performance capability will be consistent with an intermediate class Commercial Launch Vehicle. Additional capability might be offered at the cost of a decrement to the AO Cost Cap.

Q-19 How will the GO/GI programs be evaluated (including but not limited to their value in Form A, requirements in Form B, cost implications in form C, additional page allocations, etc.)

A-19 Please see sections 7.2.2, 7.2.3, 7.2.4, and Requirement B-4 and the Proposal Structure and Page Limits table, in the Draft Probe Announcement of Opportunity, which can be found at https://go.nasa.gov/Hertz15.

Q-20 Should the Science Traceability Matrix have a main science goal, with several secondary goals, as an Explorer mission would have, or should it answer a range of science questions?

A-20 Please see section 5.1 in the Draft Probe Announcement of Opportunity, which can be found at https://go.nasa.gov/Hertz15.

Q-21 In an answer to a previous question on the community announcement, a response indicated that the Probe Missions would be classified as "Class C"; however, for NASA's Class C classification, the mission's duration is limited to 3 years. Will 3-year mission proposals be accepted and evaluated the same as a longer proposed mission that would need to be Class B, and will Class B mission proposals be accepted?

A-21 As noted in response to Q-12, as discussed in Appendix C of NPR 8705.4A, the considerations provided there are not definitive, nor is any specific mission criterion

alone intended to be the ultimate driver to designating a mission or instrument risk tolerance class. Ultimately, the mission or instrument risk tolerance class is designated by the Mission Directorate in accordance with paragraph 3.1.4 of NPR 8705.4A. The NASA Science Mission Directorate (SMD) has approved the Astrophysics Probe risk classification of Class C and a prime mission of five years in order to maximize the science achievable within the cost cap.

The intent is to allow proposers to propose the design features, the safety and mission assurance practices, etc., they deem most appropriate and cost-effective, to maximize the science successfully achieved within the cost cap for a five-year prime mission. Proposers may choose to propose specific features from a higher risk classification if it enables their design to show compliance with the 5-year mission life while remaining within the cost cap. A proposal for a Class C mission that meets all the Class B requirements would be compliant with the AO, and would be evaluated against Class C requirements. Proposers can propose a mission duration <5 years if they believe they can provide sufficient science value with a reduced mission duration while staying within the cost cap. Proposer should not propose a mission duration <5 years solely based on mission risk classification.

Q-22 Requirement B-6 in the AO requires a Microsoft Project Schedule file, but Requirement B-48 calls for only a table of dates. Which is required?

A-22 Only a table of dates is required as described in Requirement B-48. Requirement B-6 will be amended accordingly in the Final AO.

Q-23 Do Collaborators have to spend 10% of their time on Phases A – D integrated or in every phase? Teams are built based in the specializations of collaborators and it is expected that they will have fluctuating levels of responsibility during Phases A through D.

A-23 The expectation is that it will be 10% on average over Phases A-D, not in every Phase.

Q-24 The draft AO [Section 5.4.3] reads: "It is expected that collaborators will spend at least 10% of their time dedicated to working on the mission over the course of Phases A-D." The requirement that Collaborators be unpaid and also dedicate at least 10% of their time to the mission is unreasonable.

A-24 Collaborators contributing to the mission are not expected to be unfunded. The assumption is that they are funded by resources other than that budgeted under the Probe. Inclusion of collaborators with less than 10% of their time allocated to the mission over the course of Phases A-D must be justified.

Q-25 Is it a formal requirement that a proposed concept fits cleanly into the definitions of either a pointed mission or a survey mission? Can a hybrid mission with >30% but <100% of the time dedicated to either directed science observations and/or a survey be proposed?

A-25 The definitions of a pointed mission and a survey mission are intended as guidance. It is up to the proposing teams to define their mission. A proposed mission could be a hybrid of a survey and a pointed observatory mission, and then 70% of the pointed observatory program would be required to be available to general observers.

Q-26 Who is the Point of Contact (POC) at Launch Services for non-standard payload accommodation?

A-26 The POC for Launch Services is listed in the "NASA Launch Services Information Summary, Rev. 1", which is item #4 under "Program Specific Documents" in the 2023 Astrophysics Program Library, located here: https://explorers.larc.nasa.gov/2023APPROBE/programlibrary.html.

Q-27 The requirements for institutional letters of commitment are inconsistent. Section 5.8.1 says they are required: Institutional Letters of Commitment signed by an institutional official must be provided from (i) all organizations offering contributions of goods and/or services (both U.S. and non-U.S.) on a no-exchange-of-funds basis and (ii) all major partners in the proposal regardless of source of funding. See Appendix B, Section J.2, for additional detail. However, appendix J.2, Requirement B-63 only requires letters for contributions. Which is correct?

