National Aeronautics and Space Administration

Heliophysics Explorers Program (HEP) 2022 Small Explorer (SMEX) and Mission of Opportunity (MO) Solicitations

Preproposal Conference
Technical, Management, and Cost (TMC)

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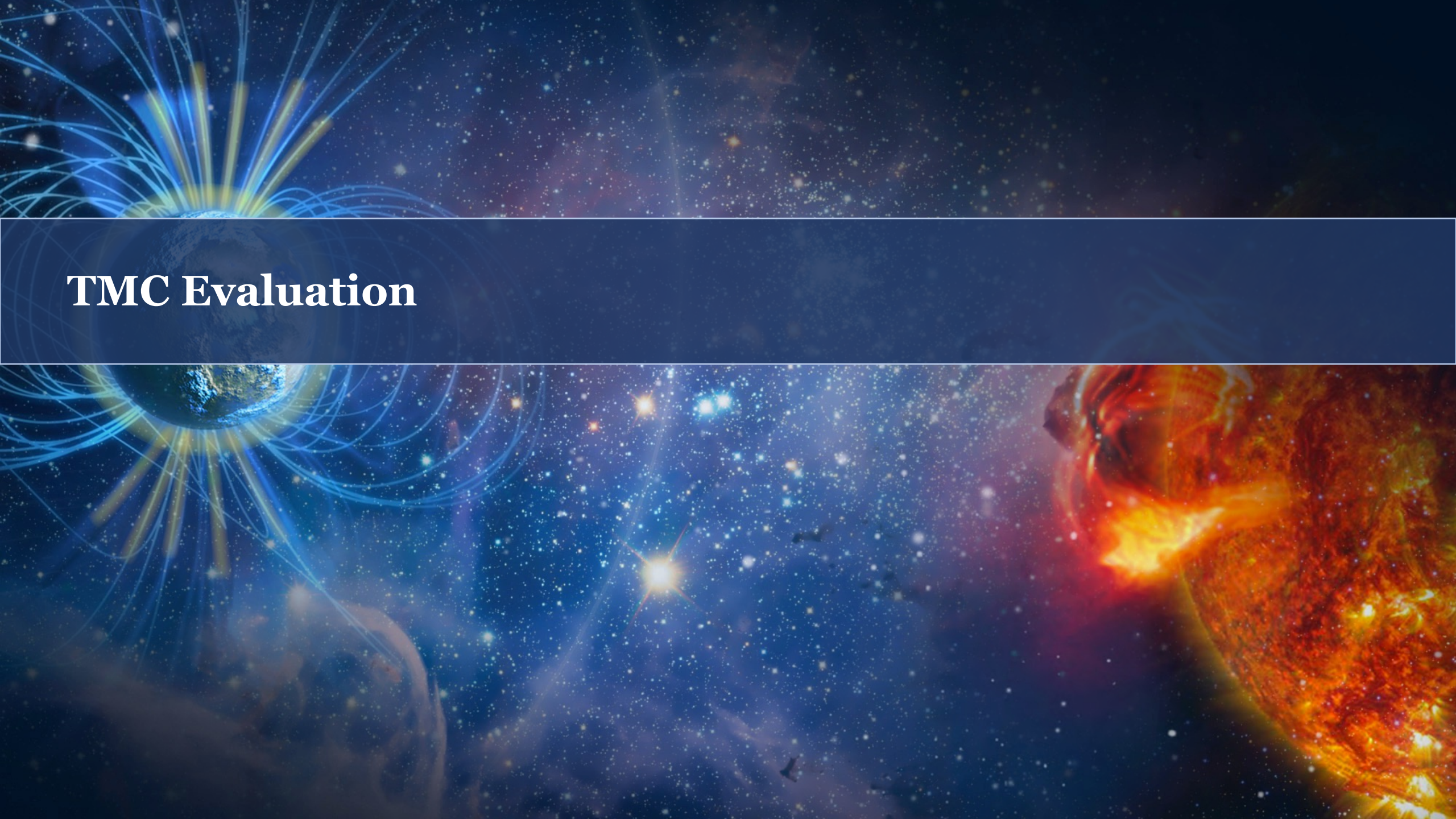
Outline

- Technical, Management, and Cost (TMC) Evaluation
- Highlights Common to both AOs
  - AO Simplification
  - New PMW Clarification Process
- SMEX AO Highlights
- Explorer MO AO Highlights
- References
- Questions

Glossary

AO	Announcement of Opportunity
MO	Mission of Opportunity
NOI	Notice of Intent
PMW	Potential Major Weakness
PPC	Preproposal Conference
RPL	Rideshare Payload
SMEX	Small Explorer
SPA	Secondary Payload Adapter
TMC	Technical, Management, and Cost
TRL	Technology Readiness Level
VADR	Venture-Class Acquisition of Dedicated and Rideshare

TMC Evaluation



Proposal Evaluation Criteria

- Science Merit of the Proposed Investigation
- Science Implementation Merit and Feasibility of the Proposed Investigation
- **TMC Feasibility of the Proposed Mission Implementation**

Weighting: The first criterion is weighted approximately 40%; the second and **third criteria are weighted approximately 30%** each.

