2018 Heliophysics Technology Demonstration Mission of Opportunity (TechDemo MO)

SALMON-3 AO PEA L

Preproposal Conference

Technical, Management, and Cost Overview

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Overview

- Proposers should read both PEA and SALMON-3 documents. Both documents provide requirements and guidelines for proposers. In the case of conflicting or ambiguous requirements, the PEA document takes precedence.

- This PEA solicits Small Complete Mission (SCM) proposals for spaceflight demonstration of innovative **medium Technology Readiness Level (mid-TRL) technologies** that enable significant advances in NASA's Heliophysics Science Objectives and Goals.

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

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Section 5.3.3 Mission Category and Payload Risk Classification

- The Payload Risk Classification is Streamlined Class D.
- NASA's Science Mission Directorate has defined a new approach to managing Class-D investigations that are less than $150M, not including launch services. The *NASA Science Mission Directorate (SMD) Class-D Tailoring/Streamlining Decision Memorandum* describes the approach that has been approved by SMD leadership to guide the implementation of Streamlined Class D investigations.
- This new approach is a tailoring/streamlining of NPR 8705.4 Risk Classification of NASA Payloads and NPR 7120.5E, NASA Space Flight Program and Project Management Requirements.
- All TechDemo investigations solicited by this PEA will be considered to be Streamlined Class-D investigations and thus must use the principles, guidelines, and approaches described in the documents.

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Section 5.3.3 Mission Category and Payload Risk Classification

- The following Class D and Streamlined Class D related documents are available in the Program Library:
  - *NASA SMD Class-D Tailoring/Streamlining Decision Memorandum (issued Dec. 7, 2017)*
  - *Guidance and Expectations for Small Category 3, Risk Classification D (Cat3/ClassD) Space Flight Projects with Life-Cycle Cost Under $150M*
  - *Science Mission Directorate Class D Town Hall Presentation*
  - *TROPICS Project Plan*
  - Earned Value Management 101
  - *Technical, Management, and Cost Panel Expectations on SMA-Related Program Requirements for NASA Class C and Class D Payloads*

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Section 5.3.3 Mission Category and Payload Risk Classification

- Streamlined Class-D Investigations must identify those requirements not specifically identified as already being tailored in the *NASA Science Mission Directorate (SMD) Class-D Tailoring/Streamlining Decision Memorandum* and described in NPR 7120.5E that are proposed for adjustment, provide a rationale for each adjustment, and describe any cost, schedule, and/or other benefits that would be realized should one or more of the adjustments be accepted by NASA. (See Requirement L-10)
- Note that these adjustments reflect potential modifications to the baseline investigation, to be addressed after down-selection.
- The panel evaluating the third evaluation criterion, “Technical, Management, and Cost” (TMC) Feasibility of the Proposed Investigation Implementation, will provide comments to the Selection Official on the proposed adjustments and their justifications. These comments will not be considered for the TMC Feasibility of the Proposed Investigation Implementation risk rating but may be considered in the selection decision.

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Section 5.3.4 New Technologies/Advanced Engineering Environments

- For this solicitation, each system that includes a technology to be demonstrated needs to be matured to TRL 5 by PDR; this requirement supersedes the requirement for all systems to be matured to TRL 6 by PDR given in Section 5.3.5 of the SALMON-3 AO. All systems that do not include a technology demonstration must be matured to TRL 6 by PDR, as required in Requirement 35 of the SALMON-3 AO.

- Requirement L-11. Investigations that propose to demonstrate technologies that are below TRL 5 at time of proposal submission shall include a plan for the maturation of the systems containing the technologies to TRL 5 by no later than PDR. For the purposes of this PEA, no back-up plan is needed. Systems that do not include a technology demonstration shall adhere to Requirement 35 of the SALMON-3 AO.

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Section 5.3.4 New Technologies/Advanced Engineering Environments

- SALMON-3 Requirement 35. Unless otherwise specified in the applicable PEA, proposals that use systems currently at less than TRL 6 when proposed shall include a plan for system maturation to TRL 6 by no later than PDR and a backup plan in the event that the proposed system cannot be matured as planned.
- SALMON-3 Section 5.3.5, For the purpose of TRL assessment, **systems are defined as level 3 WBS payload developments (*i.e.*, individual instruments) and level 3 WBS spacecraft elements (*e.g.*, electrical power system).**
- Appendix B, F.4 New Technologies/Advanced Engineering Developments
  - "PEAs issued by NASA STMD, including those that solicit a technology demonstration investigation as opposed to a science or exploration investigation, will require technologies to be matured to TRL-5, not TRL-6, no later than PDR and therefore Requirement B-46 applies for TRL-5 by PDR. If Requirement B-46 is not applicable, it will be replaced by requirements in the applicable PEA."