A-27 They are both correct. Requirement B-63 is not exclusive. Requirement B-63 expands on earlier requirements for parties that are required to submit letters, e.g. requirements 35 (ScaN), 88, 91 (contributions) and 92 (major partners).

Q-28 Section 5.6.7 says "The requirement for institutional Letters of Commitment for contributions does not apply to contributed support for Co-Is and collaborators." Section 5.8.2 says "No Institutional Letters of Commitment are required for individuals in the Step-1 proposal, unless the individual's effort is contributed and the individual is part of the Proposal Team, collaborators excepted." Which is correct?

A-28 Section 5.8.2, "No Institutional Letters of Commitment are required for individuals in the Step-1 proposal, unless the individual's effort is contributed and the individual is part of the Proposal Team, collaborators excepted" is correct. The inconsistency will be fixed in the final AO.

Q-29 The prescribed likelihood and cost table in Requirement B-51 does not cover all risks, *e.g.*, a risk of on-orbit failure could have no cost impact but could be mission ending. How will this be addressed?

A-29 The risk table requirement in the final AO will not prescribe the format.

Q-30 An observatory requires time to reach orbit, checkout the spacecraft, commission its instruments, and routinely interrupt science observations for maintenance activities. Does the 5 year minimum "science mission duration" and "prime mission operations" (Sections 4.1.4 and 5.1.4) include this non-observing time?

A-30 NASA defines prime mission as beginning after launch, early operations, and commissioning. The prime mission requirement is five years of calendar time, which includes observing as well as all necessary overhead and engineering time.

Q-31 For a pointed observatory, does the ≥70% of "mission observation time" requirement for the general observing (GO) program (Requirement 17) include normal operations (i.e. slewing, settling, desaturating reaction wheels, communicating, etc.) that could reduce observatory efficiency?

A-31 Yes, in the relevant proportion. It is expected that, like JWST, Probe time allocation policies will explicitly attribute the time required by indirect overhead activities to individual observing programs. The more usual policy of space- and ground- based observatories is to make such costs invisible to the user, by reducing, ab initio, the total time available for science by the time required for overhead activities such as instrument calibration and observatory maintenance. Exposing the time needed for indirect overhead activities provides total cost accounting that will allow the overall observatory efficiency to be more transparent to users and improves general accountability. These will be clarified in the final AO. To see JWST policies, please visit https://jwst-docs.stsci.edu/jwst-opportunities-and-policies/jwst-general-science-policies/jwst-observing-overheads-and-time-accounting-policy.

Q-32 What is the relative weight in the evaluation of the PI-led science (evaluation criteria Factors A-1 to A-3 and B-1 to B-5) versus the general observing or guest investigator program (new evaluation criteria Factors A-4 and B-6)?

A-32 Individual factors are not weighted. Form A and Form B will each receive one overall rating which will be based on the major strengths and major weaknesses across all factors.

Q-33 In providing details of the general observing (GO) and guest investigator (GI) program in the proposal, are proposing teams allowed to prescribe any of the programmatic details for the GO/GI program in our proposal?

A-33 Proposing teams may propose programmatic details for GO/GI programs, and those details will be evaluated as part of the review process. NASA is responsible for the GO/GI program, and final constraints will be negotiated between NASA and the selected Probe team.

Q-34 For the new cost and unencumbered reserves required during Phase E (Requirement 76: Proposals shall include a minimum of 25% unencumbered cost reserves on *mission operations* and 10% on the PI-led science investigation against the cost to complete Phase E"), does this mean that 25% reserve is required for Phase E-F on WBS 1,2,7,9; and 10% on WBS 4?

A-34 Mission operations in Phases E-F includes everything except WBS 4.

Q-35 If the PI of an APEX proposal is at a non-NASA government institution and the management organization is a non-profit private research institution (that is not a NASA center), is it allowed for the Probes office to fund the managing institution directly, rather than sending all the funds to the PI institution and having them put the funds on contract?

A-35 It would be outside our normal policy for the Program Office to fund a non-government managing organization when the PI is at a government organization, but it may be possible given a compelling reason. Note that if there is any NASA Center or other government agency involvement as part of the proposing team, they would be funded directly.

Q-36 How should proposers estimate the cost of the PI mission vs the General Observer/ Guest Investigator program?

A-36 These items will be outside the PI-managed mission cost:

i) General Observer/Guest Investigator Facility (GOF) user support for community users
ii) Managing the GO/GI process to select community participants
iii) Managing the GO/GI award process and funding those awards

All other items will be inside the PIMMC, including:

- 5 years of mission operations; all communications costs (DSN/LEGS/NEN) will be reflected as a decrement to the AO cost cap

- 5 years of science operations, including scheduling observations and pipelining data to create standard data products and deliver it to the archives
- Provision of tools necessary to analyze the standard data and data products
- Funding for the PI-led science team to carry out their science investigation

GO or GI programs that would require instrument modes or data processing beyond those that are used or validated for the PI-led science program, or a greater intensity of mission operations (e.g. Targets of Opportunity, solar system objects, etc.) than is envisaged for the PI-led program, should be proposed as Science Enhancement Options (SEOs). SEOs do not count towards the science merit of a proposal.

