2018 Heliophysics Technology Demonstration Mission of Opportunity Questions & Answers

Change Log		
Rev.	**Date**	**Description of Changes**
01	05/14/2018	Added Q&As 1–3
02	05/22/2018	Added Q&As 4–6
03	05/29/2018	Added Q&A 7
04	06/07/2018	Added Q&As 8–10
05	07/05/2018	Added Q&As 11–12; Added final sentence to A 2
06	07/23/2018	Added Q&As 13-14
07	07/24/2018	Added Q&A 15
08	08/06/2018	Added Q&As 16-22
09	08/20/2018	Added Q&A 23
10	08/20/2018	Added Q&A 24
11	09/07/2018	Added Q&As 25-55 Amended Q-2: Modified High Energy Earth Orbit C3 range. [Edits in ***bold italics*** in question response] Q-22 superseded by Q-39
12	09/12/2018	Added Q&A 56
13	09/21/2018	Added Q&A 57
14	09/24/2018	Added Q&As 58-59
15	09/25/2018	Added Q&A 60
16	10/01/2018	Added Q&A 61–65 Note: Q-61 is related to Q-45 Note: Q-65 is related to Q-28
17	10/03/2018	Added Q&A 66
18	10/17/2018	Added Q&A 67-68
19	10/18/2018	Added Q&A 69
20	11/19/2018	Added Q&A 70
21	11/28/2018	Added Q&A 71

Q-1 Will the FINAL TechDemo MO PEA require launches on the IMAP EELV?

Yes. Investigations proposed for the TechDemo MO must be a secondary payload on the IMAP EELV. The DRAFT 2018 Heliophysics Science MO PEA that was released on May 4th includes launches on the IMAP ESPA as an option.

Q-2 Can additional details regarding the release of the TechDemo SCM(s) from the IMAP EELV be provided? Will the EELV be on a transfer orbit to the Earth-Sun L1 Lagrange point? If so, would a TechDemo SCM need to provide its own delta-V (i.e., propulsion) to enter into an orbit about the Earth-Sun L1 Lagrange point? Finally, if an SCM were not to change orbit from the initial L1 transfer orbit, what sort of orbit would the SCM be on—heliocentric or geocentric?

At this stage in the IMAP mission development, its trajectory and consequently that of the TechDemo SCM(s) is still to be determined. *NASA's Multi-Mission Payload, Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA) System Interface Specifications (SIS) For Heliophysics Missions of Opportunity* (available in the Program Library [https://soma.larc.nasa.gov/STP/tdmo/tdmo-library.html] as item 1 under PEA Specified Documents) specifies a range of orbits proposers must currently account for:

> High Energy Earth Orbit (C3 = ~~-0.8 to -0.1~~ ***-0.68 to -0.48*** km^2/s^2)
> Escape (C3 = 0 km^2/s^2 or higher)

Note that the characteristic energies above may be updated prior to the release of the FINAL TechDemo PEA.

Regarding orbiting the Earth-Sun L1 Lagrange point, a TechDemo SCM would need to provide its own delta-V capability. Proposers should not assume that the IMAP EELV will perform any maneuvers specifically for a TechDemo SCM after the release of IMAP.

TechDemo SCM releases will not occur until after the release of IMAP [added 07/05/2018].

Q-3 The Community Announcement said that the ESPA was "intended to be an unpowered, non-propulsive ESPA Grande ring". However, the DRAFT PEA only specifies an ESPA, which provides fewer critical resources. Please clarify.

Accommodations will be provided on an ESPA Grande. Interface requirements, including mass and volume limits, are specified for a 5-port ESPA Grande in *NASA's Multi-Mission Payload, Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA) System Interface Specifications (SIS) For Heliophysics Missions of Opportunity*. While a 4-port ESPA Grande may be utilized instead, the interface requirements for it are essentially identical to those for the 5-port ESPA Grande, save for the Rideshare Payload (RPL) Volume Stay-Out Zone represented by Figure 4.2 in the current SIS. The SIS will be updated to specify the enveloping characteristics of potential ESPA Grande and Launch Vehicle combinations—an existing example of which is the "Allowable RPL Volume" of 42"x46"x38" in Table 4.1 of the current SIS.

Q-4 Can the use of two ESPA ports be proposed?

Yes, although doing so would put the proposal in direct competition with any ESPA-based proposal, whereas a single-port mission with a sufficiently low PIMMC might be able to be paired with another single-port mission.

Q-5 Where can we find out information on the mass/volume of the payload that can be accommodated on the ESPA?