TMC Evaluation Purpose

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

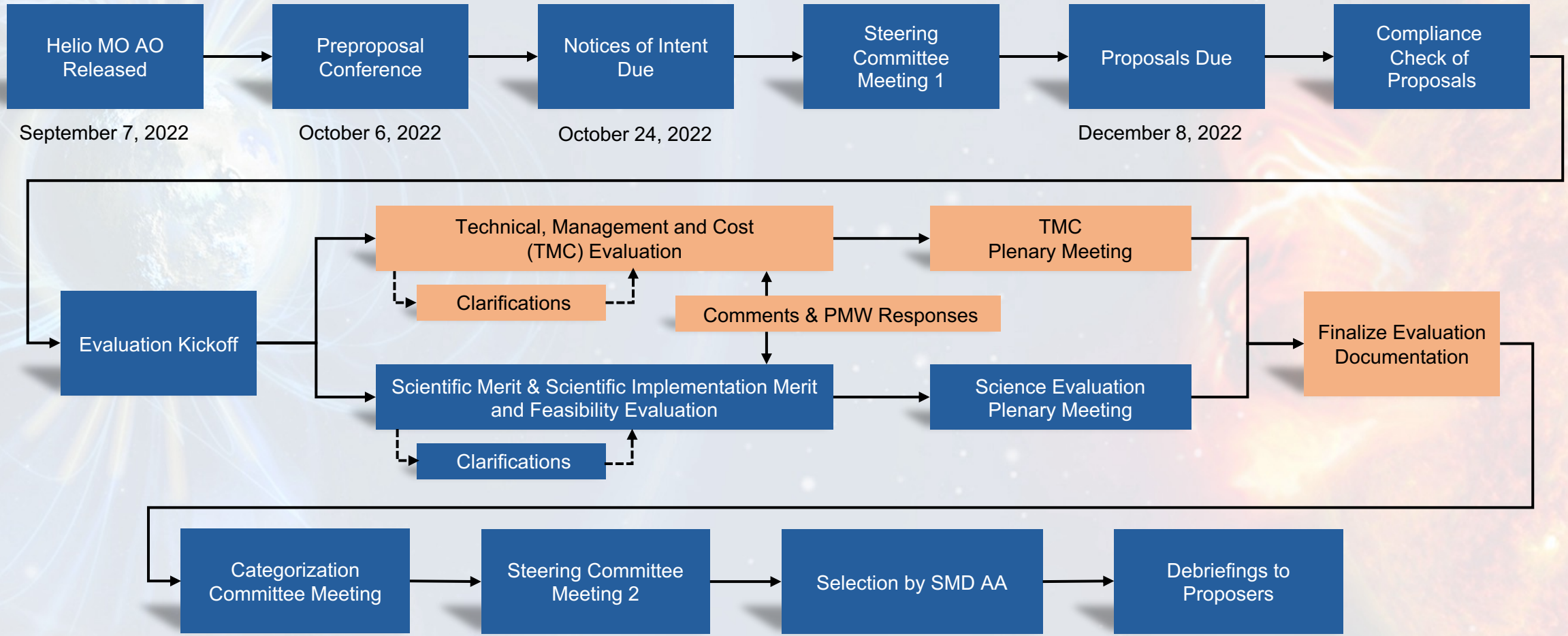
TMC Evaluation Factors

TMC evaluation factors are presented in the following AO sections.

- SMEX AO, Section 7.2.4, "TMC Feasibility of the Proposed Mission Implementation"
- Explorer MO AO, Section 7.2.4, "TMC Feasibility of the Proposed Mission Implementation"

- Factor C-1. Adequacy and robustness of the instrument implementation plan.
- Factor C-2. Adequacy and robustness of the mission design and plan for mission operations.
- Factor C-3. Adequacy and robustness of the flight systems.
- Factor C-4. Adequacy and robustness of the management approach and schedule, including the capability of the management team.
- Factor C-5. Adequacy and robustness of the cost plan, including cost feasibility and cost risk.

Proposal Evaluation Flow



Principles for Evaluation

- All proposals are to be treated fairly and equally.
- Merit and Risk are to be assessed on the basis of the material in the proposal and the clarification process.
- Ratings shall reflect the written strengths and weaknesses.
- Everyone involved in the evaluation process is expected to act in an unbiased objective manner; advocacy for particular proposals is not appropriate.