Q-37 Where can science operations and the General Observer/Guest Investigator Facility (GOF) be proposed?

A-37 Pis may propose any institution as a mission science operations center, and indicate that any of the current GOFs (GSFC, STScI, IPAC, CXC) can be partners with proposing teams as science centers and/or GOFs. However, NASA reserves the right to decide after selection that a proposed science center or GOF is not the optimal one and will choose an alternate. The final AO will be updated to reflect this.

Q-38 Requirement 36 states "Missions operating beyond GEO altitude and within 2 million kilometers of Earth shall be compatible with the Lunar Exploration Ground Segment (LEGS) as applicable, …." Is it reasonable to restate this requirement using, "apogee less than 2 million km"?

A-38 No. If any part of the orbit in which a spacecraft will routinely operate is between GEO and 2 million kilometers and the proposer will use ScaN assets, the spacecraft must be compatible with LEGS during those portions of the orbit.

Q-39 Section 5.2.6.2 states that the use of planned Lunar Exploration Ground Segment (LEGS) assets for cislunar missions (missions operating beyond GEO altitude and within 2 million kilometers of Earth) is recommended to allow the DSN assets to be used primarily for missions beyond 2M km from Earth. Requirements 36 and 37 imply that missions operating beyond GEO altitude and within 2 million kilometers of Earth can use DSN, but must be compatible with the Lunar Exploration Ground Segment (LEGS). Is the intention that DSN can still be used for missions operating below 2 million kilometers?

A-39 SMD is working with ScaN on clearer wording for the Final AO that accounts for the demands on ground station assets. The DSN is not expected to be available for Astrophysics Probe routine mission operations. The demand on DSN resources is growing and time allocations will have to prioritize in terms of user need. The use of the Deep Space Network is a necessity for deep space missions where distances are large. It

will also be critical for crewed missions. In order to maximize the chances that sufficient ground network resources will be available for Astrophysics Probe missions, Section 5.2.6.2 will be updated and the Final AO will include requirements similar to:

Requirement xx. *Astrophysics Probe missions shall be designed to the maximum extent possible to be able to perform routine operations without any use of the DSN. These restrictions do not apply to station hand-offs, critical event coverage, safe mode or other emergency services, radio science measurements, or navigation observations (e.g., delta differential one-way ranging or delta-DOR).*

Requirement yy. *Proposals for missions that would use the DSN for routine operations shall include a justification of the necessity of the DSN for achieving the scientific potential of the mission, to include a discussion of what changes designing without the DSN would incur on the mission concept (science, spacecraft design, operations, and cost).*

Requirement zz. *Proposals for missions that use more than eight (8) hours per week of DSN apertures for routine operations should include a justification for the reasonableness of this usage, to include a description of how the mission concept minimizes the required contact time.*

Q-40 Requirement 36 states "Missions operating beyond GEO altitude and within 2 million kilometers of Earth shall be compatible with the Lunar Exploration Ground Segment (LEGS) as applicable, ….". Some of the documents under heading 5 in the Program library describe limited data rate capabilities for the NSN. Is the intent to limit the data rates and data volumes, with the resulting constraints on the proposed science investigation?

A-40 The intent of this Requirement was not to limit data rates but to reduce demands on the Deep Space Network. Note that this requirement will be revisited in the Final AO as described in A-39.

An updated Near Space Network User's Guide is available in the Program Library. The anticipated capabilities of the LEGS, including in terms of data rates, are described in the *LEGS Brochure* available in the Program Library.

Q-41 Section 5.2.6.2 states and Requirement 37 specify the use of only a single DSN 34 meter-diameter antenna. This is inconsistent with the same section also encouraging "antenna arraying" among the examples cited. Under what conditions is "antenna arraying" encouraged?

A-41 "Antenna arraying" is not applicable to this opportunity and this example will be removed from the final AO.

Q-42 Is the "*Space Communications and Navigation (ScaN) Mission Operations and Communications Services (MOCS),* Rev 4, effective 08/13/2021" the combination of documents 5a, 5b, 5c, 5d and 5e in the Program Library?

A-42 No, the *MOCS* document is available at the link with that name, under item 5. Items 5a through 5e are additional relevant documents relating to the *ScaN* services.

Q-43 Do the Program Library documents accurately reflect the latest requirements from ScaN? What other documents are available to describe the current capabilities of ScaN that will be available for Astrophysics Probe proposals?