Not-to-exceed mass and volume specifications are given in the "ESPA Class Payloads Interface Requirements" section of *NASA's Multi-Mission Payload, Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA) System Interface Specifications (SIS) For Heliophysics Missions of Opportunity* in the Program Library.

Q-6 The Community Announcement stated that "ESPA is intended to be an unpowered, non-propulsive, ESPA Grande ring." Does that mean ESPA-based missions cannot have their own propulsion systems?

Propulsion systems on ESPA-based missions are not prohibited.

Q-7 Can investigations that are already funded for Phase A be proposed?

Yes. However, if selected, a Concept Study Report for the investigation would still need to be submitted for down-selection consideration. Note that per SALMON-3 Section *5.7.6 Contributions*, "[t]he cost of contributions does not include funding spent before the start of the investigation (i.e., before initiation of Phase B)."

Q-8 Evaluation Factors A-5 and B-6 on Science Enhancement Options (SEOs) state "[a]lthough evaluated by the same panel as the balance of [Criterion A and B] factors, this factor will not be considered in the overall criterion rating." The use of these factors in the selection is unspecified. Thus, it is difficult to assess the contribution of SEOs to the merits of the overall proposal. It is unclear how much effort should be put into describing SEOs in proposals.

Findings under Factors A-5 and B-6 do not contribute to Criterion A and B ratings, respectively, due to SEOs not being part of Baseline Investigations. However, findings under the factors may be considered by the Selection Official(s), who according to SALMON-3 Section 7.3 Selection Factors "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".

Q-9 DRAFT PEA Section *4.3.2 Delivery of Data to Archive* identifies "data products … low-level (raw)… high-level (processed) data" as archival data products; it also identifies "related software and/or other tools necessary to interpret the data". Are those tools for raw data, processed data, or both?

Both.

Q-10 Either DRAFT PEA Requirement tbd-1 or tbd-3 appears to be redundant. If this is not the case, can the difference between them be addressed?

Requirement tbd-1 represents an update to Requirement tbd-3, which will be removed in the FINAL PEA.

Q-11 The DRAFT PEA indicates that "alternative configurations (e.g., a second ESPA) may be considered subject to compatibility with the IMAP launch and operational constraints". Please expand on the option.

Alternative IMAP EELV configurations will not be offered in the FINAL PEA.

Q-12 The DRAFT PEA ties certain due dates to the IMAP Launch Readiness Date. Has the date been established?

Yes, the IMAP Launch Readiness Date is NLT October 1, 2024.

Q-13 If, in the process of demonstrating a new technology, scientifically useful data is to be collected, processed, and put into a public archive, how does this weigh into the evaluation? Factor A-1 seems to only assess the value of the demonstrated technology; no value is placed on any associated science.

The interpretation is correct. DRAFT PEA Section 1.1 states: "[p]roposal merit will be determined by the magnitude of heliophysics science advancements enabled by the proposed TechDemo investigation … [w]hether the targeted science advancement is achieved during the TechDemo investigation, or during some future mission within the specified timeframe, will not be a factor in the evaluation criteria." Scientifically useful data collected in the course of demonstration of the enabling capability of proposed technology(ies) will impact the evaluation of proposed Baseline and Threshold Investigations only to the extent that it facilitates the demonstration. As described in DRAFT PEA Section 4.3.1, the PI is responsible for analysis of the investigation data necessary to complete the proposed investigation. Sufficient PIMMC funds must be proposed to collect, process, analyze, and archive the data. However, activities that further address the inherent scientific impact of the data will be considered SEOs, and should be proposed as such for evaluation. This will include science that is not directly related to or

necessary for the demonstration of the proposed technology(ies) and/or required measurements that extend past the end of the Baseline Investigation.

Q-14 Will the evaluation and selection of TechDemo proposals reflect a higher risk tolerance than typical SMD science opportunities?

This opportunity is uniquely open to high risk, high reward investigations. The PEA specifically enables this by superseding SALMON-3 with lower TRL requirement at PDR, a waiver of technology development backup plans, and allowance of a higher fraction of costs to be expended prior to the Preliminary Design Review. The evaluation process for the TMC Feasibility of the Proposed Investigation Implementation criterion itself will not change. Instead, recommendations to the Selection Official will emphasize the return from investigations with higher risk ratings than has historically been the case for SMD science investigations.

Q-15 When is the FINAL TechDemo PEA to be released?

NASA expects the FINAL TechDemo PEA to be released in August.