General Evaluation Ground Rules

- All proposals will be evaluated to uniform standards established in the AOs, and without comparison to other proposals.
- All evaluators will be experts in the areas that they evaluate.
- Specialist Evaluators (to provide special technical expertise to the TMC Panel) and non-panel/mail-in Reviewers (to provide special science expertise to the Science Panels) may be utilized, respectively, based on need for expertise in a specific technology or science that is proposed.

TMC Evaluation Products: Findings

- **Major Strength:** A facet of the implementation response that is judged to be well above expectations and can substantially contribute to the ability of the project to meet its technical requirements on schedule and within cost.
- **Major Weakness:** A deficiency or set of deficiencies taken together that are judged to substantially weaken the project's ability to meet its technical objectives on schedule and within cost.
- **Minor Strength:** A strength that is worthy of note and can be brought to the attention of Proposers during debriefings, *but is not a discriminator in the assessment of risk*.
- **Minor Weakness:** A weakness that is sufficiently worrisome to note and can be brought to the attention of Proposers during debriefings, *but is not a discriminator in the assessment of risk*.

Note: Findings that are considered "as expected" are not documented on the Form C.

TMC Evaluation Products: Risk Ratings

Based on the narrative findings, each proposal will be assigned one of three risk ratings, defined as follows:

Low Risk: There are no problems evident in the proposal that cannot be normally solved within the time and cost proposed. Problems are not of sufficient magnitude to doubt the proposer's capability to accomplish the investigation well within the available resources.

Medium Risk: Problems have been identified, but are considered within the proposal team's capabilities to correct within available resources with good management and application of effective engineering resources. Investigation design may be complex and resources tight.

High Risk: One or more problems are of sufficient magnitude and complexity as to be deemed unsolvable within the available resources.

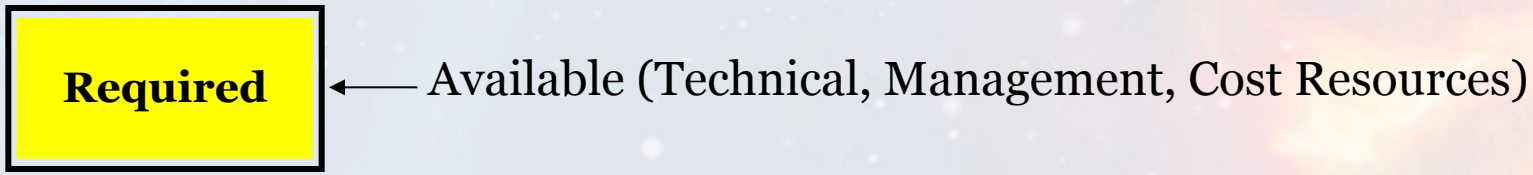
Note: Only Major findings are considered in the risk rating.

TMC Envelope Concept

Envelope: Contains all TMC Resources available to handle known and unknown development problems that occur. Includes schedule and funding reserves; reserves and margins on physical resources such as mass, power, and data; descope options; fallback plans; and personnel.

Low Risk: Required resources fit well within available resources.

Medium Risk: Required resources just barely inside available resources.



High Risk: Required resources DO NOT fit inside available resources.

Highlights Common to SMEX and Explorer MO AOs

SMD Class D MAR, SPD-39

Science Mission Directorate Policy: SMD Standard Mission Assurance Requirements For Payload Classification D

- Heliophysics Explorers missions are required to meet the requirements for safety, reliability, and mission assurance in SPD-39.
- SPD-39 is available in both SMEX and MO Program Libraries.

SMEX AO Requirement 40; Explorer MO AO Requirement 51

- Proposals shall indicate any expected deviations from the recommended requirements in SPD-39 and in Appendix C of NPR 8705.4A for the payload class specified in Section 4.1.4.
- Tailoring below SPD-39 shall not be proposed, even for individual flight elements within a constellation.

DSS Guidance for Class D Missions

Projects proposing multiple spacecraft are expected to show how the proposed mission architecture affects risk to mission success. Additional guidance for Steps 1 and 2 on how projects with multiple spacecraft can meet this expectation is available in the Program Library in *Guidance for Distributed Satellite System (DSS) Architectures for Class D Missions*.

The TMC Panel will consider a 60 percent Preliminary Mission Reliability Estimate as an acceptable "safe harbor" for Step 1

The TMC Panel will consider a 75 percent Preliminary Mission Reliability Estimate as an acceptable "safe harbor" for Step 2

Phase E/F Unencumbered Cost Reserves

SMEX AO Requirement 71; Explorer MO AO Requirement 85

- Proposals shall include a minimum of 15% unencumbered cost reserves against the cost to complete Phases E/F.