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Section 5.3.4 New Technologies/Advanced Engineering Environments

- SALMON-3 Appendix B, F.4 New Technologies/Advanced Engineering Developments
  - Requirement B-46. This section shall describe any proposed new technologies and/or advanced engineering developments and the approaches that will be taken to reduce associated risks. Descriptions shall address, at a minimum, the following topics:
    - Identification and justification of the TRL for each proposed system (**level 3 WBS payload developments and level 3 WBS spacecraft elements**) incorporating new technology and/or advanced engineering development at the time the proposal is submitted (for *TRL definitions*, see NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*, Appendix E, in the PEA-specific Program Library);
    - **Rationale for combining the TRL values of components and subsystems to derive each full system TRL as proposed, appropriately considering TRL states of integration** (see NASA/SP-2007-6105 Rev 1, *NASA Systems Engineering Handbook*);
    - Rationale for the stated TRL value of an element that is an adaptation of an existing element of known TRL;
    - The approach for maturing each of the proposed systems to a minimum of TRL-6 (or TRL-5) by PDR:
      - Demonstration (testing) in a relevant environment can be accomplished at the system level or at lower level(s);

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- Appendix B, F.4 New Technologies/Advanced Developments – Req B-46 (cont'd)

  - If applicable, **justify what demonstration(s) in a relevant environment** at lower level(s) (subsystem and/or subsystem-to-subsystem) **would be sufficient to meet system level TRL-6 (or TRL-5)**, considering (i) where any new technology is to be inserted, (ii) the magnitude of engineering development to integrate elements, (iii) any inherent interdependencies between elements (*e.g.*, critical alignments), and/or (iv) the complexity of interfaces – **see the PEA-specific Library for examples**;
  - Include discussion of simulations, prototyping, demonstration in a relevant environment, life testing, etc., as appropriate;

  - An estimate of the resources (staffing, cost, and schedule) required to complete the technology and/or advanced engineering development; and
  - Approaches to fallbacks/alternatives that exist and are planned, a description of the cost, decision date(s) for fallbacks/alternatives, relevant development schedules, and performance liens they impose on the baseline design, and the decision milestones for their implementation.*

  If no new technologies or advanced engineering development is required, system TRL-6 (or TRL-5) or above at the time of proposal submission shall be clearly demonstrated.

*Note: Fallbacks bullet above applies only to those systems that need to be matured to TRL 6 by PDR.

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Section 5.3.4 New Technologies/Advanced Engineering Environments

- Note the following TRL related documents, available in the Program Library, are geared towards providing guidance for the TRL 6 system level requirement, but should be beneficial as well for the TRL 5 by PDR system level requirement:
  - *System Level TRL 6 Examples*
  - *An Example for Demonstrating Systems Level TRL*
  - *Assessment of TRL in AO-Based Evaluations and Common Causes of Major TRL Weaknesses*

- Additional TRL related documents, available in the Program Library, include:
  - NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*
  - NASA/SP-2016-6105 Rev 2, *NASA Systems Engineering Handbook**
  - NASA/SP-2016-3404/REV1, *NASA Work Breakdown Structure (WBS) Handbook**

*Note: These documents are listed in the PEA as the latest versions of these documents.

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Section 5.3.6 PEA-Provided Access to Space

- Access to space for the solicited TechDemo investigations will be provided by NASA in the form of a secondary payload opportunity on the EELV Secondary Payload Adapter (ESPA) Grande that is planned for the IMAP mission.
- Information on the ESPA Grande can be found in the NASA's Mission Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter (ESPA) System Interface Specification (SIS) For Heliophysics Missions of Opportunity document (ESPA SIS), found in the Program Library.
- Proposals shall clearly demonstrate compliance to the ESPA Grande requirements and enveloping characteristics, as given in the ESPA SIS. (See Requirement L-12)
- Proposals shall utilize one or two ESPA Grande ports. Investigations requiring two ports shall comply with the ESPA SIS for each port. (See Requirement L-13)
- Rideshare scheduling information can be found in the ESPA SIS document. (See Section 5.4.1)

