National Aeronautics and Space Administration

2021 Astrophysics Medium Explorers (MIDEX)

Evaluation Plan

~~November 2, 2021~~ Revised January 11, 2022

Announcement of Opportunity
NNH21ZDA004J

Outline

Introduction

This Astrophysics MIDEX Evaluation Plan covers evaluation information from the Announcement of Opportunity (AO) and from the evaluation processes conducted by the Science Panel and the Technical Management and Cost (TMC) Panel.

The AO Cost Cap for an Astrophysics Medium Explorer mission is $300 million in NASA Fiscal Year (FY) 2022 dollars, not including the cost of standard launch vehicle and launch services or any contributions.

This Evaluation Plan describes a two-step competitive process to selection.

The approval page for the Evaluation Plan is on page 58.

For missions selected in Step 1, $3M and 9 months will be allocated for each Concept Study.

2021 Astrophysics MIDEX Solicitation

- All investigations proposed in response to this solicitation must support the goals and objectives of the Astrophysics Explorers Program (Section 2.2 of the MIDEX AO), must be implemented by Principal Investigator (PI) led investigation teams (Section 5.3.1), and must be implemented through the provision of complete spaceflight missions (Section 5.2.1).
- Standard launch services on a domestic Launch Vehicle (LV) will be provided for MIDEX missions at no charge against the PI-Managed Mission Cost (Section 5.9.2). Any launch services beyond the standard launch services offered must be funded out of the PI-Managed Mission Cost (Section 5.9.2.1).
- Launch services may not be arranged by the proposer (Section 5.9.2).

Evaluation Organization

Evaluation Panel

Dr. Linda Sparke, Program Scientist
Science Mission Directorate (SMD), NASA Headquarters