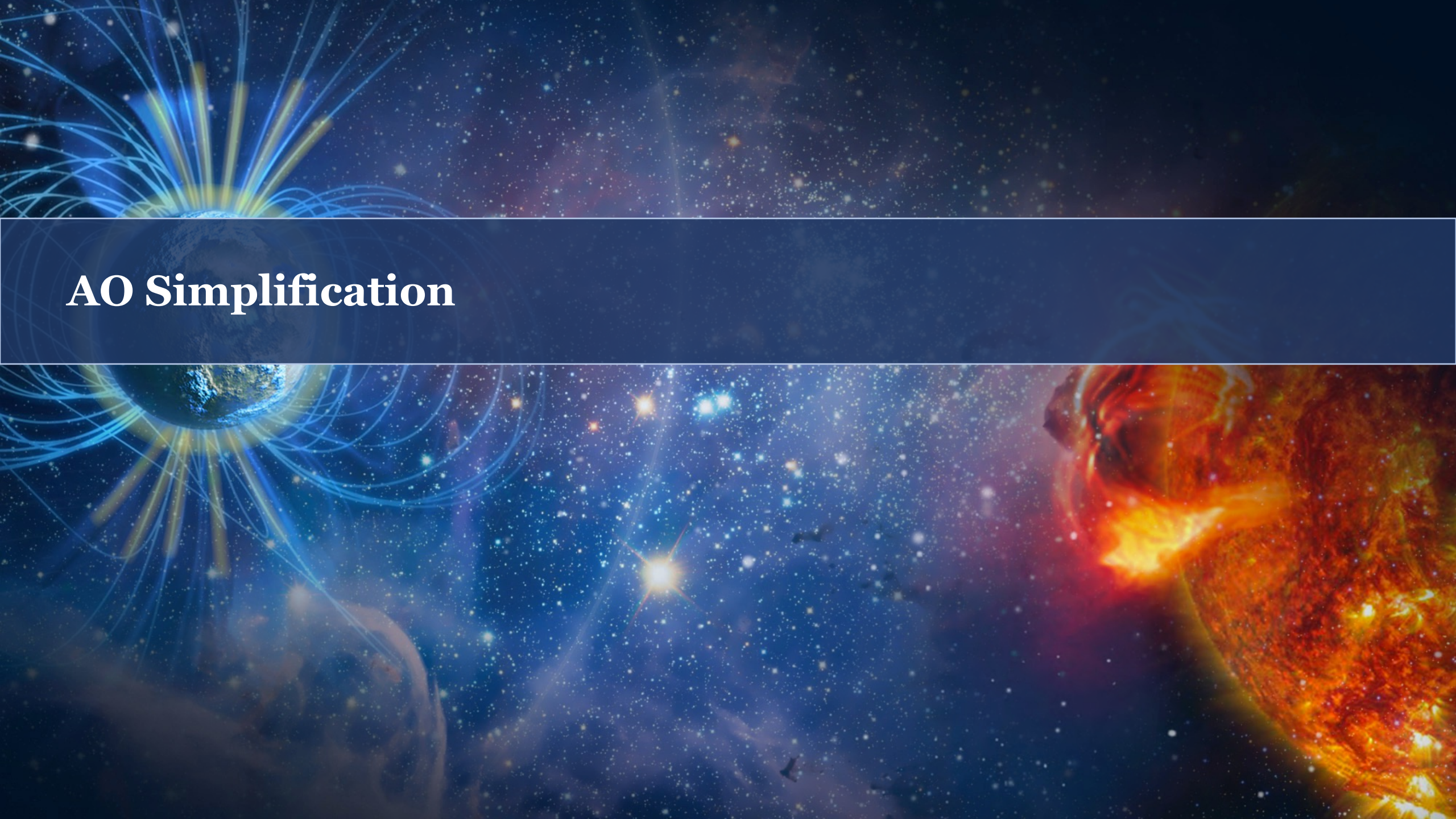
NSN and DSN Costs

SMEX AO Requirement 35; Explorer MO AO Requirement 46

If use of NASA's network SCaN services is proposed, costs for services, as described in the SCaN MOCS document, including the cost of any development, shall be represented as a reduction to the AO Cost Cap. If the use of NASA DSN services are proposed, the proposal shall discuss how DSN usage is within the capabilities described in the SCaN MOCS document and is not excessive (e.g., the proposal demonstrates the use of only one DSN 34-meter antenna at any time for normal operations, not including periods of station hand-off, emergencies, Delta-DOR measurements, etc.).

- NSN and DSN costs are represented as reductions to the AO Cost Cap to better capture the full costs to NASA SMD for each proposed mission.
- Cost estimation algorithms for the NSN and DSN and persons to contact to obtain costs for other networks and various Government-operated facilities are contained in the SCaN MOCS document or at the Interplanetary Network Directorate's Commitment Office website at https://deepspace.jpl.nasa.gov/about/commitments-office/.