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Section 5.6 Cost Requirements

- The PEA Cost Cap is $65M in FY 2019 dollars for Phases A through F. (See Requirements L-19 and L-20)
- The Phase A concept study is capped at $400,000 FY 2019 dollars, with a duration of 9 months.
- The sum of contributions of any kind to the entirety of the investigation is not to exceed one-third (1/3) of the proposed PIMMC.
- Access to space via a rideshare on the IMAP launch vehicle will be provided by NASA; integration costs to the IMAP ESPA Grande will be funded by NASA and do not need to be included within the PIMMC.
- As NASA expects investigations proposed to this solicitation to require more development than non-technology demonstration solicitations, proposals may spend up to 30% of the PIMMC prior to KDP-C. (See Requirement L-21)
- Required minimum unencumbered cost reserves percentages:
  - Phases A/B/C/D cost is 30%
  - Phases E and F cost is 20%

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Section 5.8 Classified Materials

- PEA Section 5.8 supersedes SALMON-3 Section 5.9.4.
- In order to increase the capabilities of investigations proposed in response to this solicitation, while minimizing the development and operations risks within the PIMMC, proposers may choose to leverage technology with classified heritage that was developed by other institutions and agencies, as well as by NASA and NASA-funded partners.
- This section discusses three options for proposers to support heritage claims from classified programs:
  - Delivery to NASA: Requires delivery to NASA Headquarters (HQ) separately from the proposal.
  - Delivery in Place: The classified material is not delivered to NASA but is kept at the point of origin.
  - Sponsor Verification: Classified materials are only referenced; they are not provided to NASA in any format. This option is only available if the sponsor organization is not a proposed partner.

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Section 7.1.3 TMC Feasibility of the Proposed Investigation Implementation

Factors C1 – C5: From SALMON-3, Section 7.2.4

- Factor C-1. Adequacy and robustness of the instrument implementation plan.
- Factor C-2. Adequacy and robustness of the investigation design and plan for 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.

The PEA uses the evaluation criterion as described in Section 7.2.4 of the SALMON-3 AO, with the following amendments:

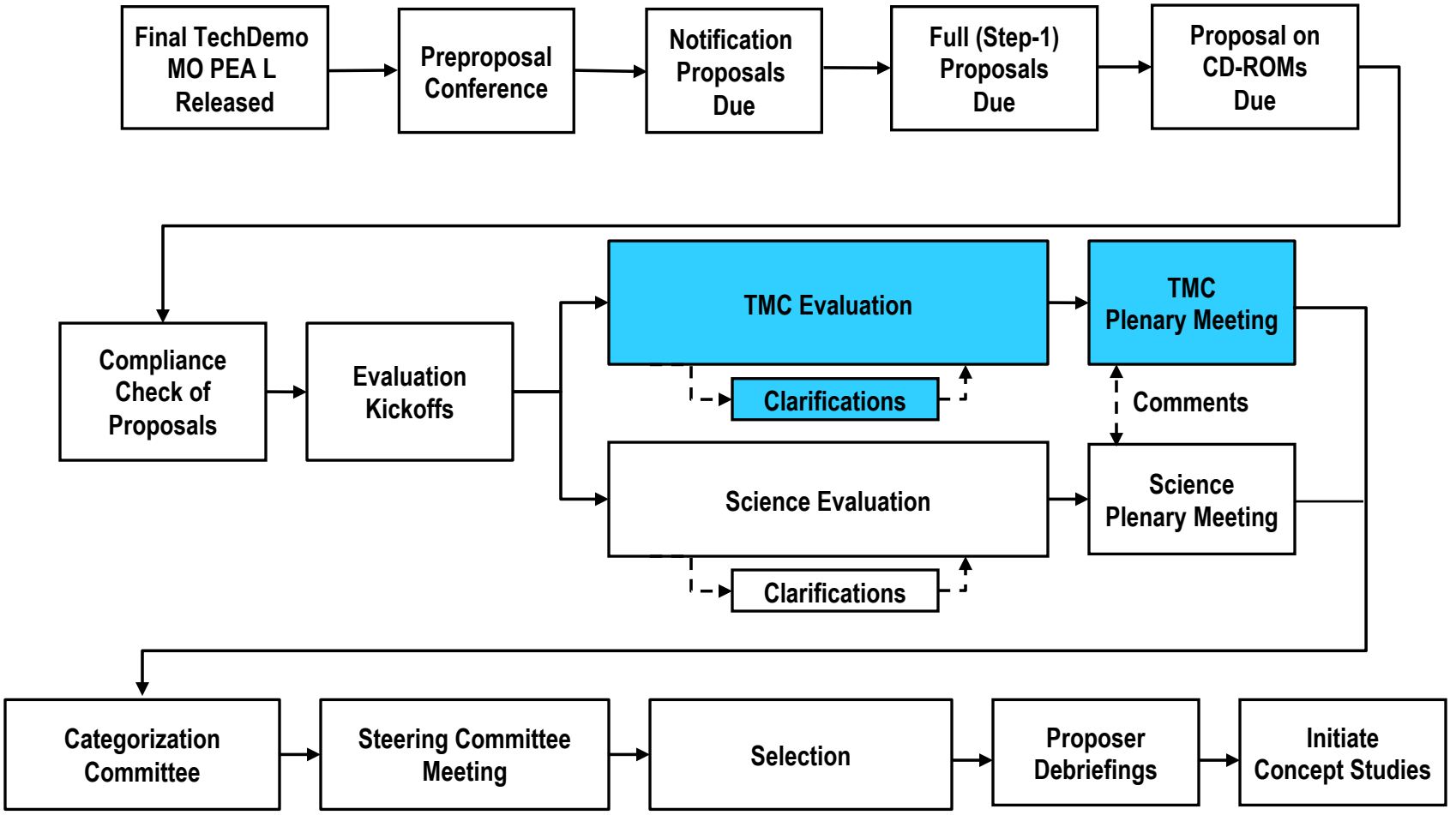
Factors C-1 and C-3 are amended so that plans for the maturation of systems that contain the proposed technologies result in TRL 5 by PDR (see PEA Requirement L-11).

Factor C-4 is amended to delete evaluation of the PI's spaceflight experience. The capability of the management team will be evaluated as a whole, as opposed to assessing the capabilities of each of the Key Team Members independently. Comments about the managerial experience of the PI, and whether appropriate mentoring and support tools are in place, will be made to the Selection Official but these comments shall not impact the "Technical, Management, and Cost Feasibility" rating.

TMC Evaluation Process

TMC Evaluation Process

TechDemo MO PEA L Solicitation, Evaluation and Selection Flow



TMC Evaluation Process

TMC Panel Composition and Organization

The Acquisition Manager, who is a Civil Servant from the NASA Science Office for Mission Assessments (SOMA) at NASA Langley Research Center (LaRC), leads the TMC panel. NASA SOMA works directly for NASA Headquarters and is firewalled from the rest of NASA LaRC.

TMC Panel evaluators are a mix of the best non-conflicted contractors, consultants, and Civil Servants who are experts in their respective fields.

- Evaluators read their assigned proposals.
- Evaluators provide findings on their assigned proposals.
- Evaluators provide ratings of proposals that reflect the findings.

Specialist evaluators may be called upon when technical expertise is needed that is not represented in the panel. They evaluate only those parts of a proposal that are specific to their particular expertise.

TMC Evaluation Process

TMC Panel Product: Form C

For each proposal, the TMC evaluation results in a Form C that contains:

- Proposal title, PI name, and submitting organization;
- The TMC Feasibility of the Proposed Investigation Implementation adjectival risk rating from each evaluator of “LOW Risk”, “MEDIUM Risk” or “HIGH Risk”;
- Summary rationale for the median risk rating;
- Narrative findings supporting the adjectival risk rating in the form of specific major or minor strengths or weaknesses;
- Comments to the PI, Comments to the Selection Official (optional)

TMC Evaluation Process

TMC Panel Evaluation Findings Definitions

- 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.
- 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.
- 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 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 in the Form C.

TMC Evaluation Process

TMC Risk Ratings

Based on the narrative findings, each proposal is 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 Evaluation Process

Potential Major Weaknesses Clarification Process

NASA will request clarifications of PMWs identified by the TMC panel in the third criteria: TMC Feasibility of the Proposed Investigation Implementation. NASA will request such clarification uniformly from all proposers.