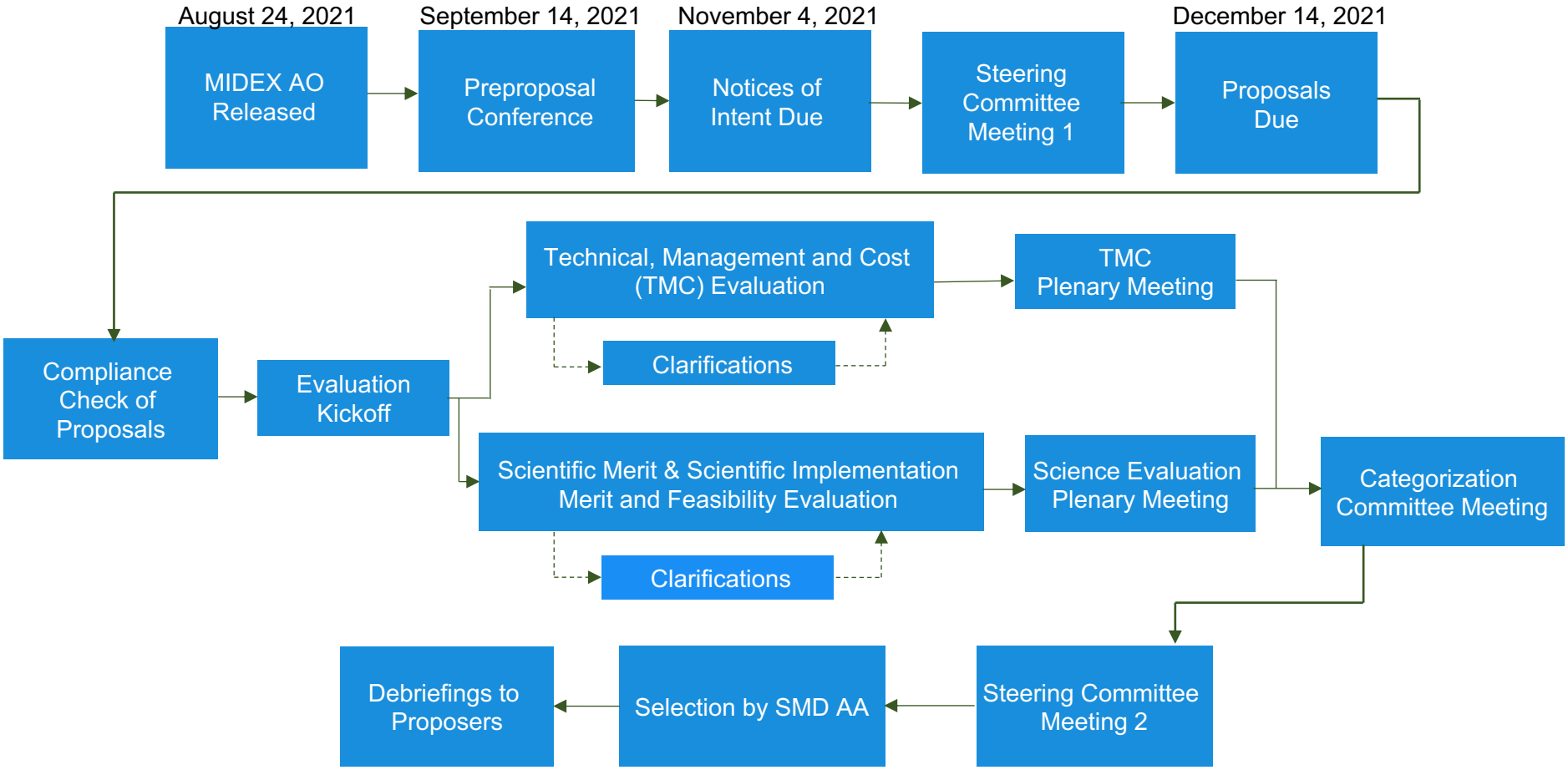
Science Evaluation Panel

Dr. Linda Sparke, Program Scientist
Dr. Patricia Knezek, Deputy Program Scientist
Dr. Hannah Jang-Condell, Deputy Program Scientist
Astrophysics Division, SMD

TMC Evaluation Panel

Odilyn Luck, Acquisition Manager (AM)
Tony Tyler, Deputy Acquisition Manager (AM)
Behzad Raiszadeh, Backup AM
NASA Science Office for Mission Assessments (SOMA)

Proposal Evaluation Flow



Compliance Checklist

2021 Astrophysics MIDEX AO

Appendix F

Administrative

Scientific

Technical

Administrative

1. Electronic proposal submitted on time
2. Proposal on CD-ROMs received on time
3. Meets page limits
4. Meets general requirements for format and completeness (maximum 5.5 lines per vertical inch and page numbers shall be specified. Margins at the top, both sides, and bottom of e ch page shall be no less than 1 inch if formatted for 8.5 x 11-inch paper)
5. Required appendices included; no additional appendices
6. Budgets are submitted in the required format
7. All individual team members who are named on the cover page indicate their commitment through NSPIRES
8. All export-controlled information has been identified
9. Restrictions Involving China acknowledged on Electronic Cover Page

Scientific

10. Addresses solicited science research programs
11. Requirements traceable from science to instruments to mission
12. Data Management and Archiving plan included
13. Baseline science mission and threshold science mission defined

Technical

14. Complete spaceflight mission (Phases A-F) proposed
15. Team led by a single PI
16. PI-Managed Mission Cost within AO Cost Cap or Adjusted AO Cost Cap, as applicable
17. Phase A costs within Phase A cost limit
18. Contributions within contribution limit
19. Co-investigator costs in budget
20. Launch readiness prior to launch readiness date
21. Includes table describing non-U.S. participation
22. Includes letters of commitment from funding agencies for non-U.S. participating institutions
23. Includes letters of commitment from all U.S. organizations offering contributions
24. Includes letters of commitment from all major partners and non-U.S. institutions providing contribution of efforts of anyone on the Proposal Team.

General Evaluation Requirements

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.