A-43 An updated Near Space Network User's Guide is provided in the Program Library. Proposers should use the following information:

- LEGS: The anticipated capabilities of the LEGS are described in the *LEGS Brochure* available in the Program Library.
- Other NSN Ground Stations: Summary of station characteristics for the other NSN stations is available at https://esc.gsfc.nasa.gov/static-files/NSN Services Brochure.pdf and their locations is summarized in the NSN User's Guide, Figure 5.
- Space Network (SN): Proposers should be advised that ScaN intends to migrate away from use of Tracking and Data Relay Satellite Services (TDRSS). Astrophysics Probe investigations shall meet all science requirements without the use of TDRS. This will be reflected in the Final AO.
- DSN: For those capabilities that will be allowed in the new requirement, the Deep Space Network services and capabilities are described in detail at the following link. Also see A-39 regarding DSN usage.

https://deepspace.jpl.nasa.gov/about/commitments-office/mission-documents/

Q-44 Since the requirements in B-51 for the top risks and the descopes are too different to be able to combine them easily into a single table, can these be separated into two tables.

A-44 The requirements will be changed to allow two tables in the final AO.

Q-45 *Reference Requirement 28, Systems Engineering Processes and Requirements*
To help formulate how best to reply to this requirement, could the AO provide examples of what would be considered mission unique? Systems Engineering is a mature field with established processes and requirements provided by the

handbooks and NPRs. Those processes have been applied for numerous science payloads through integration to mission operations. If the SE processes and requirements are similar to previous missions, can we assume that they are not mission unique?

A-45 That is the intent of the change. The proposal doesn't need to describe well established or textbook processes, but rather, (1) anything that is proposed to be different from the standard practice or (2) specifics of how the driving challenges associated with the proposed mission affect the systems engineering and software engineering approaches. An approach the proposing team has already used to solve a similar challenge on a previous project can still be considered "mission unique" if relevant to the particulars of what is being proposed. A paraphrase from existing process documents that applies equally to many projects would not be considered "mission unique".

Q-46 Requirement 16 in the draft AO is deferred until Step 2, but Requirement 29 calls for specific NPR and procedural requirements' deviations to be addressed. As waivers have already been deferred, can deviations also be deferred for the step-1 proposal?

A-46 Requirement 16 should not be deferred and this will be corrected in the Final AO.

Q-47 In the answer for Q-22, an MPP file is no longer required. Will the inclusion of an MPP file still be accepted?

A-47 No. As part of AO simplification, this requirement was changed to be just a table of major milestones so proposers don't have to create an entire Microsoft Project schedule in Step-1. If a proposer provides an MPP file, it will not be provided to the evaluators.

Q-48 The LSIS only gives "Performance Upper" curves for low inclination orbits. Is the baseline launch vehicle capable of reaching low inclination orbits, and if so what do the "performance baseline" curves to these orbits look like?

A-48 The updated *Launch Vehicle Services Information Summary* in the Program Library includes performance curves to low inclination orbits for both "Performance Baseline" and "Performance Upper" categories.

Q-49 For LEO, only low inclination and sun-synchronous orbits are given. What inclination maximizes the payload mass to orbit of the baseline and upper LVs for this AO? Should we assume 28.5°? Is it possible to obtain performance curves for both the baseline and upper performance LVs to whatever this max payload mass inclination is?

A-49 The updated *Launch Vehicle Services Information Summary* in the Program Library includes performance curves to a nominal 28.5 inclination orbit.

Q-50 Will a larger fairing be made available to proposers than what is currently in the *Launch Services Information Summary*?

A-50 The updated *Launch Vehicle Services Information Summary* in the Program Library provides an option for a larger volume fairing that is available only with the "Performance Upper" LV category. The Table titled *Cost Cap deltas for launch services in FY2023$M* in the Final AO will be updated to show the following reductions to the AO Cost Cap:

	Cost Cap Reduction for each Fairing	
	Standard Fairing	Larger Volume Fairing
Intermediate (Performance Baseline)	$0M	N/A
High (Performance Upper)	$50 M	$65 M

Q-51 Are there any Payload Attach Fitting (PAF) diameters available that we can baseline greater than the 47" diameter given in the Launch Services Information Summary? If so, are there any penalties to the PI-managed cost cap or any other penalties on the proposal for nonstandard services?

A-51 Proposers requiring a different PAF/separation system than the 47-inch system baselined in the Launch Service Information Summary (LSIS) should contact the LSP POC describing their plans for an alternative system. The LSP POC will provide guidance with a high-level description of the impacts the proposal should account for in terms of: fairing usable volume, delivered mass performance, and cost. While many alternative commercial PAF systems with flight history are available and present low risk, it may not be possible to quantitatively assess all impacts due to the varying degree of potential solutions across the field of candidate launch vehicles expected to be available at the time of selection. Cost impacts, if any, would be considered a non-standard mission-unique item to be included in the PIMMC. Generally, there is unlikely to be a cost or performance impact for the intermediate class missions expected under Astro Probes utilizing PAFs that are most commonly in use today across commercial launch vehicles (e.g., 2624mm vs. 1194mm). The Final AO will provide additional detail on how such an interaction with LSP should be documented in the proposal.