Q-16 Are there any overall guidelines for utilization of *NASA's Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter System Interface Specification For Heliophysics Missions of Opportunity*?

- As secondary payloads, proposed TechDemo investigations are completely dependent on IMAP mission timeline and parameters.
- The IMAP launch vehicle will not be selected until 36 months (estimated) prior to launch. In addition, IMAP mission requirements will continue to evolve. As such, it is critical that secondary payloads carry additional margins to account for any associated applicable uncertainty.
- All ESPA Grande accommodations assume standard ascent ground rules and payload separation sequences, which may vary based on IMAP requirements.
- Since this is an iterative process, the ESPA SIS will be updated periodically and it is each proposer's responsibility to check for updates. A cut-off date for updates will be established and relayed at the Preproposal Conference—it will not be any later than 30 days before proposals are due.

Q-17 At what Earth-centered altitude or geocentric distance will the primary spacecraft separation from the LV and ESPA occur?

IMAP will separate from the LV at an Earth-centered altitude of ~500km. This could vary on the order of +/- 200km depending on the LV and the mission design, but it will certainly occur in the low-Earth realm.

Q-18 At what time after launch will the primary spacecraft separation from the LV and ESPA occur?

In the case of a "short" park orbit coast, IMAP will separate from the LV ~30 minutes after launch. In the case of a "long" park orbit coast, IMAP will separate from the LV ~75 minutes after launch. This coast duration will depend on IMAP requirements and the LV mission design.

Q-19 How long after separation of the primary spacecraft from the LV and ESPA may RPL separation and maneuvers begin?

Based on typical CCAM (Contamination Control Avoidance Maneuver) sequences, RPL separation would likely be able to occur ~7 minutes after IMAP separation. This could vary (most likely would only increase) based on the design of the CCAM and any hardware / integration requirements.

Q-20 Would it be possible to protrude on the X-axis within the ESPA port, using potentially empty space inside the ESPA ring? If so, what would be the allowable length for this protrusion?

At this time, we are unable to commit to this volume being available for protrusion due to the unknowns in proposal responses. Proposers are allowed to propose using this volume, which will be assessed during proposal evaluation. However, backup plans must also be provided in the case that the volume cannot be made available.

Q-21 Per Figure 5.2 (section 5.2.2.1) of the ESPA SIS (7-10-18 version), a dynamic clearance stay-out zone of 2"x 2" must be added on the inboard vertical corners of the RPL allowable volume. However, the figure does not clearly show the shape of this zone. Is it a square of 2" per side, or a right triangle of 2" per leg?

After further investigation, it was recognized that the PEA-provided separation system width of approximately three inches will extend the RPL away from the ESPA ring. This will create a larger gap between RPLs so that a stay out zone will no longer be required, which will be reflected in a future update of the ESPA SIS.

~~Q-22 Per section 5.2.2.3 of the ESPA SIS (7-10-18 version), the RPLs are required to have the ability to add ballast. Are there any restrictions on where this ballast would need to be added, or its maximum magnitude?~~

~~RPLs need to have the ability to add ballast such that the combined mass of the RPL and ballast can vary up to the maximum mass requirement of 320 kg. The required minimum ballast mass has not been established. Any ballast mass must remain within the defined volume limits, as well as maintain compliance to the CG requirement 5.2.2.2.~~
[Q-22 was superseded by Q-39 on 7 Sep 2018.]

Q-23 In Section 6.2 of the PEA, the *Proposal Structure and Page Limits* table shows several items with strike through. In particular, can you clarify why Appendix J.7 "Discussion of End-of-Mission Spacecraft Disposal Requirements" is struck out?

Appendix J.7 "Discussion of End-of-Mission Spacecraft Disposal Requirements" is struck out, because it is not required for the Step-1 proposal, but rather deferred until Step 2. This is stated in Section 8.2 of the PEA "Exceptions to General SALMON-3 Requirements": "SALMON-3 AO Requirement 53 and Requirements B-73 through B-76 on orbital debris and disposal are deferred for this Step One of the Two-Step evaluation process". These requirements are typically deferred in Two-Step evaluations.

Q-24 What are the requirements for DSN Aperture Fees? This is not addressed in the PEA.

