2018 Heliophysics Science Mission of Opportunity Questions & Answers

Change Log		
Rev.	**Date**	**Description of Changes**
01	05/11/2018	Added Q&A 1
02	05/18/2018	Added Q&As 2-6
03	07/02/2018	Added Q&As 7- 12 Amended Q-1: Replaced the incorrect section title *New Technologies/Advanced Engineering Developments*
04	07/10/2018	Added Q&A 13
05	07/24/2018	Added Q&A 14
06	07/27/2018	Amended Q-13: Added "Proposed investigations utilizing the NASA-PEA-provided IMAP ESPA Grande access to space must now be an SCM." Clarified costs charged to the PIMMC and the associated PEA Cost Cap for SCMs utilizing the NASA-PEA-provided IMAP ESPA Grande access to space. Excluded PMOs from utilizing the NASA-PEA-provided IMAP ESPA Grande access to space. Noted updated ESPA SIS in Program Library. [Edits in ***bold italics*** in question response]
07	08/06/2018	Added Q&As 15-21
08	08/15/2018	Added Q&As 22-24
09	08/17/2018	Added Q&As 25-26
10	09/07/2018	Added Q&As 27-57 Amended Q-6: Modified High Energy Earth Orbit C3 range. [Edits in ***bold italics*** in question response] Q-21 superseded by Q-41
11	09/13/2018	Added Q&As 58-62
12	09/21/2018	Added Q&A 63
13	09/24/2018	Added Q&As 64-65
14	10/01/2018	Added Q&As 66−70 Note: Q-66 is related to Q-47 Note: Q-70 is related to Q-28
15	10/3/2018	Added Q&A 71
16	10/16/2018	Added Q&As 72-74
17	10/17/2018	Added Q&A 75
18	11/16/2018	Added Q&A 76
19	11/28/2018	Added Q&A 77

Q–1 DRAFT PEA Section *5.3.4 Science Investigations* states that the PEA "does not solicit technology or advanced engineering development projects as described in Section 5.3.5 of the SALMON-3 AO". The "as described in" reference to SALMON-3 Section *5.3.5 New Technologies/Advanced Engineering Developments* implies that *no* new technologies or advanced engineering development efforts are allowed. Was this the intent?

No. The standard SALMON-3 non-STMD investigation requirement to demonstrate TRL 6 by PDR at the WBS 3 system level will be utilized. The following clarified version of the section is being planned for the FINAL PEA:

5.3.4 Science Investigations

New Technologies/Advanced Engineering Developments are described in Section 5.3.5 of the SALMON-3 AO. This PEA solicits *science* PMO and SCM investigations with associated TRL 6 by PDR requirements; it does not solicit technology or advanced engineering development projects.

Note that Section 5.3.5 of the SALMON-3 AO references NASA/SP-2007-6105 Rev 1, *NASA Systems Engineering Handbook.* The latest version of this document, NASA/SP-2016-6105 Rev 2, should be used instead, and is available in the Program Library.

Q–2 Will the Heliophysics Science 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*, they "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. Per DRAFT PEA Section *5.6.6 Contributions*, "[t]here are no limits to the amount of contributions from sources other than SMD."

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–3 The Community Announcement states that there will be a $35M (FY19) PEA Cost Cap for suborbital-class SCMs. Would it be appropriate to submit a proposal with a substantially lower PI-Managed Mission Cost?

Also, the following language in the DRAFT PEA appears to preclude the submission of suborbital proposals:

This opportunity solicits proposals for science investigations requiring the development and operation of space-based investigations.

The DRAFT PEA did not intend to preclude suborbital investigations. The statement above will be amended to include them in the FINAL PEA.

There are no requirements for a minimum PI-Managed Mission Cost (PIMMC). However, a proposal with a PIMMC substantially lower than that of other proposals may not be evaluated as favorably under Criterion A Intrinsic Science Merit of the Proposed Investigation, if evaluators believe significantly better science could have been proposed using funding more closely approaching the PEA Cost Cap. On the other hand, such proposals may facilitate the down-selection of additional investigations beyond the minimum of two specified in the Community Announcement.

Q–4 Is the International Space Station (ISS) expected to be able to accommodate payloads for some period after 2024?

NASA currently plans to operate ISS through FY 2024, and while the agency is taking no action that would preclude operation beyond FY 2024, no commitment has yet been made to do so. An SCM investigation requiring flight on the ISS should plan to complete its primary mission investigation or complete deployment from the ISS by the end of FY 2024.

While Section 5.3.1 of the DRAFT PEA provides for the option to propose a single-step selection, any proposal doing so must also address the impacts of instead proceeding through a competitive Phase A concept study.

Partner Mission of Opportunities (PMOs) requiring flight on the ISS must coordinate with their partners regarding the primary mission investigation period.