Q-52 The 2-page limit for J.13 is quite constraining. Would SMD consider increasing the page limit to 5?

A-52 Yes, this will be changed to 5 in the Final AO.

Q-53 For general proposal requirements, given the additional pages for "additional non-identical instrument" and "additional non-identical flight element," would SMD consider allowing an additional schedule foldout to address an additional non-identical instrument or flight element?

A-53 Two pages are outside of the section page limit. Proposers are free to use additional pages that count against their page limit.

Q-54 Historically, the Heritage appendix was unlimited, then recently was limited to 30 pages. The 15-page limit feels insufficient to adequately characterize the heritage attributes of Probe-level mission elements. Would SMD reconsider returning to a 30-page limit for Appendix J.12?

A-54 No. This limit was intentionally imposed as part of the recent AO Simplification activity.

Q-55 IV&V for flight software is required at a minimum for Cat 1 and Cat 2 missions with payload class A and B. The Probes are Cat 2 class C, which is outside of that automatic requirement, but the Chief SMA has the ultimate authority to decide whether it is required. IV&V is one of the proposal requirements we do not need to address in Step 1, but it would be good to understand the eventual expectations for addressing software IV&V for this class of mission.

A-55 IV&V will be required for Astrophysics Probe projects.

Q-56 Are there any updates on the due date for the proposal submission?

A-56 Yes, with a target date for the final Probe AO of July 2023 the proposal due date is NET mid-Nov 2023.

Q-57 Is there an update on the duration of the Phase A study?

A -57 The competitive Phase A studies will last 12 months, this information will be updated in the final AO.

Q-58 Are there any constraints on the launch window, in addition to the NLT Launch Readiness date (LRD)? In particular:

a) Is there a no-earlier-than restriction for launch readiness or the launch itself?

b) Is there a no-later-than restriction for the launch itself?

A-58 a) No, there is not an "no-earlier-than" restriction for launch readiness. As noted in section 4.3.4 of the draft AO, the Astrophysics Explorers Program's planning budget can accommodate a selection at the AO Cost Cap or Adjusted AO Cost Cap, as applicable, with a typical funding profile over a nominal approximately 6.5-year development period. Proposers should propose a funding profile that is appropriate for their investigation and is consistent with the selection, down-selection, and launch readiness in Section 3 of the draft AO.
b) Other than the NLT LRD, there are no constraints on the launch window.

Q-59 Can we include STM elements to provide mission capabilities for guest observers that are not required for the directed science portion of the mission?

A-59 As noted in Q&A 36, GO or GI programs that would require instrument modes or data processing beyond those that are used or validated for the PI-led science program, or a greater intensity of mission operations (e.g. Targets of Opportunity, solar system objects, etc.) than is envisaged for the PI-led program, should be proposed as Science Enhancement Options (SEOs). SEOs do not count towards the science merit of a proposal. STM elements may be included to provide mission capabilities for guest observers that are not required for the directed science portion of the mission; these science capabilities would then be evaluated against the baseline mission, would count towards the science merit of the proposal, and the associated costs must be covered under the PIMMC.

Q-60 Why does the Astrophysics Probe Program Library carries an older version of the LEGS information brochure when v23 is available?

A-60 The Program Library has been updated to include the LEGS Brochure v23.

Q-61 Per the NSN Users' Guide and the LEGS information brochure v23, the LEGS ground stations are identified as being X-band and Ka-band only with no S-band support. Will missions be able to use future NSN-DTE assets that may have the ability to support S-band, or is there a preference to use X-band for command, telemetry and ranging?

A-61 The LEGS information brochure v23 indicates the capability of the first three LEGS ground stations, LEGS-1, LEGS-2 and LEGS-3. X-band is preferred as it is consistent with this committed capability. However, NASA has issued a Request For Proposal (RFP) for future commercial LEGS ground stations. The requirements in the RFP call for S-band support in addition to X- and Ka-band. NASA expects that LEGS capabilities will include S-band support by the time of mission operations for the APEX mission. Therefore APEX proposers can assume S-band support available from LEGS, with the following characteristics:

- Forward: EIRP of 81 dBW, forward distortions of 1 dB max,

- Return: G/T of 28 dB/K, implementation loss of 2 dB max.

Q-62 The Artemis missions, Lunar Gateway, and other cis-lunar activities will have priority for the LEGS assets. Is it acceptable to utilize DSN for routine operations during periods where LEGS is not available?