AO Simplification



AO Simplification

Purpose of Simplification

- To reduce the workload on investigation teams generating Pre-Phase A proposals, NASA SMD has developed these solicitations with numerous requirements either deferred to Step 2 (see Sections 1.1 of the AOs) or simplified. Proposal evaluators will be directed to perform the evaluation based on these requirement deferrals, simplifications, and page reductions.

Overall

- The page allocations have been reduced to reflect requirement deferrals and simplifications. These page reductions also take into account the recent change in format to 5.5 lines per vertical inch as stated in Requirement B-3 of Appendix B of the AOs.

Investigation Implementation

AO Sections 5.2.2, and Appendix B, Section F.3.

- Systems Engineering: Requirement for a description of overall systems engineering approach eliminated; only the description of systems engineering aspects unique to the mission, if any, is required (SMEX AO Requirements 25 and B-38; MO AO Requirements 22 and B-37).
- Schedule: Two schedule foldouts do not count against the page limit instead of three; narrative for the schedule foldout is not required (Appendix B, p. B-2 and Section F.6).

AO Simplification (continued)

Management

Both AO Sections 5.2.2, 5.3.1 – 5.3.6, and Appendix B, Section G; Explorer MO AO Section 5.3.7

- Requires only the management organization chart to be provided and the decision-making authority, and the teaming arrangement and responsibilities to be briefly discussed.
- Only mission-unique roles and responsibilities of the key management team are required. Eliminates explanation of traditional roles for key personnel.
- Defers naming Project Manager (PM) and Project Systems Engineer (PSE) until Step 2.
- Project risk and potential mitigation strategies in the form of a table only.
- Requires waivers to NASA Procedural Requirements (NPRs) only to be listed. Eliminates need for a description.

Cost and Cost Estimating Methodology

Both AO Section 5.6.3; SMEX AO Requirements 69, B-49, and B-50; Explorer MO AO Requirements 82, B-48, and B-49.

- Requires a Basis of Estimate table and a brief description of the methodologies and assumptions used to develop the proposed cost estimate.
- Only requires a brief discussion of cost reserves.
- Only requires a brief discussion of cost risk.
- Eliminates presenting a rationale for the costing methodology.
- Eliminates description/evaluation of any independent cost estimates performed outside the proposing organizations.
- Eliminates description of cost management tools.

AO Simplification (continued)

Proposal Appendices

Both AO Appendix B, Section J; SMEX AO Requirements B-56 to B-58; Explorer MO AO Requirements B-56 to B-58.

- Letters of commitment only required from (i) all organizations offering contributions of goods and/or services on a no-exchange-of-funds basis, collaborators excepted, and (ii) from the launch services provider for PI-provided access to space; but not including the institutions signing the NSPIRES Cover Page.
- Resumes – eliminates requirement for the resume of the PM and PSE.
- Eliminates appendix for Summary of Proposed Program Cooperative Contributions.
- International Participation – reduced to a table and a brief, one-page narrative.
- Defers appendix for Discussion of Limiting the Generation of Orbital Debris and End of Mission Spacecraft Disposal Requirements.
- Heritage – reduced page count from 30 to 15 pages. This reduction also applies to the Classified Appendix Regarding Heritage.

Scientific/Technical Evaluation Factors

TMC Evaluation Criteria Updates – Rewording reflects simplified requirements. Refer to AO Section 7.2.4.

New PMW Clarification Process

PMW Clarifications Process: Modified from Previous AOs

Section 7.1.1 of the AOs states ”Proposers should be aware that, during the proposal evaluation and selection process, NASA may request clarification of specific points in a proposal; if so, such a request from NASA and the proposer’s response must be in writing. In particular, before finalizing the proposal evaluation, NASA will request clarification on specific potential major weaknesses (PMWs) identified for the *Scientific Merit of the Proposed Investigation* (see Section 7.2.2), the *Scientific Implementation Merit and Feasibility of the Proposed Investigation* (see Section 7.2.3), and the *TMC Feasibility of the Proposed Mission Implementation* (see Section 7.2.4) evaluation criteria. NASA will request clarification in a uniform manner from all proposers. Proposers will be allowed up to **eight combined pages** in total (with some restrictions) for clarifications of the PMWs associated with the *Scientific Merit of the Proposed Investigation* (A-factors) plus the *Scientific Implementation Merit and Feasibility of the Proposed Investigation* (B-Factors) evaluation criteria. Up to **six pages** in total (with some restrictions) will be allowed for clarifications of the PMWs associated with the *TMC Feasibility of the Proposed Investigation Implementation* (C-factors) evaluation criterion. These clarifications may include text, tables, and figures to address the PMWs and to provide additional information. The requirements and constraints of the clarification process will be addressed in the Preproposal Conference (see Section 6.1.1 of this AO) and the Evaluation Plan …”

PIs whose proposals have no PMWs will be informed that no PMWs have been identified.