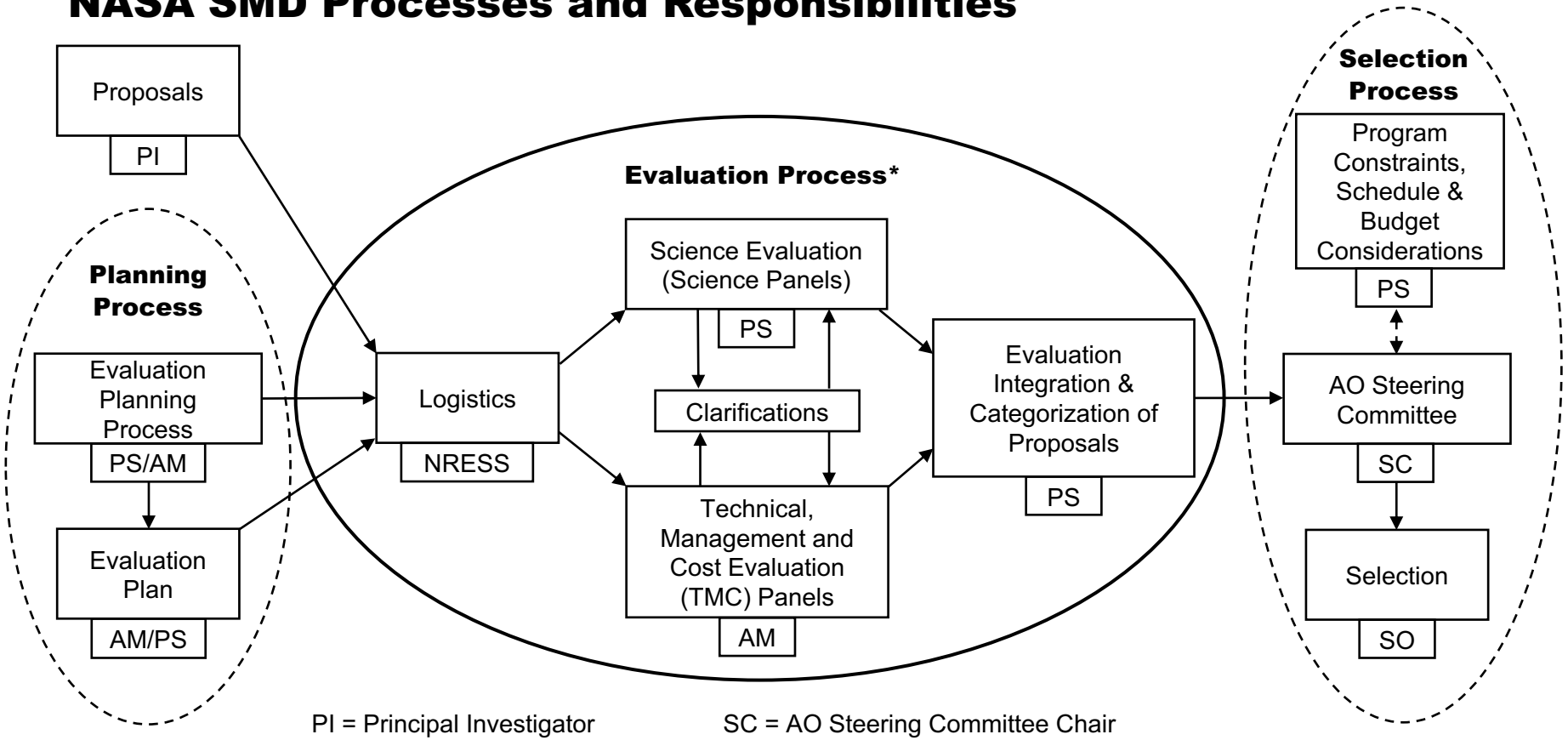
General Evaluation Ground Rules

- All proposals will be evaluated to uniform standards established in the 2021 Astrophysics MIDEX AO, 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.

NASA SMD Processes and Responsibilities



PI = Principal Investigator
PS = Program Scientist
AM = Acquisition Manager

SC = AO Steering Committee Chair
SO = Selecting Official
NRESS = NASA Research and Education Support Services

** The Evaluation Process is addressed in this document.*

Pre-Evaluation - Steering Committee Meeting 1

- As part of the Evaluation Planning Process, before the evaluation process begins, an AO Steering Committee will be convened. This Committee is composed of the SMD Deputy Associate Administrator for Research (DAAR) and a small number of SMD Program Scientists/Executives.
- The AO Steering Committee will conduct an independent assessment of the planned evaluation and associated processes regarding their compliance to established policies and practices, completeness, and self-consistency. They may provide recommendations to the Program Scientist and Acquisition Manager on potential adjustments to the evaluation team and the planned processes.

Conflicts of Interest (COI) Prevention and Mitigation Requirements (1 of 2)

- The Science Panel members are on-boarded through NASA Research and Education Support Services (NRESS), and the non-Civil Servants are provided an honorarium for their participation. NRESS cross-checks all the Science Panel members against the lists of personnel and organizations identified in each proposal submitted to determine whether any organizational Conflict of Interest (COI) exists.
- The non-Civil Servants TMC Panel members will be hired as contractors through the NASA Science Office for Mission Assessments (SOMA) support contractor, Cornell Technical Services. CTS cross-checks all contracted TMC Panel members against the lists of personnel and organizations identified in each proposal submitted to determine whether any organizational COI exists.
- All contracted evaluators must divulge any other financial, professional, or potential personal COIs, and whether they work for a profit-making company that directly competes with any profit-making proposing organization.
- All Civil Service (CS) and Intergovernmental Personnel Act (IPA) evaluators must self-certify their COI status by reviewing a combined listing of individuals and organizations associated with the MIDEX proposals.
- The TMC evaluators must notify the SOMA Acquisition Managers in case there is a potential conflict. The Science evaluators must notify the Program Scientist in case of a potential conflict.

COI Prevention and Mitigation Requirements (2 of 2)

- All known potential COI issues are documented, and a COI Mitigation Plan is developed to minimize the likelihood that an issue will arise in the evaluation process. In the case of science evaluators recruited through the NRESS contract, standard mitigations have been defined (See SPD-01A) and will be applied. The results of the mitigations will be recorded in a log to be appended to the COI Mitigation Plan. For science evaluators not recruited through the NRESS contract, any potential COI issue is discussed with the Program Scientist and the SMD Deputy Associate Administrator for Research and documented in the COI Mitigation Plan. All determinations regarding possible COIs that arise will be logged as an appendix to the COI Mitigation Plan.
- If any previously unknown potential COI arises during the evaluation, the conflicted member(s) will be notified to stop evaluating proposals immediately, and the Panel Chair will be notified immediately. If a COI is confirmed, the conflicted member(s) will be immediately removed from the evaluation process, and steps will be taken expeditiously, to remove, mitigate, or accept any actual or potential bias imposed by the conflicted member(s). The steps will be documented in the COI Mitigation Plan.
- Members of the Science and TMC panels are prohibited from contacting anyone outside their panel for scientific/technical input, or consultation, without the prior approval of the Program Scientist.