A-62 Astrophysics Probe proposers are not to make any assumptions as to the specific times the LEGS or the DSN might be reserved for other missions. The AO calls for compatibility with LEGS for all routine operations, in order to account for other priorities on the use of ScaN assets. By designing for compatibility with LEGS, proposers will also ensure compatibility with the more capable DSN. Compatibility with both LEGS and DSN provides more flexibility for ScaN to allocate resources between various missions.

Q-63 Could a project procure commercial ground station services for command and telemetry, while also using ScaN services for science data return?

A-63 The AO allows proposing the use of commercial ground stations, whether or not combined with ScaN usage. Proposers are invited to read the AO carefully for different requirements applying to each type of service (See draft AO Requirements 33, 34, 36, 37, 38 and 86).

Q-64 Will the Page count for sections F and G be updated for the Final AO?

A-64 The page count table in the final AO will be updated to allow 28 pages + 2 pages / additional non-identical flight element in sections F and G. It will also increase the number of schedule foldouts that do not count against limit to 3.

Q-65 The 2017 Explorers and Heliophysics Projects Division (EHPD) Mission Assurance Requirements (MAR) – Class C document in the Program Library has an expiration date of September 2022. Has it been updated and will the updated version be posted in the Program Library?

A-65 The approved 2017 EHPD MAR - Class C is the version in the Program Library. A draft version that updates the expired version has also been posted in the Program Library. The draft MAR will be replaced in the Program Library by the final EHPD Class C MAR once it has been signed and the 2017 MAR will be removed.

Q-66 There are certain technologies and products (e.g. cryocoolers, detectors) that were developed by government labs for use on Astrophysics instrumentation. These unique items could be potential technology discriminators, and if made available to only one competitor, may result in an unfair competition. Can you please confirm

that items in this category will be made available, with appropriate technical support, to all proposal teams?

A-66 NASA's intent is that all proposing teams will have access to unique technologies and products developed at NASA Centers using federal funding that are not available anywhere else except at that Center. Such products and technologies can be negotiated on a case by case basis.

Q-67 Q&A-55 states that IV&V will be required for Astrophysics Probe missions. Does this mean that the NASA IV&V facility will have to perform the IV&V services?

A-67 No, the software IV&V can be performed by any qualified independent organization (as defined by IEEE). The final AO will include the language:
The NASA Science Mission Directorate Associate Administrator (SMDAA) has the authority, in consultation with the IV&V Program and the Office of Safety and Mission Assurance, to select software projects to which Independent Verification and Validation (IV&V) must be applied, as defined in NASA-STD-8739.8, *Standard for Software Assurance and Software Safety*, and NPR 7150.2, *NASA Software Engineering Requirements*. Software IV&V can be performed by any qualified independent organization (as defined by IEEE), including the NASA IV&V Center. PI teams must budget for IV&V services as part of the PI-managed mission cost. If the PI chooses to use the services of the NASA IV&V Center, the PI team will be required to contact the Office of the Director at the NASA IV&V Program to gain a preliminary understanding of the potential level of safety and software risks. The Office of the Director can be contacted at (304) 367-8248.

Q-68 Q&A-14 states that "Non-NASA contributions to the science instruments are not to exceed one-third (1/3) of the PI-Managed Instrument Cost. The 'PI-Managed Instrument Cost' is defined as the sum of the costs assigned to elements 4.0 (Science) and 5.0 (Payload(s)) in the standard Work Breakdown Structure." Is one-third of the PIMMC an absolute maximum cost?

A-68 No, that is an approximate limitation within the total value of all contributions. The AO will be updated with the following language: The size and nature of contributions will be considered during the selection process (Section **Error! Reference source not found.**). For size, NASA expects contributions to be a minority of the project element costs, with the total value of all contributions not exceeding one-third of the PIMMC. Within that constraint, it is further expected that contributions to lower-level project elements will be of a similar scale, for example with contributions to the science team being no more than approximately one-third of the PI-managed cost of WBS 4, and contributions to the instrument complement being no more than approximately one-third of the PI-managed cost of WBS 5. Regardless of the scale of non-SMD contributions, NASA considers potential over-reliance on contributions to be a programmatic factor in selection along with those discussed in Section **Error! Reference source not found.**.

Q-69 The documentation currently states, "Alternatively, an astronomical survey may comprise a set of images, spectra, or other observations of objects that share a common type or feature." May this be taken to include light curves? This would seem to be included under "other observations", but the current text is sufficiently vague that it would be good to make this explicitly clear.

A-69 Light curves are included.

Q-70 The documentation states that for the purposes of time allocation, slew time should be assigned to the observations around it. If the mission's capabilities allow it to produce a useful survey with the slew data, and those survey products are made available in a manner consistent with the requirements for a survey observatory, may this be considered a survey rather than having the time be assigned to observations before or after the slew?

A-70 A proposed survey done during slewing of the observatory would be evaluated during the APEX review process. If the survey is evaluated as being scientifically compelling then that time can be considered a survey rather than having the time be assigned to observations before or after the slew. See Q&A-25 for the constraints on the pointed observatory program.