TMC PMW clarification responses relevant to the Science evaluation are provided to the Science panel. Science PMW clarification responses relevant to the TMC evaluation are provided to the TMC panel. Only the PMW clarification responses (not the PMWs) are provided to the other panel.

PMWs Clarification Process Requirements (1 of 3)

Clarifications Responses must conform to the following requirements:

Requirement 1: Proposers shall submit only one Clarification Response Document that addresses each PMW for the A and B factors (combined). Proposers shall submit only one Clarification Response Document that addresses each PMW for the C-factors.

Requirement 2: The Clarification Response Documents shall be a single unlocked (e.g., without digital signatures) searchable Adobe Portable Document Format (PDF) file, composed of the response text, figures, and/or tables. Images (e.g., figures and scans) shall be converted into machine-encoded text using optical character recognition. Animations shall not be included. Links to materials outside of the response are not permitted. Do not insert any comment fields.

Requirement 3: The Clarification Response Documents shall be presented in 8.5 x 11 inch paper (or A4). Text shall not exceed 5.5 lines per vertical inch and page numbers shall be specified. Margins at the top, both sides, and bottom of each page shall be no less than 1 inch if formatted for 8.5 x 11 inch paper; no less than 2.5 cm at the top and both sides, and 4 cm at the bottom if formatted for A4 paper. Type fonts for text, tables, and figure captions shall be no smaller than 12-point (i.e., no more than 15 characters per horizontal inch; six characters per horizontal centimeter). Fonts used within figures shall be no smaller than 8-point.

Requirement 4: For the A- and B- factors PMWs combined, the Clarification Response Documents shall not exceed eight pages. For the C-factor PMWs, the Clarification Response Documents shall not exceed six pages. Text, table(s) and figure(s) are permitted; however, all material shall be within the page limits specified above and limitations in Requirements 2, 3 and 9. Response files shall not exceed 10MB.

PMWs Clarification Process Requirements (2 of 3)

Requirement 5: The Clarification Response Documents shall not contain International Traffic in Arms Regulations (ITAR), Export Administration Regulations (EAR), or classified material.

Requirement 6: Each PMW shall be addressed, and each clarification response labelled with the PMW number provided. Each PMW clarification response shall contain only information specific to the PMW. Although your clarification response may point back to references in your proposal, please note that there are already references to locations on your proposal with the PMWs, which indicates that the evaluation team is familiar with and has already evaluated that data, therefore they are not obliged to re-consider them. When making references to the material in your proposal in your clarification responses, refer to the proposal page number on the bottom of the page, as opposed to the electronic PDF file page number.

Requirement 7: In the Clarification Response Document, the proposers are free to provide any additional information on any criteria or requirements relevant to the proposed investigation, e.g. for TMC Feasibility of the Proposed Investigation Implementation, advances in proposed technologies since proposal submission. However, this response together with the PMW clarification responses shall not exceed the total page limitation per Clarification Response Document.

Requirement 8: In addition to the references in the proposal, in support of each PMW clarification response, proposers may provide up to two references; references are restricted to peer reviewed literature. In support of any additional information response in Requirement 7, proposers may provide up to two additional references; references are restricted to peer reviewed literature. References with a publication or release date after the proposal due date are allowed. Proposers shall not provide URLs with any of the responses.

PMWs Clarification Process Requirements (3 of 3)

Requirement 9: Proposers may append to the page-limited response complete versions of a modified Science Traceability Matrix (STM; Table B1, both AOs), Mission Traceability Matrix (MTM; Table B2, both AOs), Total Mission Cost Profile table (Table B3b, both AOs), Master Equipment List (MEL; Table B5, both AOs), and/or schedule foldout (Requirement B-42, HPSMEX22 AO; Requirement B-41, HPExMO22 AO). These modified fold-out(s)/table(s) shall have modifications clearly marked by the use of a different color font or by a colored-bordered box (labeled “PMW Clarification”). Proposers shall provide the description of the updates and changes to the modified fold-out(s)/table(s) as text in the page limited document. The complete versions of the modified STM, MTM, Total Mission Cost Profile table, MEL and schedule will not count against the page limit. Any new or other fold-out(s) will count as two pages against the response page limit.