This topic was addressed with the SALMON-3 release. From SALMON-3, Section 5.3.11: "A cost estimation algorithm for the DSN and persons to contact to obtain costs for other networks and various Government-operated facilities are contained in the *NASA's Mission Operations and Communications Services* document or at the DSN Future Missions Planning Office website at http://deepspace.jpl.nasa.gov/advmiss/. For assistance with the cost calculation, contact the persons named on the website. **Proposers to this AO should compute the estimated DSN Aperture Fees and report this in their proposal as a means of assessing the reasonableness of the proposed DSN use. DSN Aperture Fees should not be included in the PI-Managed Mission Cost nor should they appear in any cost table.**"

Note that the URL listed in the SALMON-3 is no longer active. The URL to access now is:
https://www.jpl.nasa.gov/deepspace/about/commitments-office/proposal-preparation

For DSN Services contacts, see: https://deepspace.jpl.nasa.gov/about/commitments-office

For SCaN Services contacts, see:
https://www.nasa.gov/directorates/heo/scan/csp/scan_services_contacts

Q-25 The PEA states that the PI cannot be changed between submissions of the Notification Proposal and the Full Proposals. Are there any exceptions to this?

There are no exceptions. This requirement is necessary in order for the Science and TMC panels to be formed with unconflicted evaluators in time for the evaluations.

Q-26 Will the TechDemo MO call be open to Non-U.S. institutions?

Non-U.S. institutions are welcome to submit proposals. Per SALMON-3 Section 5.8.2 *General Guidelines Applicable to Non-U.S. Proposals and Proposals that include Non-U.S. Participation*, "All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S.".

Alternatively, non-U.S. institutions may participate by way of contributions to U.S. proposals. However, there is a limit for the TechDemo PEA. From Section 5.6.4 of the PEA, "… and (ii) in order to ensure a preponderance of NASA interest in the mission, as well as to ensure that missions of roughly comparable scope are proposed for purposes of equitable competition, the sum of contributions of any kind to the entirety of the investigation is not to exceed one-third (1/3) of the proposed PIMMIC (see SALMON-3 Section 5.7.6)."

Please note the following excerpt from SALMON-3 Section 5.8.1 *Overview of Non-U.S. Participation*:
Owing to NASA's policy to conduct research with non-U.S. entities on a cooperative, no-exchange-of-funds basis, NASA does not normally fund non-U.S. research proposals or non-U.S. research efforts that are part of U.S. research proposals. Rather, cooperative research efforts are normally implemented via agreements between NASA and the appropriate non-U.S. entity. Non-U.S. proposers, whether as primary proposers or as participants in U.S. research efforts, must arrange for non-U.S. financing for their portion of the research.

Finally, per SALMON-3 Section *5.8.1 Overview of Non-U.S. Participation*, "[t]he direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted."

Q-27 Would an investigation hosted on another agency's spacecraft be compliant with the TechDemo PEA?

No. The TechDemo PEA only allows for Small Complete Missions (SCMs). Partner Missions of Opportunity (PMOs) are not an option. (See Presentation 2, Slide 13, of the 24 August 2018 Preproposal Conference.) Nor is alternative access to space—including hosted payloads—offered as an option. While the non-PEA provided spacecraft could be provided as a contribution, Section *5.6.4 Contributions* limits the value of the sum of all contributions to one-third (1/3) of the proposed investigation's PIMMC.

Q-28 Many recent solicitations—including 2016 Heliophysics Explorer MO—have allowed extra pages to be distributed between Sections D–G, as desired. Can this option be extended to this solicitation?

Yes. Any extra pages allocated in the "Proposal Structure and Page Limits" table may be distributed between Sections D–G, as desired. **[see related Q-65 posted 10/1/18]**

Q-29 Can information, specifications, and CAD models of the RUAG PAS 610S be provided in the Program Library?

The following CAD models for the RUAG separation system PAS 610S will be provided:

- S0001-941_Activering610.stp
    - This active ring model shows the separation system ring that stays attached to the ESPA Port. It shows details of the ring and locations for mounting hole, spring brackets, and connector brackets.
- S0001-942_Passivering610.stp
    - This passive ring model shows the separation system ring that is the fly away portion of the separation system. The passive ring stays attached to the spacecraft when deployed. The model shows details of the ring and locations for mounting hole, spring tab, and connector brackets.
- Release Envelope PAS 610S.stp
    - This model shows the stay-out zones that must be maintained from integration through deployment.
- Installation Envelope PAS 610S.stp
    - This model shows the stay-out zones that are required for RPL installation.

Q-30 Can the IMAP LV upper stage be commanded to point in a specific direction when an RPL is released?