Proprietary Data Protection Requirements

- All proposal and evaluation materials are considered proprietary.
- Viewing of proposal materials will be only on a need-to-know basis.
- Each non-CS or non-IPA evaluator will sign a Non-Disclosure Agreement (NDA) that must be on file at NRESS prior to any proposals being distributed to that evaluator. CS and IPA evaluators are under statutory obligations.
- The proposal materials that each evaluator has access to is documented.
- Evaluators are not permitted to discuss proposals with anyone outside their Science or TMC Panel.
- All proprietary information that must be exchanged between evaluators will be exchanged via the secure NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES), via the secure Remote Evaluation System (RES), via the secure NASA Box file exchange system, via secure WebEx, via NASA Google docs or via encrypted email, parcel post, fax, or regular mail.
- Web conferences or teleconferences among evaluators will be conducted via controlled Web conference and teleconference lines.
- Evaluators' electronic and paper evaluation materials will be deleted/destroyed when the evaluation process is complete. Archival copies will be maintained in the NASA SOMA vault.

Evaluation Criteria from 2021 Astrophysics MIDEX AO:

- Scientific Merit of the Proposed Investigation (Section 7.2.2);
- Scientific Implementation Merit and Feasibility of the Proposed Investigation (Section 7.2.3);
- TMC Feasibility of the Proposed Mission Implementation, including Cost Risk (Section 7.2.4).

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

Other Selection Factors (Section 7.3):

- Programmatic factors
- PI-Managed Mission Cost

Science Evaluation

Science Panel Composition and Organization (1 of 2)

- The Program Scientist leads the Science Panel
- Science Panel evaluators are typically, but not exclusively, recruited from the academic, governmental, and industrial research communities.
- The approach to evaluator identification is reviewed by the pre-evaluation Steering Committee convened by the DAAR (Steering Committee Meeting 1, page 16).
- The Science Panel evaluates Science Merit (Section 7.2.2 of the 2021 Astrophysics MIDEX AO) and Scientific Implementation Merit and Feasibility (Section 7.2.3).
- The science evaluation will be conducted via a single Science Panel, and sub-panels may be employed, depending on the number and variety of proposed investigations.
  - Any sub-panel will be led by a NASA Civil Servant and may be co-chaired by a member from the scientific community.
  - Sub-panels may have an Executive Secretary.

Science Panel Composition and Organization (2 of 2)

- Each proposal will be reviewed by assigned panel members.
  - The Lead Reviewer for each proposal will lead the discussion. At least two secondary (supporting) reviewers will be assigned to each proposal.
  - At the request of the Lead Reviewer, a Supporting Reviewer will take notes on the discussion.
- The TMC Panel may provide comments and questions to the Science Panel, and vice versa.
- The Science Panel may request clarifications from proposers on any Potential Major Weaknesses (PMWs) in Science Merit (Form A) or Science Implementation Merit and Investigation Feasibility (Form B) that are identified during the evaluation process.

Science Panel Procedures (1 of 2)

- The Science Panel will review a version of the proposal in which any export-controlled material has been redacted. Proposers are required to indicate such material; NRESS will redact the proposal pdf.
- Each Science Panel member evaluates proposals as directed by the Chair.
  - If special science expertise is required, the Science Panels may utilize non-panel/mail-in evaluators to assist with one or more proposals.
  - Non-panel/mail-in evaluators evaluate only those parts of proposals pertinent to their scientific specialties.
- Each proposal may be discussed by the evaluators in web conferences.
  - Findings in the form of Strengths and Weaknesses form the basis for initial panel discussions
  - Each assigned evaluator provides an individual evaluation prior to the web conferences.
  - The proposal and the individual evaluations are discussed at the web conferences, including those from non-panel evaluators.
  - The Lead Evaluator generates a Draft Evaluation including draft findings, based on the individual evaluations and the discussion. Draft findings include PMWs to be sent to the proposers for clarification.
  - After PMW clarification responses are received, a web conference is held to consider clarification responses. Draft findings are updated if applicable.
  - No overall merit grade is assigned at the web conferences.