Q-71 Q&A-61 states that APEX proposers can assume S-band support available from LEGS, with the following characteristics:

- **Forward: EIRP of 81 dBW, forward distortions of 1 dB max,**
- **Return: G/T of 28 dB/K, implementation loss of 2 dB max.**

Are there any more known constraints on S-hand support?

A-71 Yes. Due to frequency congestion or expected congestion in the proximity to lunar orbits, S-band cannot be used where interference with lunar missions can occur. Contact the ScaN POC to discuss potential APEX mission orbits and locations within those orbits where S-band will not be available.

Please Note: The following questions were submitted in response to the release of the Final AO for the 2023 Astrophysics Probe Explorers acquisition.

Q-72 The AO and the release letter include the following statement: "Proposals must be responsive to the preponderance of the mission theme's objectives as provided in Sections 7.5.3.2 through 7.5.3.4 of the Decadal Survey."

In Community Announcement #2, it says "Change 2: The European Space Agency (ESA) is considering whether the Athena mission will be substantially replanned. It is no longer practical to require proposed X-ray probes to `complement ESA's Athena Observatory.' This requirement has therefore been removed." This statement was not included in the final AO. Does an X-ray probe need to complement ESA's Athena Observatory?

A-72 No. Proposals do not need to be responsive to the portion of section 7.5.3.4 of the Decadal Survey that recommends an X-ray probe mission to complement ESA's Athena Observatory objective.

Q-73 If a proposal is submitted without a Student Collaboration (SC) and/or Citizen Science (CS) and is selected for a Phase A study, will the study team be allowed to add an SC and/or CS in the Step 2 Concept Study Report (CSR)?

A-73 Yes.

Q-74 On page B-23, the text notes that J.4 should provide a table of contributions. However, Table B0 (on page B-2) lists that appendix as 'deleted'. Is this appendix required as per Requirement B-67 or is it deleted? Previous Aos also required an 'exploded diagram' in this requirement. Is the 'exploded diagram' still required?

A-74 Table B0 is incorrect and the page limit should state "Sufficient to satisfy Requirement B-67." The portion of previous Aos that required an 'exploded diagram' in Appendix J.4 has been removed and an 'exploded diagram' is not required.

Q-75 On page B-25, the text notes that J.6 is only required for missions that could hit the Moon or other non-Earth object, and that any requirements are deferred. However, Table B0 marks J.6 simply as N/A. Should Table B0 say "N/A (deferred to Step 2)?"

A-75 Yes. As per the statement in section J.6 on page B-25, any requirement is deferred to step 2, and the page limit for Appendix J.6 should state **"**N/A (deferred to Step 2)."

Q-76 In Appendix B of the AO there is no requirement for E.3 Data Sufficiency (B-25) even though there are two sentences with "shall." Is there supposed to be a requirement in E.3?

A-76 A mistake in editing duplicated the E.4 requirement text and left off the requirement number for the actual E.3 requirement. The first paragraph will be deleted in section E.3 and the second paragraph has the new requirement number B-28A in the AO amendment.

Q-77 The updated LEGS brochure (r23) removes S-Band from the list of capabilities. Are the responses to Q-61 and Q-71 – which state that proposers can assume LEGS S-Band support – still applicable to the Final AO?

A-77 Yes.

Q-78 Section 5.5.7 of the AO states (page 58): The requirement for institutional Letters of Commitment for contributions does not apply to contributed support for Co-Is and collaborators.

Requirement 90 states: 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 (unless they are a collaborator only institution).

Are letters of commitment needed from non-U.S institutions for contributed support for Co-Is?

A-78 Yes, institutional letters of commitment are required for all contributed Co-Is. The AO amendment will remove "Co-Is" from the statement in section 5.5.7.

Q-79 Does the value of contributed Co-I and collaborator support need to be estimated and included in Table B3b?

A-79 Contributed Co-Is and collaborator support needs to be included in Table B3b. Requirement 85 states, "the costs for the contributions shall be separately identified within the Total Mission Cost" and the B3b template has a row titled "List by organization and WBS element" under contributions for the Total Mission Cost. Table B3b should include a row for each institution that is contributing Co-Is or collaborators, with a separate row if that institution is contributing hardware (since the Co-Is/collaborators should be a different WBS than hardware). Note the AO states that the Cost Table Foldouts do not count against the page limit.

Q-80 Are there any constraints on science investigations that are proposed as SEOs?

A-80 Yes. A proposed Pointed Observatory shall include a GO program that is no less than 70% of the mission observing time. The time allocated for the GO program shall not be useable by either the baseline PI-led science mission or any science investigation(s) proposed as a SEO. Requirement 15 is clarified in the AO amendment.