Yes, the launch vehicle upper stage will be able to accommodate pointing of the RPL prior to deployment. If pointing is required, the pointing requirement must be clearly defined in the proposal.

Q-31 Can the IMAP LV upper stage be repointed such that a second RPL can be ejected in the same direction as the first RPL?

Yes, the upper stage will be able to repoint such that a second RPL can be ejected in the same direction as the first RPL provided sufficient launch vehicle performance margin exists. The proposal must provide analysis clearly showing that no contact will occur between the two RPLs ejected along the same path.

Q-32 If two ports are used on the IMAP ESPA Grande, how much time will pass between the release of the first and second RPL?

The time between deployment of each RPL will be approximately 2 minutes.

Q-33 Can the IMAP LV upper stage be stabilized such that it is not rotating at the moment an RPL is released?

Yes, the upper stage is routinely stabilized as an inertial platform pointing in the required direction at the moment an RPL is released.

Q-34 Would the IMAP LV be able to accommodate a spinning release of an RPL?

No, the launch vehicle upper stage will act as a three-axis stabilized, inertial platform and it is the responsibility of the RPL to impart any additional characteristics.

Q-35 Can a spacer be installed between the separation system and the ESPA port, in order to move the RPL further away from the port interface plane? This spacer could remain with the ESPA after the RPL gets deployed to gain clearance for protrusions along the X-axis.

Yes. The thickness of the spacer will reduce the x-axis dimension from the envelope available to the RPL. The spacer and RPL design will still have to conform to all requirements in the *ESPA SIS*. The spacer must remain with the ESPA for the configuration in question.

Q-36 Are there any constraints as to how many separation springs an RPL can choose to have? RUAG material says 4 to 10.

Proposers are constrained to a minimum of 4 springs and a maximum of 8 springs for use with the RUAG PAS 610S.

Q-37 If an RPL has to carry ballast, can the ballast be ejected from the RPL?

No, ejecting non-valued and uncontrolled space debris will not be permitted based on orbital debris policy.

Q-38 Does the RPL have to be powered off from the time of integration through deployment?

No. While the current *ESPA SIS* (Effective Date: August 2, 2018, Revision 1) requirement 5.3.1.1 indicates that the RPL has to be powered off from the time of integration to deployment, it will be modified to state: "RPLs shall be powered off during all integration and hazardous operations and from launch through deployment. RPLs can be powered on from time of integration to just prior to launch only for battery charging and hazardous system monitoring." A new requirement (5.3.1.2) will be added to the next revision of the *ESPA SIS* to establish a RPL T-0 electrical interface deadface (electrical isolation) requirement at T-5 minutes prior to primary mission launch.

Q-39 Does the IMAP ESPA RPL have to ballast up to 320 kg?

No. This *ESPA SIS* requirement has been removed. Overall system CG ballasting is anticipated to be achieved by arrangement of RPLs around the ESPA and mass retained on the ESPA ring.

Q-40 Does the ballast need to fly away with the RPL, or can it stay with the ESPA ring after RPL separation?

The ballast can stay with the ESPA ring.

Q-41 What is the expected range of inclinations of the IMAP injection orbit and thus secondary payload orbits after separation of IMAP from the Launch Vehicle?

The target for the Declination of the Apogee Vector (DAV) (DAV is the equivalent of inclination for a near-escape orbit like IMAP) has not been established at this time. The only current indication of this quantity is found in the IMAP mission where it is stated that the L1 Lissajous orbit for IMAP is designed for a range of Sun-Earth-Probe angles between 4.6 degrees and 9.4 degrees during the mission.

Q-42 What is the timeline from launch for the deployment of the primary payload (IMAP) and the disposal burn?

The following is a notional description of the timeline:

- In the case of a "short" park orbit coast, the primary spacecraft will separate from the LV ~30 minutes after launch.
- In the case of a "long" park orbit coast, the primary spacecraft will separate from the LV ~75 minutes after launch. (This coast duration will depend on the primary spacecraft requirements and the LV mission design.)

- Based on typical CCAM (Contamination Control Avoidance Maneuver) sequences, RPL separation would likely begin approximately 7 minutes after primary spacecraft separation. This could vary (most likely would only increase) based on the design of the CCAM and any hardware / integration requirements.
- Time between RPL deployments will be around two minutes.

Q-43 After deploying the primary payload (IMAP), can the LV perform a delta-V maneuver(s) prior to deployment of a secondary?

No.

Q-44 Would NASA consider providing a different sized RUAG separation system and/or the reducing adaptor?

No.