Science Panel Procedures (2 of 2)

- A Meeting of the Science Panel or sub-panels is held upon completion of individual evaluations for all proposals.
  - The Science Panel (or sub-panel) compiles all of the findings for each proposal.
  - If the sub-panels meet separately, a web conference of the sub-panel chairs, or of sub-panel members explicitly tasked with consistency, will review the draft findings of all sub-panels for consistency ahead of the sub-panel meetings.
  - For each proposal, the Chair or designated Lead Evaluator leads the discussion, summarizes the proposed investigation, and documents the results.
  - Evaluations of all proposals are reviewed during the Science Panel Meeting to ensure that standards have been applied uniformly and in an appropriate and fair manner.
  - After the discussion, each member of the Panel or sub-panel assigns a merit rating for Science (Form A) and for Science Implementation and Feasibility (Form B) to each proposal. Non-panel evaluators do not assign ratings.

Science Panel Evaluation Factors

Criterion A: Scientific Merit of the Proposed Investigation

Factors from 2021 Astrophysics MIDEX AO section 7.2.2

- Factor A-1. Compelling nature and scientific priority of the proposed investigation's science goals and objectives.
- Factor A-2. Programmatic value of the proposed investigation.
- Factor A-3. Scientific value of the Threshold Science Mission.

Factors A-1 and A-2 are evaluated for the Baseline Science Mission assuming it is implemented as proposed and achieves technical success. Factor A-3 is similarly evaluated for the Threshold Science Mission.

Evaluation Criterion A

Factor A-1. Compelling nature and scientific priority of the proposed investigation's science goals and objectives. This factor includes the clarity of the goals and objectives; how well the goals and objectives reflect program, Agency, and national priorities; the potential scientific impact of the investigation on program, Agency, and national science objectives; and the potential for fundamental progress, as well as filling gaps in our knowledge relative to the current state of the art.

Factor A-2. Programmatic value of the proposed investigation. This factor includes the unique value of the investigation to make scientific progress in the context of other ongoing and planned missions; the relationship to the other elements of NASA's science programs; how well the investigation may synergistically support ongoing or planned missions by NASA and other agencies; and the necessity for a space mission to realize the goals and objectives.

Factor A-3. Scientific value of the Threshold Science Mission. This factor includes the scientific value of the Threshold Science Mission using the standards in the first factor of this section and whether that value is sufficient to justify the proposed cost of the mission.

Science Panel Evaluation Factors

Criterion B: Scientific Implementation Merit and Feasibility of the Proposed Investigation

Factors from 2021 Astrophysics MIDEX AO section 7.2.3

- Factor B-1. Merit of the proposed mission architecture, instruments, and measurement techniques for addressing the goals and meeting the science objectives.
- Factor B-2. Probability of technical success.
- Factor B-3. Data adequacy, analysis, and archiving.
- Factor B-4. Science resiliency.
- Factor B-5. Probability of science team success.

The panel evaluating the "Science Implementation Merit and Feasibility" will provide comments to NASA regarding the extent to which the proposed investigation provides career development opportunities to train the next generation of science leaders. While these comments will not be considered in the evaluation, they may be considered during selection.

Evaluation Criterion B

Factor B-1. Merit of the proposed mission architecture, instruments, and measurement techniques for addressing the goals and meeting the science objectives. This factor includes how well the anticipated measurements support the goals and objectives; the appropriateness of the selected instruments and mission architecture for addressing the goals and objectives; and the appropriateness of the mission requirements for guiding development and ensuring scientific success.

Factor B-2. Probability of technical success. This factor includes the maturity and technical readiness of the instruments or demonstration of a clear path to achieve necessary maturity; the adequacy of the plan to develop the instruments within the proposed cost and schedule; the robustness of those plans, including recognition of risks and mitigation plans for retiring those risks; the likelihood of success in developing any new technology that represents an untested advance in the state of the art; the ability of the development team—both institutions and individuals—to successfully implement those plans; and the likelihood of success for both the development and the operation of the instruments within the mission design.

Evaluation Criterion B (continued)

Factor B-3. Data adequacy, analysis, and archiving. This factor includes the degree to which the proposed mission and instruments can provide the quality and quantity of data necessary to complete the investigation and meet the proposed science objectives. Additionally, it includes the merit of data analysis plans, including the fidelity of physical models required to connect the measurements to the science objectives; and plans for archiving, to preserve data and analysis of value to the science community. Considerations include planning and budget adequacy, with plans for well-documented, high-level data products and software usable to the entire science community; adequate resources for physical interpretation of data; reporting scientific results in the professional literature (e.g., refereed journals); and timely release of the data to the public domain.

Factor B-4. Science resiliency. This factor includes both developmental and operational resiliency. Developmental resiliency includes the approach to descoping the Baseline Science Mission to the Threshold Science Mission in the event that development problems force reductions in scope. Operational resiliency includes the ability to withstand adverse circumstances, the capability to degrade gracefully, and the potential to recover from anomalies in flight.