Q–5 Is there any prohibition on proposing an instrument that is currently being used for an operational rather than scientific capability?

There is no prohibition, but the instrument must be utilized to address heliophysics science objectives and goals, which will be the basis of the evaluation of Criterion A Intrinsic Science Merit of the Proposed Investigation – weighted approximately 40% in proposal categorization (see SALMON-3 Section *7.2.1 Overview of Evaluation Criteria*).

If significant development is necessary and/or addressing heliophysics science objectives and goals is out of scope, proposing to the Heliophysics Technology and Instrument Development for Science (H-TIDeS) program may be more appropriate.

Q–6 Can more information be provided regarding the IMAP ESPA Grande access to space? For example, what trajectory would an SCM be on upon release?

At this stage in the IMAP mission development, its trajectory and consequently that of any Science MO SCM 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/2018HelioMO/programlibrary.html] as item 20 under Documents Referenced by PEA) 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)
> [Edits in bold italics made on 7 Sep 2018.]

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

If orbiting the Earth-Sun L1 Lagrange point is desired, a Science MO 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 Science MO SCM after the release of IMAP.

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–7 The 2016 Heliophysics Explorers MO PEA Q, NNH12ZDA006O included Requirement Q-41, which allocated two additional pages to for each additional separate, nonidentical science instrument and flight element. This seemed a reasonable way to address the increased complexity of proposals with multiple science instruments and/or flight elements. The DRAFT PEA does not provide the same allocation. Was this limitation intentional?

No, the FINAL 2018 Heliophysics Science MO PEA will provide the same additional page allocations as the FINAL 2016 Heliophysics Explorers MO PEA.

Q–8 Program Library document *NASA's Multi-Mission Payload, Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA) System Interface Specifications (SIS) For Heliophysics Missions of Opportunity* provides inconsistent dimensions: Figures 4.1 and 4.2 do not agree with Table 4.1. What are the correct dimensions for the allowable Rideshare Payload (RPL) volume?

From the answer to Q-6 above, "[t]he SIS will be updated to specify the enveloping characteristics of potential ESPA Grande and Launch Vehicle combinations". *NASA's Multi-Mission Payload, Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA) System Interface Specifications (SIS) For Heliophysics Missions of Opportunity* is currently a draft version. However, the dimensions for allowable RPL volume given in Table 4.1 of the draft SIS are expected to represent the required dimensions. Proposers should note that the RPL volume stay-out zone in Figure 4.2, which will impose additional constraints on volume.

Q–9 Will NASA provide a historical basis for assessing the launch delay probability for secondary, co-manifested, and hosted payload opportunities?

DRAFT PEA Requirement tbd-21's "the expected cost when weighted by likelihood shall also be provided" will be made optional in the FINAL PEA. However, as justification of the schedule risk will be required, proposers will still need to work with their access to space provider for applicable data.

Q–10 The exclusion of SOWs, cost and pricing data for Phase A concept studies and subsequent phases, and subcontract plans from proposals in Section *7.3.2 Award Administration and Funding of Investigations* appears to be in conflict with the requirement for "plans and budgets for Phases A-F for costs that are within the PIMMC" in DRAFT PEA Requirement tbd-26. Please clarify.

DRAFT PEA Requirement tbd-26 addresses data necessary for the Step-1 evaluation, which does not rise to the level of that necessary for contract implementation and/or the Step-2 evaluation.

Q–11 Is it correct to assume that proposed Small Complete Mission (SCM) can include more than one spacecraft, assuming that the SCM otherwise meets all requirements (e.g. one port, cost, mass)?

Yes, that is a correct assumption.

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 May investigations utilize more than a single ESPA Grande port?

Yes. The FINAL PEA will allow for the use of one *or* two ports. ***Proposed investigations utilizing NASA-PEA-provided IMAP ESPA Grande access to space must now be an SCM.*** While costs for the associated PEA-provided access to space will be outside of the PIMMC ***(i.e., there will be no charge to the PIMMC or the associated PEA Cost Cap)***, the PEA Cost Cap for SCMs ~~***and PMOs***~~ on the IMAP ESPA Grande will be reduced to $75M (FY19) ***total, whether one or two ports are proposed***. Investigations requiring two ports must comply with the ESPA SIS for *each* port ***(see the updated ESPA SIS in Program Library)***. [Edits in bold italics made on 27 Jul 2018.]

Note that utilization of two ports will put a proposal in direct competition with any ESPA Grande-based proposal, whereas a single-port investigation with a sufficiently low PIMMC might be able to be paired with another single-port investigation.

Q–14 When is the FINAL Helio Science PEA to be released?

NASA expects the FINAL Helio Science PEA to be released in August.

Q–15 Are there any overall guidelines for utilization of *NASA's Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter System Interface Specifications For Heliophysics Missions of Opportunity*?