2022 Heliophysics SMEX AO Highlights

SMEX AO Highlights

- AO Cost Cap is $150M (FY22), not including the cost for AO-provided access to space or any contributions.
- PI-led mission; naming of PM and PSE are deferred to Step 2.
- Missions selected from this AO are Category 3 projects (per NPR 7120.5F) with Class D payloads (per NPR 8705.4A).
- Total contributions NTE one-third (1/3) of the proposed PIMMC.
- Foreign contributions to science instruments should not exceed approximately one-third (1/3) of the science payload.
- This is Step 1 of a 2-step process. Step 2 funded at $2M if selected.
- Down-selected mission(s) delivery NLT Q4 CY2028; or for PI-provided primary launch services, ready for launch NLT Q4 2028.

AO-Provided Access to Space

- No cost* for AO-provided access to space under LSP VADR or Rideshare on Government Primary launches.
  * charge(s) against the PIMMC for any mission-unique launch services beyond the standard options
- Multiple options available for AO-provided access to space.

Launch Options Summary	Representative Orbit	Maximum Mass to Representative Orbit
1 or 2 × Option A	500 km Sun-Synchronous*	1 or 2 × 300 kg
1 × Option B	500 km Sun-Synchronous*	1 × 910 kg
1 or 2 × ESPA or 1 or 2 × ESPA Grande Port (Option C)	Low Earth Orbit, Geosynchronous Transfer Orbit, or Cis-Lunar Space	1 or 2 × 220 kg per ESPA Port or 1 or 2 × 465 kg per ESPA Grande Port
1 × Option A and 1 × Option C	As per Option	As per Option

AO-Provided Access to Space (cont'd)

- Up to $6M reimbursement for missions that require a PI-provided propulsive stage or propulsion system augmentation
- Cost estimates for up to two years of storage and maintenance are required, but are outside of the PIMMC and are deferred to Step 2.

Investigations on the International Space Station

- Accommodations on and transportation to the International Space Station are provided by NASA at no cost against the PIMMC.
- Nominal on-orbit mission life of three years, but baseline mission must be completed before end of ISS operations (nominal 2030).
- See AO Section 5.9.2.2 and contact ISS RIO.

PI-Provided Access to Space

- PI-provided access to space, where the investigation team takes responsibility for all of the mission's access to space, is permitted under this AO.
- May include launch as primary or secondary (e.g., on a secondary payload adapter) payloads on a U.S.-manufactured launch vehicle, and deployment from a spacecraft not related to this AO.
- Contributed PI-provided access to space from a non-U.S. partner and/or on a foreign-manufactured launch vehicle is not allowed.
- Up to $12M reimbursement for a PI-provided access to space offered as an increase to the AO Cost Cap.
- Launch delay costs from delays in spacecraft and/or payload elements the PI team is responsible for shall be funded out of the PIMMC.

2022 Heliophysics Explorer MO AO Highlights

Explorer MO AO Highlights

- This Explorers MO AO solicits two classes of Complete Spaceflight Missions MOs:
  - Standard-class – AO Cost Cap is $70M (FY22), including payloads hosted on ISS, but not including the cost of access to space or any contributions.
  - SmallSat-class – AO Cost Cap, or $35M (FY22), not including the cost of access to space or any contributions.
  - Application of AO-specified incentives and/or charges may result in a proposal-specific Adjusted AO Cost Cap.
- Missions selected from this AO are Category 3 projects (per NPR 7120.5F) with Class D payloads (per NPR 8705.4A).
- PI-led mission; naming of PM and PSE are deferred to Step 2.
- Total contributions NTE one-third (1/3) of the proposed PIMMC.
- Foreign contributions to science instruments should not exceed approximately one-third (1/3) of the science payload.
- Proposed investigations will be evaluated, selected, and down-selected through a two-step competitive process. However, if warranted by the evaluation process, NASA reserves the right to select through a single step.
- The 6-month Phase A study funding is capped at:
  - $600,000 (FY22) for a Standard-class MO (AO Requirement 79)
  - $350,000 (FY22) for a SmallSat-class MO (AO Requirement 80)
- Selected mission(s) must be ready for launch or delivery no later than Q1 CY 2028.

Access to Space

- AO-provided access to space, where NASA is responsible for the mission's access to space, is offered under this AO. The following classes of platforms are offered under the AO-provided access to space.
  - Accommodation as an RPL on a SPA (up to 2 ports) to the following orbit categories :
    - LEO (e.g. 500km Sun-synchronous)
    - GTO
    - Cislunar space
  - Accommodation for Standard-class MO as a VADR launch services Primary Payload with capability to lift up to 300 kg to 500 km Sun-synchronous orbit.
  - For other orbits, refer to the *Launch Services Program Information Summary* in the Program Library.
  - Complete spaceflight missions on the International Space Station (ISS).
- PI-provided access to space, where the investigation team takes responsibility for all of the mission's access to space, is permitted under this AO.
  - Only the aspects that are under the control of the PI will be evaluated.
  - Non-U.S. contributed PI-provided access to space is not an option, hosted payloads excepted.