Q-45 Can a PI-managed team mount a non-deploying adapter directly to the ESPA 24" port which reduces to a 14" diameter separation system?

No. NASA specified a standard interface and made it a requirement in order to simplify and standardize the development and the mission integration cycle. **[see related Q-61 posted 10/1/18]**

Q-46 Can the ESPA system accommodate the actuation of two separation systems stacked on one port?

Yes, but the second separation system (between RPLs) must be approved by NASA, and the proposer will be responsible for the cost of the additional separation system. Also, the second separation system must remain connected to the spacecraft to ensure no space debris is deployed. The molecular particulate contamination characteristics of any separation system is a critical issue in the NASA approval criteria.

Q-47 Would it be possible to accommodate a mechanical connection between two adjacent ESPA ports?

No, a mechanical connection between two ESPA ports would violate the allowable RPL volume specified in the *ESPA SIS*.

Q-48 Would it be possible to accommodate an electrical connection between two adjacent ESPA ports?

No, an electrical connection between two ESPA ports would violate the allowable RPL volume specified in the *ESPA SIS*.

Q-49 Is battery charging allowed until T-0?

No. Battery charging is allowed until T-5 minutes, at which time the circuits will be deadfaced (electrically isolated) since live circuits are not permissible at the time of interface separation. A new *ESPA SIS* requirement (5.3.1.2) will be added to capture this requirement.

Q-50 Can a T-0 purge be provided to the RPLs?

Yes, it can be provided upon request as a GFE mission-unique service. Associated requirements must be clearly stated in proposal.

Q-51 For a CubeSat constellation, can they fly at a certain distance from each other such as a formation flying?

Yes, but they must provide analysis demonstrating no re-contact to preclude the generation of orbital debris.

Q-52 Can a CubeSat dispenser (holding one or more CubeSats) be proposed for an IMAP ESPA Grande port?

Yes, the PI-managed-team-provided dispenser system(s) will need to be hard-mounted to the ESPA port. Only the CubeSats will be deployed. See section 5.6 U-Class Containerized (CubeSat) RPLs Requirements.

Q-53 Is the peak line load across the ESPA/RPL interface at the separation system to ESPA ring interface, or at the spacecraft separation plane interface?

The peak line load across the ESPA/RPL interface is defined at the actual separation plane between the active and passive (fly away) half of the separation system.

Q-54 How soon after separation can an RPL expect to get DSN contact?

Nominally, contact will be established once the spacecraft is powered on sufficiently and is oriented to downlink to Earth. For example, MarCO (secondary payload on Insight) acquired contact within 3 minutes.

Q-55 How frequently, and for how long, will it be possible for any one RPL to recontact the DSN for commissioning activities?

As often as required within the constraints of the DSN schedule.

Q-56 From page 1 of the solicitation there are various text statements regarding TRL:

1. **"…innovative medium Technology Readiness Level (mid-TRL) technologies that enable significant advances in NASA's Heliophysics Science Objectives."**
2. **"The TechDemo investigation might inform the mission recommendations of the next heliophysics decadal study by raising the TRL of a key technology to the point it is no longer considered a defining risk to those missions."**

Is the "key technology" referred to in number 2 above a subsystem TRL or system TRL?

The technology to be demonstrated can be either a WBS-level-3 system or a subsystem or a component thereof. In any of these cases, the technology will have to be raised to at least TRL 5 by PDR as required in PEA Section 2.2 *Heliophysics Technology Demonstration Objectives and Goals*, due to the system-level TRL being constrained to the lowest TRL of any subsystem and/or component of the system. Naturally, proposals must describe in detail further development required for the baseline investigation to successfully demonstrate the technology in space. Finally, if additional development to enable or enhance future investigations is necessary (e.g., to address scaling of a capability), proposals must describe it in Section D (Technology Investigation) and/or Section E (Experiment Implementation).

Q-57 What are the steps for submitting a Notification Proposal in NSPIRES? Where will we see the "PEA-specific questions"?

The Notification Proposal is created in NSPIRES by selecting "create proposal" (do not select "create NOI"). The authorizing official for the PI's organization must then submit it. Once the proposal record is created in NSPIRES, the questions may be seen under the "Program Specific Data" link.

Q-58 Why has the trajectory characteristic energy (C_3) range for the IMAP mission varied significantly from the draft ESPA SIS to the newly released Revision 2 (dated September 18, 2018)?