- Proposed Heliophysics Science investigations on the IMAP ESPA are secondary payloads and will be completely dependent on the 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–16 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–17 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, the IMAP will separate from the LV ~30 minutes after launch. In the case of a "long" park orbit coast, the IMAP will separate from the LV ~75 minutes after launch. This coast duration will depend on IMAP requirements and the LV mission design.

Q–18 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–19 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–20 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–21 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-21 was superseded by Q-41 on 7 Sep 2018.]

Q–22 The CubeSat options in the *LSP Small Payload Access to Space Catalog* provided with the DRAFT PEA appeared to be overly constrained. Will additional options be provided with the release of the FINAL PEA?

The defined options for single CubeSats did not change, but the reductions/charges to the applicable PEA Cost Cap either remained zero or were reduced—these changes will be reflected in an update to the Catalog.

The defined options for constellations of CubeSats did not change either. But because it is acknowledged that the Catalog cannot capture all possible options, proposers are advised to contact one of the CubeSat POCs for feedback on any non-Catalog option being considered. The POC will provide a quote for the reduction/charge to the applicable PEA Cost Cap, as well as an initial assessment of likelihood of being able to manifest the entire constellation before the applicable LRD; proposers are required to document the final communication in the Letters of Commitment section.

Q–23 Although the DRAFT PEA indicated that the *Program Level Dispenser and CubeSat Requirements Document* includes requirements for 12U CubeSats, it does not. Will the document be updated before the release of the FINAL PEA to address 12U CubeSats?

While the FINAL 2018 Heliophysics Science PEA continues to offer PEA-provided access to space for 12U CubeSats, the *Program Level Dispenser and CubeSat Requirements Document* may not be updated before the due date for proposals. Consequently, proposers of 12U CubeSats are advised to address questions regarding the application of the document to the CubeSat POCs. Note that proposers of 12U CubeSats will be required to provide waiver requests as necessary.

Q–24 There seems to be a considerable amount of commonality between the Heliophysics Technology Demonstration and Science Missions of Opportunity. Perhaps their Preproposal Conferences should be combined?

The Heliophysics Science MO Preproposal Conference (PPC) will be slipped a day to coincide with the Heliophysics Technology Demonstration MO PPC scheduled for August 24, 2018. Check the TechDemo and Science MO PPC pages for the final schedule.

Q–25 Do the evaluation standards for PMOs differ from those of SCMs and NMESs?

No. Although PMOs on two proposed M4 missions under consideration by ESA were selected for the 2016 Heliophysics Explorer Mission of Opportunity and 2016 Astrophysics Explorer Mission of Opportunity, no special consideration was accorded in the *evaluation* of the PMOs against the PEA-specified criteria. However, as stated in SALMON-2, and now SALMON-3 Section 7.3:

> The Selection Official(s) may take into account a wide range of programmatic factors in deciding whether or not to select any proposals and in selecting among top-rated proposals, including, but not limited to, planning and policy considerations, available funding, programmatic merit and risk of any proposed partnerships, and maintaining a programmatic balance across the mission directorate(s).

Q–26 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–27 Section 5.2.4 of PEA M says "[n]o information on Science Enhancement Options (SEOs) is needed for the Step-1 proposal". But Requirement M-39 says "[t]he two extra pages allocated in the *Proposal Structure and Page Limits* table for proposed Science Enhancement Options (SEOs) in the Technology Sections (D and E) are for all SEOs combined". Please confirm that the definition of plans and costs for proposed SEO activities is deferred to the Step-2 Concept Study Report.

Deferral of SEO plans and costs is confirmed for investigations that plan to proceed through Step 2. If provided in a proposal, SEO plans and costs will be evaluated according to Factors A-5 and B-6.

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-70 posted 10/1/18]**

Q–29 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–30 Do PMOs qualify for the three extra pages for alternative access to space?

No. PMOs do not fit the classes of alternative access to space specified in SALMON-3 Section 5.3.8.1 Non-NASA Launch Services and Section 5.3.8.2 Hosted Payloads.

Q–31 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–32 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–33 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–34 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–35 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–36 Would the IMPA 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–37 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–38 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–39 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–40 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 an RPL T-0 electrical interface deadface (electrical isolation) requirement at T-5 minutes prior to primary mission launch.

Q–41 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–42 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–43 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–44 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–45 After deploying the primary payload (IMAP), can the LV perform a delta-V maneuver(s) prior to deployment of a secondary?

No.

Q–46 Would NASA consider providing a different sized RUAG separation system and/or the reducing adaptor?

No.

Q–47 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-66 posted 10/1/18]**

Q–48 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–49 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–50 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–51 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–52 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–53 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–54 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–55 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–56 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–57 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–58 Are sRLV flights managed through the NASA Flight Opportunities Program considered "NASA-PEA-provided", or do proposal budgets need to include $2M for NASA launch vehicle monitoring functions and advisory services?