Cost of Access to Space

- The cost caps and cost of access to space (both FY 2022 dollars) are summarized in the following table (See AO Section 5.6.1.1).

MO Cost Cap and Access to Space	SmallSat-class MO	Standard-class MO
AO cost cap (FY 2022 dollars)	$35M	$70M
Adjustment to AO Cost Cap for PI-provided access to space	NTE +$4.2M	$0
Adjustment to AO cost cap for AO-provided secondary rideshare	$0	-$4.2M/ESPA-class port -$6.5M/ESPA Grande-class port
Adjustment to AO cost cap for AO-provided primary VADR Launch Services	N/A	-$12M
Adjustment to AO cost cap for AO-provided access to the International Space Station (ISS)	$0	$0

References

SMEX and MO Reference Material

2022 Heliophysics SMEX and Explorer MO Acquisition Page

The 2022 Heliophysics SMEX and Explorer MO acquisition home page is available at https://explorers.larc.nasa.gov/HPSMEX22/

The contents of the web site include the following:

- Links to SMEX and Explorer MO pages
- 2022 Heliophysics SMEX and Explorer MO news
- Preproposal conference
- Community announcements
- SAM.gov
- SMEX and MO Q&As
- Teaming interest

SMEX Reference Material

2022 Heliophysics SMEX Acquisition Home Page

- The 2022 Heliophysics SMEX Acquisition Home Page available at https://explorers.larc.nasa.gov/HPSMEX22/SMEX/index.html, will provide updates and any addenda during the solicitation process. The contents of the SMEX acquisition page include the following:
  - Links to the NSPIRES for access to the solicitation
  - Program library
  - Evaluation plan
  - Q&A
  - SAM Announcement

2022 Heliophysics SMEX Program Library

- The Library provides additional regulations, policies, and background information. The Library is accessible at https://explorers.larc.nasa.gov/HPSMEX22/SMEX/programlibrary.html
- It is incumbent upon the proposer to ensure that the documents used in proposal preparation are of the date and/or revision available in the Program Library.
- A detailed Change Log has been implemented, and will continually document updates to the Program Library.

MO Reference Material

2022 Heliophysics Explorer MO Acquisition Home Page

- The 2022 Heliophysics Explorer MO Acquisition Home Page available at https://explorers.larc.nasa.gov/HPSMEX22/MO/index.html, will provide updates and any addenda during the solicitation process. The contents of the SMEX acquisition page include the following:
  - Links to the NSPIRES for access to the solicitation
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  - Q&A
  - SAM Announcement

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- It is incumbent upon the proposer to ensure that the documents used in proposal preparation are of the date and/or revision available in the Program Library.
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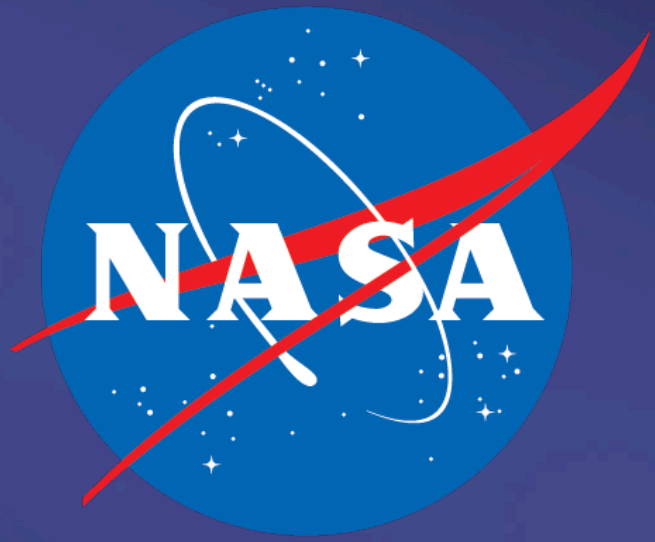
TMC Evaluation

- **<u>Common Causes of Major Weaknesses References</u>**
- Technology Readiness Level:
  - *Assessment of TRL in AO-Based Evaluations and Common Causes of Major TRL Weaknesses*
  - Located in Program Libraries
- Management:
  - *Common Management Major Weaknesses in Step One Proposals*
  - Located at SOMA website: https://soma.larc.nasa.gov/tmcll/ManagementFindingsStudy-to-post-R3.pdf

Questions?

All further questions pertaining to the SMEX AO or Explorer MO AO MUST be addressed by email to:

Dr. Dan Moses
Heliophysics Explorers Program Scientist
Science Mission Directorate
NASA Headquarters
Washington, DC 20546
dan.moses@nasa.gov
(subject line to read “SMEX AO or Explorer MO AO as applicable")


NASA