In the DRAFT release of *NASA's Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA) System Interface Specifications (SIS) For Heliophysics Missions of Opportunity*, Section 5.1 stated RPLs should consider a range of orbit insertions from C_3 = -0.8 to -0.1 km^2/s^2 for non-escape trajectories. Due to IMAP mission maturation, the initial release of the ESPA SIS (dated July 5, 2018) changed the range of trajectories to C_3 = -0.59 to -0.57 km^2/s^2. However, further investigation uncovered a magnitude error in the C_3 range calculations which has been corrected in the latest version of the ESPA SIS (Revision 2, dated September 18, 2018), which now states the range of trajectories to be **C_3 = -0.68 to -0.48 km^2/s^2**. Proposers should not expect the C_3 range to vary from these values before the proposal due date.

Q-59 Table 5.2 in the ESPA SIS Revision 2 (dated September 18, 2018) swaps the labeling of the dimensions on the X and Z axis when compared to previous versions of the ESPA SIS and the dimensions shown on slide #5 of the Preproposal Conference (PPC) presentation on IMAP ESPA Grande Accommodations by Garrett Skrobot. Was this intentional?

Yes, the correct maximum allowable dimensions are 38" in the X-axis and 46" in the Z-axis and the axis definitions in Figure 5.2 are correctly shown in Revision 2 of the ESPA SIS. An updated PPC presentation by Garrett Skrobot was posted on September 24, 2018 to the PPC website and is available for download.

Q-60 Section 6.1.2 *Required Notification Proposal* lists the required content for the Notification Proposal. Item (d) is as follows:

(d) A brief statement (4000 characters or fewer) covering the following:

1. technology objectives of the proposed mission;
2. general design or architecture of the mission;
3. identification of the technology to be demonstrated as part of the mission; and
4. identification of other instrumentation and systems that may be employed as part of the mission.

Is #4 above referring to other instrumentation and systems that are employed as part of the mission, but whose technology is not being demonstrated? Or is #4 referring to synergistic opportunities with other missions?

Item #4 above is referring to the other instrumentation and systems that are employed as part of the mission, but whose technology is not being demonstrated. Parts 1 through 4 of

item (d) together provide important information for planning purposes; in particular, it will identify skills needed for the evaluation panels.

Q-61 Can the answer to Q-45 be modified to allow a non-deploying reducing adapter if the proposing team is responsible for the procurement and mass of the adapter and any separation system cabling extensions (e.g., pigtail) needed to enable this change?

Yes, because we are allowing a non-deploying ballast ring attached to an ESPA port, a non-deploying adapter (whether reducing or not) essentially has the same characteristics. The proposing team is responsible for the procurement and mass of the non-deploying adapter and any separation system cabling extensions (e.g., pigtail). It is important to note that this adapter will reduce the available distance along the X-axis dimension of the allowable envelope.

Q-62 What is the anticipated Right Ascension and Declination of the target vector outgoing asymptote imparted to IMAP by the launch vehicle upper stage?

The IMAP orbit has a C3 < 0, so there is no asymptote vector. Right ascension and declination of the apogee vector (RAV and DAV) are synonymous to Right ascension of Launch Asymptote (RLA) and Declination of Launch Asymptote (DLA) in this type of orbit. The anticipated RAV is 201.37 degrees, and the anticipated DAV is -0.49 degrees.

Q-63 How long after launch (or separation) can we expect the RPL to be in full sunlight?

The launch vehicle is expected to enter full sunlight 9 minutes after the Transfer Trajectory Insertion (TTI) state provided in the slide entitled "IMAP Transfer Trajectory Initial State" available in the Program Library, PEA Specified Documents section.

Q-64 Could the LV RFP include a requirement to reduce the LV upper stage 3 sigma dispersions as much as possible using current technology (e.g., use the upper stage RCS thrusters to refine the trajectory based on GPS inputs)? Upper stage 3 sigma dispersions without this feature result in widely varying RPL trajectories, and the impact of this trajectory unpredictability is expected to reduce the cumulative value of the RPL missions by much more than the cost of minimizing the LV dispersions.

Thank you, we will take this under consideration when the time comes to provide requirements for launch vehicle acquisition.

Q-65 The answer to Q-28 for PEA L of SALMON-3 states that any extra pages can be distributed in sections D-G as desired, but Requirement L-33 in the PEA has not been changed to reflect that answer. Does the answer to Q-28 supersede Requirement L-33 in the PEA, or will an amendment need to be issued to make this go into effect?