Factor B-5. Probability of science team success. This factor will be evaluated by assessing the experience, expertise, and organizational structure of the science team and the mission design in light of any proposed instruments. The role of each Co-Investigator will be evaluated for necessary contributions to the proposed investigation; the inclusion of Co-Is who do not have a well-defined and appropriate role may be cause for downgrading during evaluation.

Science Evaluation Products

For each proposal, this process results in Form A and Form B, each of which includes

- Proposal title, PI name, and submitting organization;
- Proposal summary;
- Based on findings, number of panel members selecting each adjectival rating for Intrinsic Scientific Merit (Form A) and for Science Implementation Merit and Investigation Feasibility (Form B). Adjectival ratings range from “Excellent” to “Poor”, including half-step ratings (e.g. Very Good/Good)*;
- Summary rationale for the median rating; if the median rating falls between the two half-steps, the rating closer to the mean is adopted; if the mean and median are equal, the score will be “rounded” towards the less favorable grade.
- Narrative findings, identified as major or minor strengths or weaknesses;
- Comments to the Proposers, comments to the Selection Official*, and comments to the TMC Panel*. (optional)

*** Note: not provided to proposers**

Science Evaluation Products: Findings

- **Major Strength:** A facet of the implementation response that is judged to be of superior merit and can substantially contribute to the ability of the project to meet its scientific objectives.
- **Major Weakness:** A deficiency or set of deficiencies taken together that are judged to substantially weaken the project's ability to meet its scientific objectives.
- **Minor Strength:** An aspect of the proposal that is judged to contribute to the ability of the project to meet its scientific objectives.
- **Minor Weakness:** A deficiency or set of deficiencies taken together that are judged to weaken the project's ability to meet its scientific objectives.

Note: Findings that are considered "as expected" are not documented on Forms A and B.

Form A and B Grade Definitions

Excellent: A comprehensive, thorough, and compelling proposal of exceptional merit that fully responds to the objectives of the AO as documented by numerous and/or significant strengths and having no major weaknesses.

Very Good: A fully competent proposal of very high merit that fully responds to the objectives of the AO, whose strengths fully outbalance any weaknesses.

Good: A competent proposal that represents a credible response to the AO, having neither significant strengths nor weaknesses and/or whose strengths and weaknesses essentially balance.

Fair: A proposal that provides a nominal response to the AO, but whose weaknesses outweigh any perceived strengths.

Poor: A seriously flawed proposal having one or more major weaknesses (e.g., an inadequate or flawed plan of research or lack of focus on the objectives of the AO).

Note: Only Major Findings are considered in the adjectival rating.

TMC Evaluation

TMC Panel Composition and Organization

- The Acquisition Manager, who is a Civil Servant in 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 findings.
- Additionally, specialist evaluators may be called upon in cases where technical expertise that is not represented on the panel is needed.
  - Specialist Evaluators evaluate only those parts of a proposal that are specific to their particular expertise.
  - Specialist Evaluators provide only findings; they do not provide ratings.

TMC Panel Evaluation Factors

Criterion C: TMC Feasibility of the Proposed Mission Implementation, Including Cost Risk

Factors from 2021 Astrophysics MIDEX AO section 7.2.4

- 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.

Please note the following:

- **Ground systems and facilities are not evaluated under Factor C-2, but are relevant to other evaluation factors.**
- **The panel will provide comments to NASA regarding the extent to which the proposed investigation provides career development opportunities to train the next generation of engineering and management leaders. While these comments will not be considered in the evaluation, they may be considered during selection.**

Evaluation Criterion C

Factor C-1. Adequacy and robustness of the instrument implementation plan. The maturity and technical readiness of the instrument complement will be assessed, as will the ability of the instruments to meet mission requirements. This factor includes an assessment of the instrument design, accommodation, interface, heritage, and technology readiness. This factor includes an assessment of the instrument hardware and software designs, heritage, and margins. This factor includes an assessment of the proposer's understanding of the processes, products, and activities required to accomplish development and integration of the instrument complement. This factor also includes adequacy of the plans for instrument systems engineering and for dealing with environmental concerns. This factor includes an assessment of plans for the development and use of new instrument technology, plans for advanced engineering developments, and the adequacy of backup plans to mature systems within the proposed cost and schedule when systems having a TRL less than 6 are proposed.

Factor C-2. Adequacy and robustness of the mission design and plan for mission operations. This factor includes an assessment of the overall mission design and mission architecture, the spacecraft design and design margins (including margins for launch mass, delta-V, and propellant), the concept for mission operations (including communication and navigation/ tracking/trajectory analysis), and the plans for launch services. This factor includes mission resiliency—the flexibility to recover from problems during both development and operations—including the technical resource reserves and margins, system and subsystem redundancy, and reductions and other changes that can be implemented without impact to the Baseline Science Mission. [Note that ground systems and facilities will be evaluated at Step 2 under Factor C-7: see the Guidelines and Criteria for the Phase A Concept Study document, available in the Program Library.]