Section 5.3.6 of the PEA states "[p]latforms to host payloads on sRLVs" are platforms that represent NASA-PEA-provided access to space, or near space. As NASA-PEA-provided access to space, or near space, they are exempt from the $2.0M charge for NASA launch vehicle monitoring functions and advisory services required for alternative (non-NASA-PEA-provided) access to space.

Q-59 Section 5.6.2 of the PEA states "[c]osts associated with … will be outside the PIMMC" for SCM access to the ISS, payloads on sRLVs, high-altitude balloons and launch services, access to space for a single 1U, 1.5U, 2U, or 3U CubeSat that uses CSLI, and NASA-PEA-provided IMAP ESPA Grande access to space. The other options specify a charge against the PEA cost cap. Please indicate whether options in the first set have any charges against the PEA cost cap.

There are no pre-defined charges against the PEA M Cost Cap for SCM access to the ISS, payloads on sRLVs, high-altitude balloons and launch services, access to space for a single 1U, 1.5U, 2U, or 3U CubeSat that uses CSLI, or NASA-PEA-provided IMAP ESPA Grande access to space. However, any mission-unique charges specified by the applicable POC must be included in the PIMMC.

Q-60 In the *Overview of the 2018 Heliophysics MO Solicitations* by Dan Moses, slide 12 shows the expected numbers of selections for MO SCM proposals for the IMAP ESPA and Explorer-class MO proposals. How many New Missions for Existing Spacecraft (NMES) may be or are expected to be selected?

Slide 12 states, "selection intentions herein are provided for planning purposes and should not be considered binding"; there are no dedicated selections for NMES specifically planned. All investigations will be selected based on proposal merit/risk and funding availability.

Q-61 Can NASA clarify the access to space costs for CubeSat constellations and why 24U is stated as the maximum allowed size in the *LSP Small Payload Access to Space Catalog*? If the proposed CubeSat constellation procures a separate dedicated launch, is it bound to the 24U total size limit?

CubeSat constellations are limited to 24U because that is the largest payload any single CSLI launch vehicle can accommodate. Note that SMD and CSLI contributions are *per mission* rather than per launch—the PEA Cost Cap charges in the *LSP Small Payload Access to Space Catalog* have been determined accordingly. Other launch options may exist for PEA-provided CSLI access to space, but the cost will *not* scale linearly with those in the *LSP Small Payload Access to Space Catalog*.

Proposed CubeSat constellations that utilize a dedicated NASA-PEA-provided small launcher or alternative access to space are not restricted to 24U. However, proposers should be aware that purchased alternative access to space launch services are limited to U.S. launch vehicles.

Q-62 May investigations that plan to be accommodated by the ISS propose SEOs that extend operations beyond the end of FY2024?

Yes.

Q-63 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-64 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-65 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-66 Can the answer to Q-47 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-67 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 $C_3 < 0$, 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-68 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-69 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-70 The answer to Q-28 for PEA M of SALMON-3 states that any extra pages can be distributed in sections D-G as desired, but Requirement M-39 in the PEA has not been changed to reflect that answer. Does the answer to Q-28 supersede Requirement M-39 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 M-39 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-71 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-72 Please clarify Requirement M-21 which states, "The expected cost of the reserves when weighted by likelihood may be provided, but proposals shall include at least nine months of fully funded schedule reserve for this risk." Does the expected cost of the schedule reserve have to be included in the PIMMC? If so, are reserves (25% minimum) required on top of this expected schedule reserve cost?

Yes, the appropriate fully funded schedule reserve (minimum of nine months) is included in the PIMMC. This funded schedule reserve must also be included in the basis of the calculation of the unencumbered reserve (minimum of 25%).

This is explained in SALMON-3 Section 5.7.2: "…the Phases A/B/C/D unencumbered cost reserves percentage on the PI- Managed Mission Cost is measured against the cost to complete through Phases A/B/C/D. The numerator is the amount of unencumbered cost reserves for Phases A/B/C/D, not including funded schedule reserve. The denominator is the PI-Managed Mission Cost to complete Phases A/B/C/D including the cost of technical design margins, funded schedule reserves, and encumbered cost reserves, but not including unencumbered cost reserves."

Q-73 Are the proposal page limits for both 2018 Helio MO PEAs consistent with recent SALMON MO PEAs?

Yes, the 2018 Helio MO PEAs are inline 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-74 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-75 The following is from the 2018 HPSMO PEA M, Section 6.2.2 (Amendment 10, released 9/26/18):

> Requirement M-41. Full (Step-1) Proposals shall have the same science objectives, PI, ~~Co-I~~, and institutions as the Notification Proposal. **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-HPDMO@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-76 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 the 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 Documents Referenced by SALMON-3 item 8. 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-77 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.