Please Note: Questions 81 to 92 were submitted during the Pre-Proposal Conference for the 2023 Astrophysics Probe Explorers acquisition.

Q-81 Why are alternative access to space arrangements not allowed to be considered?

A-81 That is the decision that NASA Science Mission Directorate management made for the Probe opportunity.

Q-82 Does the Diversity and Inclusion Plan have a relative weight for the evaluation criteria of the proposal?

A-82 No, the Diversity and Inclusion Plan does not have an independent weight. It will be evaluated by an independent panel, and it is Factor B-6. It is part of the overall scientific implementation merit and feasibility weight.

Q-83 Do collaborators have to spend 10% of their time in each phase or can it simply be 10% or more on average over all of Phase A-D (or B-D)?

A-83 See Q&A 23.

Q-84 Do unfunded Co-Is need individual letters of commitment (instead of just signing in NSPIRES)?

A-84 No, Co-Is don’t need individual letters of commitment as stated in Requirement 96.

Q-85 If a Co-I works for a non-US entity, does that Co-Is employer and relevant funding agency need to supply a letter of commitment for the proposal?

A-85 It is required from the responsible funding agency in the country of origin per section 5.5.7 and Requirement 90.

Q-86 Will there be individuals who are evaluating both science merit and technical, management and cost (TMC) feasibility?

A-86 No, the panels work independently in Step 1 so an individual will not be evaluating both.

Q-87 In order to plan for staffing and team availability, do you have an expected timeframe for when we might expect the clarification questions? Any guidance on when the evaluations will occur since the time between step 1 submittal and selection for step 2 has been extended?

A-87 It is anticipated that the review will start shortly after proposals are received and it typically takes at least 4-6 months. This means that the clarification questions would occur around the Spring 2024 timeframe. A letter with information regarding clarifications will be sent to proposing teams well in advance of the Potential Major Weaknesses (PMWs).

Q-88 For a Pointed Observatory, is it correct to say that the proposed time for the PI-led Guaranteed Time Observing (GTO) must be completed in 30% or less of the mission observing time? If the mission is a hybrid Pointed/Survey Observatory, how much of the mission observing time can be used for the PI-led science investigation?

A-88 For a Pointed Observatory, the PI can use at most 30% of the entire percentage of the mission observing time to accomplish the PI proposed science objectives. For a hybrid Pointed/Survey Observatory, the PI can use the entire Survey Observatory mission observing time plus at most 30% of the total Pointed Observatory mission observing time. By definition, the Survey Observatory time is entirely available to accomplish the PI's science investigation.

Q-89 Can the prime mission duration be longer than 5 years?

A-89 Yes. The mission duration is stated in Section 4.1.4 is a minimum of 5 years. Any duration of less than 5 years must be justified according to Requirement 29. There is no requirement that states a maximum mission duration.

Q-90 Will an institution who has a collaborator be forbidden from providing a reviewer?

A-90 Not necessarily. If an institution has only a collaborator, under the right circumstances a waiver can be issued. That does have to be approved officially by SMD management.

Q-91 When you say deferred, does that mean that we are encouraged not to name a PM or PSE in Step-1?

A-91 No, **but the focus of the TMC evaluation for the PM and the PSE will be their required qualifications and experience as described in Section G of the proposal,**

more so than their individual resumes. ~~but if a PM or PSE is named in Step-1, the TMC will review the qualifications and possibly provide findings (strengths or weaknesses) on that individual. Also, if a person is named in the proposal, then per section 4.2.5, any replacement, addition, or removal of that person during step-2 will require concurrence by NASA prior to the CSR submission.~~ ~~The response during the PPC stated that the individual's expertise would not be evaluated, which was incorrect as explained above.~~

Q-92 Who will evaluate the programmatic factor of the contribution limit?

A-92 The panel evaluating the TMC feasibility will provide a comment to the Selection Official with the size and nature of the contributions, and the Selection Official may consider it as one of the programmatic factors as described in Section 7.3.

Please Note: End of questions during the Pre-Proposal Conference for the 2023 Astrophysics Probe Explorers acquisition.

Q-93 In Requirement 60 and Appendix B, Requirement B-75, Appendix J.10 is required "only for proposals submitted by NASA PIs or NASA Centers (excluding JPL)." If the proposal is from an institution other than a non-JPL NASA Center, but the PI is at a NASA center, is appendix J.10 required in the proposal?

A-93 Yes, appendix J.10 is required whether the proposal is submitted by a NASA PI or a NASA center according to the NASA FAR Supplement, section 1872.306 Proposals submitted by NASA investigators.

Q-94 Will the proposal due date and dates for upload of the Augmented Submission files into NASA Box be delayed in the event of a potential government lapse in funding?

A-94 Yes, there will be a day-to-day slip with any potential lapse in funding, skipping government holidays and weekends for both the proposal and the augmented submission. An amended AO will be released once any potential lapse ends.