Evaluation Criterion C

Factor C-3. Adequacy and robustness of the flight systems. This factor includes an assessment of the flight hardware and software designs, heritage, and margins. This factor includes an assessment of the proposer's understanding of the processes, products, and activities required to accomplish development and integration of all elements (flight systems, ground and data systems, etc.). This factor includes an assessment of the adequacy of the plans for spacecraft systems engineering, qualification, verification, mission assurance, launch operations, and entry/descent/landing. This factor includes the plans for the development and use of new technology, plans for advanced engineering developments, and the adequacy of backup plans to ensure success of the mission when systems having a TRL less than 6 are proposed. The maturity and technical readiness of the spacecraft, subsystems, and operations systems will be assessed. The adequacy of the plan to mature systems within the proposed cost and schedule, the robustness of those plans, including recognition of risks and mitigation plans for retiring those risks, and the likelihood of success in developing any new technologies will be assessed.

Evaluation Criterion C

Factor C-4. Adequacy and robustness of the management approach and schedule, including the capability of the management team. This factor includes: the adequacy of the proposed organizational structure and WBS; the management approach including project level systems engineering; the roles, qualifications, and experience of the PI, PM, other named Key Management Team members, and implementing organization, mission management team, and known partners; the commitment, spaceflight experience, and relevant performance of the PI, PM, other named Key Management Team members, and implementing organization, mission management team, and known partners against the needs of the investigation; the prior working relationships of the implementing organization and known partners; the commitments of partners and contributors; and the team's understanding of the scope of work covering all elements of the mission, including contributions. Also evaluated under this factor is the adequacy of the proposed risk management approach, including any risk mitigation plans for new technologies, any long-lead items, and the adequacy and availability of any required manufacturing, test, or other facilities. The approach to any proposed descoping of mission capabilities will be assessed against the potential science impact to the proposed Baseline Science Mission. The plans for managing the risk of contributed critical goods and services will be assessed, including the plans for any international participation, the commitment of partners and contributors, as documented in Letters of Commitment, and the technical adequacy of contingency plans, where they exist, for coping with the failure of a proposed cooperative arrangement or contribution. This factor also includes assessment of elements such as the relationship of the work to the project schedule, the project element interdependencies, the associated schedule margins, and an assessment of the likelihood of meeting the proposed launch readiness date. Also evaluated under this factor are the proposed project and schedule management tools to be used on the project.

Evaluation Criterion C

Factor C-5. Adequacy and robustness of the cost plan, including cost feasibility and cost risk. This factor includes elements such as cost, cost risk, cost realism, and cost completeness including assessment of the basis of estimate, the adequacy of the approach, the methods and rationale used to develop the estimated cost, the discussion of cost risks, the allocation of cost reserves by phase, and the team's understanding of the scope of work (covering all elements of the mission, including contributions). The adequacy of the cost reserves and understanding of the cost risks will be assessed. This factor also includes an assessment of the proposed cost relative to estimates generated by the evaluation team using parametric models and analogies. Also evaluated under this factor are the proposed cost management tools to be used on the project.

TMC Cost Analysis

- The evaluation assesses the cost risk, cost realism, and cost completeness including the basis of estimate, the adequacy of the approach, the methods and rationale used to develop the estimated cost, the discussion of cost risks, the allocation of cost reserves by phase, and the team's understanding of the scope of work.
- An independent cost verification of the proposed cost for Phases A-D is performed using at least two independent cost models.
- An independent cost verification of the proposed cost for Phase E is performed using at least two cost models.
- The likelihood and cost impact of major weaknesses is assessed.
- Cost threat impacts to the proposed unencumbered cost reserves is assessed.
- The adequacy of the remaining unencumbered cost reserves is assessed.
- All draft Forms C and Cost Evaluation Summaries (CESs) are completed prior to the Plenary Meeting.
- The entire panel participates in the Cost deliberations.
- All information from the entire evaluation process is considered in the final cost assessment.
- All cost findings are included on the Form C and considered in the TMC Risk Rating.

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 threat.
- The cost threat matrix defines the adjectives that describe the *likelihood* and *cost impact*.
- The minimum cost threat threshold is $1M ***for Phases A-D, and 2.5% for Phase E***.

			Cost Impact (CI) % of PI-Managed Mission Cost to complete Phases A/B/C/D or % of Phase E not including unencumbered cost reserves or contributions					
	Likelihood of Occurrence	**Weakness**	**Very Minimal**	**Minimal**	**Limited**	**Moderate**	**Significant**	**Very Significant**
			0.5% < CI ≤ 2.5%	2.5% < CI ≤ 5%	5% < CI ≤ 10%	10% < CI ≤ 15%	15% < CI ≤ 20%	CI > 20%
				2.5% < CI ≤ 5%	5% < CI ≤ 10%	10% < CI ≤ 15%	15% < 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: Depending on proposed PI-Managed Mission Cost, some columns may not apply.