- All requests for clarification from NASA and the proposers' responses are in writing.
- The ability of proposers to provide clarification to NASA is extremely limited, as NASA does not intend to enter into discussions with proposers.
- PIs whose proposals have no PMWs are informed that no PMWs have been identified at that time.
- The form of the clarifications is strictly limited to a few types of responses:
  - Identification of the locations in the proposal (page(s), section(s), line(s)) where the PMW is addressed.
  - Noting that the PMW is not addressed in the proposal.
  - Stating that the PMW is invalidated by information that is common knowledge and is therefore not included in the proposal.
  - Stating that the analysis leading to the PMW is incorrect and identifying a place in the proposal where data supporting a correct analysis may be found.
  - Stating that a typographical error appears in the proposal and that the correct data is available elsewhere inside the proposal.

The PIs are given at least 24 hours to respond to the request for PMW clarification. Any response that goes beyond the five forms of clarification stated above will be deleted and not shown to the evaluation panel.

TMC Evaluation Process

TMC Cost Analysis

- Initial cost analyses are accomplished on the basis of information provided in the proposals (consistency, completeness, proposed basis of estimate, contributions, use full cost accounting, maintenance of reserve levels, cost management, etc.).
- One or more cost models are utilized to validate the proposed cost.
- Implementation threats are identified.
- Cost threat impacts to the proposed unencumbered reserves are assessed (see Cost Threat Matrix). The remaining unencumbered reserves are compared to the minimums required in the PEA.
- The entire panel participates in Cost deliberations.
- Significant findings are documented in the Cost Factor on Form C and considered in the TMC Risk Rating.

TMC Evaluation Process

TMC Cost Analysis: Cost Threat Matrix

- The likelihood and cost impact, if any, of each weakness is stated as "This finding represents a cost threat assessed to have an Unlikely/Possible/Likely/Very Likely/Almost Certain likelihood of a Very Minimal/Minimal/Limited/Moderate/Significant/Very Significant cost impact being realized during development and/or operations, which results in a reduction from the proposed unencumbered reserves."
- The likelihood is the probability range that the cost impact will materialize.
- The cost impact is the current best estimate of the range of costs to mitigate the realized threat.
- The cost threat matrix below defines the adjectives used to describe the likelihood and cost impact.
- The minimum cost threat threshold is $250K

		Cost Impact (CI) % of PI-managed mission cost to complete Phases B/C/D or Phase E not including unencumbered cost reserves or contributions				
		Minimal (2.5% < CI ≤ 5%) (2.5% < CI ≤ 5%)	Limited (5% < CI ≤ 10%) (5% < CI ≤ 10%)	Moderate (10% < CI ≤ 15%) (10% < CI ≤ 15%)	Significant (15% < CI ≤ 20%) (15% < CI ≤ 20%)	Very Significant (CI > 20%) (CI > 20%)
Likelihood (L, %)	Almost Certain (L > 80%)					
	Very Likely (60% < L ≤ 80%)					
	Likely (40% < L ≤ 60%)					
	Possible (20% < L ≤ 40%)					
	Unlikely (L ≤ 20%)					

Note: For each proposal the percentages in the above table will be converted to dollars by the cost estimator.

TMC Evaluation Process

Common Causes of Major Weaknesses References

- Technology Readiness Level:
  - *Assessment of TRL in AO-Based Evaluations and Common Causes of Major TRL Weaknesses*
  - Located in Program Library

- Management:
  - *Common Management Major Weaknesses in Step One Proposals*
  - Located at SOMA website: https://soma.larc.nasa.gov/tmcII/ManagementFindingsStudy-to-post-R3.pdf

TechDemo Website

- TechDemo MO Acquisition Homepage
  - https://soma.larc.nasa.gov/STP/tdmo/index.html
- Contents of the website include links to the following:
  - Announcements
  - NSPIRES access to the solicitation
  - Technology Fair
  - Program Library
  - Q&As
  - Evaluation Plan (to be posted)
  - Preproposal Conference presentations
- The Program Library provides additional regulations, policies, and background information.
  - https://soma.larc.nasa.gov/STP/tdmo/tdmo-library.html
  - A change log is included

Questions

All questions pertaining to the TechDemo MO proposals must be addressed to:

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