Regarding the distribution of extra pages across sections of a proposal, PEA Requirement L-33 could be interpreted in more than one way. The Q-28 in the Q&A file serves to clarify that the pages can be distributed as desired across Sections D-G; e.g., if only one of the two extra pages for SEOs is used, the other extra page could be used in Section F, if desired.

Q-66 Does the RPL allowable volume on the X-axis (38" long) exclude the separation system width (per section 5.2.2.1 of the ESPA SIS 7-10-18 version)? According to the Atlas V User's Guide, page 9-4, the separation system height should be included. Please clarify whether or not the separation height should be included within the RPL allowable volume.

The RPL allowable dimension on the X-axis (38" long), includes the separation system dimension. This means separation system width will be subtracted from the 38" allowable dimension. The RPL X-axis dimension plus the separation system dimension will have to be less than 38" long. This was corrected in the ESPA SIS Revision 2, dated September 18, 2018.

Q-67 How would DSN/NEN identify each RPL among many that are deployed in close proximity?

The straight forward answer is by frequency. Each Rideshare Payload will have a receiver and the ground will lock to that spacecraft's frequency per normal. There will be enough separation in frequency for each Rideshare Payload to preclude interference.

There are other options available:

1) Beacon mode. A project could opt to use a beacon for the ground to lock to initially. They would follow that up with an uplink sweep when scheduled and the project would command on their telemetry. From that point on it looks exactly like the aforementioned approach.
2) Blind acquisition. The project awaits an uplink sweep with no downlink at all. Once we perform the sweep the project will command on telemetry.
3) Other modes possible:
    a. Open loop recording. The DSN would record the raw spectrum encompassing the projects frequency bandwidth. The recording would be sent to a team who would isolate the frequency and retrieve telemetry. All of this occurs in a non-realtime manner of varying degrees of latency.

All of the aforementioned modes can be accomplished in Multiple Spacecraft Per Aperture (MSPA) which is how the ground intends to support the several smallsats on EM-1.

These are all of the possible ways that the DSN can support presently. The straight forward approach – frequency – is used nearly 100% of the time. That approach includes a project's use of safe mode for initial acquisition.

Q-68 Are the proposal page limits for both 2018 Helio MO PEAs consistent with recent SALMON MO PEAs?

Yes, the 2018 Helio MO PEAs are in line with the 2016 Helio MO, which included small complete missions. Note that proposal page limits for SALMON MO PEAs are lower than full mission AOs (e.g., 2016 Helio SMEX AO).

Q-69 The following is from the TechDemo PEA L, Section 6.1.2 (Amendment 9, released 9/26/18):

The technology objectives of the proposed mission and the PI, ~~Co-I,~~ and institutions cannot be changed between submissions of the Notification and the Full Proposals. **Requests for changes to Co-Investigators after the Notification Proposal submission must be approved by NASA before this is allowed; these requests for changes must be submitted to the PEA POC through the email address hq-techdemo@mail.nasa.gov as soon as possible, but no later than 2 weeks before the due date for Full Proposals. [amended September 26, 2018]**

Can changes to Co-Is include changes to the institutions?

Requests for changes to Co-Is resulting in new institutions not already specified in the submitted Notification Proposal are possible. *However, this adds to the likelihood the change will not be accepted in the case it imposes new institutional constraints on the review panel.* An institution that is removed is an acceptable change.

Q-70 SALMON-3 Requirement 47 states that costs for services are described in the document entitled *NASA's Mission Operations and Communications Services*. This document does not describe any Non-Recurring Engineering (NRE) costs given in the mission cost estimate provided by the POC. Should these costs be included in WBS 7 and within the PIMMC?

The document entitled *NASA's Mission Operations and Communications Services* was revised March 26, 2018 and has been retitled *Space Communications and Navigation (SCaN) Mission Operations and Communications Services (MOCS)*. The latest revision is located in the Program Library under SALMON-3 Specified Documents item 7. Proposers are strongly encouraged to check the Program Library for the correct document revision pertaining to this solicitation. Section 5.1 of the *SCaN MOCS* document in the Program Library describes NRE costs. These costs should be included in WBS 7 and within the PIMMC.

Q-71 Can letters of endorsement be included in the proposal?

Letters of support do not include "letters of affirmation" (i.e., letters that endorse the value or merit of a proposal). NASA neither solicits nor evaluates such endorsements for proposals. The value of a proposal is determined by peer review. If endorsements are submitted, they may not be submitted as an appendix. They must be included as part of the proposal and must be included within the required page limitations even though they will not be considered in the evaluation of the proposal.