Ground Systems and Facilities

- Factor C-2 is amended to delete the evaluation of “ground systems and facilities.” Ground systems and facilities are evaluated at Step 2 under Factor C-7.
  - Ground systems and facilities in AO Requirements B-27, B-29, B-35, and B-66 will not be evaluated under evaluation factor C-2. However, information on ground systems and facilities relevant to factors other than C-2 will be evaluated.
  - Although ground systems and facilities are not evaluated under evaluation factor in C-2, associated schedule and cost impacts shall be included in the Step-1 proposals. See AO Requirement B-40 for schedule and Requirement B-47 for cost of the ground systems and facilities.

Student Collaboration and Science Enhancement Options

- Definition and evaluation of Student Collaborations and Science Enhancement Options are deferred to Step 2.
- All requirements associated with Student Collaborations (AO Section 5.5.3) and Science Enhancement Options (AO Section 5.1.5) are deferred until Step 2.

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.
- **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 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 Panel Product: Form C

For each proposal, the TMC Evaluation will result in a Form C for Categorization, Steering, and Selection that contains:

- Proposal title, PI name, and submitting organization;
- Based on the findings, an adjectival median risk rating for the TMC Feasibility of the Proposed Mission Implementation of “Low Risk,” “Medium Risk” or “High Risk”;
- Summary rationale for the median risk rating;
- Narrative findings, identified as major or minor strengths or weaknesses;
- Comments to the Proposers, comments to the Selection Official*, and comments to the Science Panel*. (optional)

*** Note: not provided to proposers**

PMW Clarifications Process

PMW Clarifications Process: Modified from Previous AOs

Section 7.1.1 of the AO states " Proposers should be aware that, during the 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 evaluation of 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), NASA will request clarification on specific, potential major weaknesses in the Scientific Merit of the Proposed Investigation, the Scientific Implementation Merit and Feasibility of the Proposed Investigation, and the TMC Feasibility of the Proposed Mission Implementation that have been identified in the proposal. NASA will request clarification in a uniform manner from all proposers. Proposers will be allowed up to **eight combined pages** (with some restrictions) for clarifications of Potential Major Weaknesses (PMWs) associated with the Scientific Merit (A-factors) plus Scientific Implementation Merit and Feasibility of the Proposed Investigation (B-factors) evaluation criteria. Up to **six pages** (with some restrictions) will be allowed for clarifications of PMWs associated with the TMC Feasibility of the Proposed Mission 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 Pre-proposal Web Conference and the 2021 Astrophysics MIDEX Evaluation Plan found in the 2021 Astrophysics Explorers Acquisition Homepage."

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

The PIs are given at least 2 full working days to respond to the request for PMW clarification.

PMWs Clarification Process Requirements (1 of 3)

Clarifications Responses must conform to the following requirements:

Requirement 1: Proposers shall submit only two Clarification Response Documents; i.e., one for Scientific Merit of the Proposed Investigation (A-factors), and Scientific Implementation Merit and Feasibility of the Proposed Investigation (B-factors); and one for the TMC Feasibility of the Proposed Investigation Implementation (C-factors).

Requirement 2: Each Clarification Response Document 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.

PMW Clarification Process Requirements (2 of 3)

Requirement 3: Each Clarification Response Document 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 combined responses to Scientific Merit of the Proposed Investigation (A-factors) and Scientific Implementation Merit and Feasibility of the Proposed Investigation (B-factors) PMWs, the Clarification Response Documents shall not exceed eight pages. For the TMC Feasibility of the Proposed Investigation Implementation 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 Requirement 3.

PMW Clarifications Process Requirements (3 of 3)

Requirement 5: The Clarification Response Document 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 only contain information relevant to the PMW.

Requirement 7: 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 fulfill requirements above and not exceed the page limitation per Clarification Response Document.

Requirement 8: In support of each PMW clarification response, proposers shall not provide more than two references; references are restricted to peer reviewed literature. In support of any additional information response, proposers shall not provide more than three additional references; references are restricted to peer reviewed literature. Proposers shall not provide URLs with any of the responses.

Categorization

Categorization Process and Proposal Categories

Subsequent to the evaluation process, NASA will convene a Categorization Committee, composed wholly of CS and IPA appointees (some of whom may be from Government agencies other than NASA) and appointed by the Associate Administrator for the Science Mission Directorate. The Categorization Committee will consider the Scientific Merit, Scientific Implementation Merit and Feasibility, and TMC Feasibility of the Proposed Mission Implementation and, based on the evaluations, categorize the proposals in accordance with procedures required by NFS 1872.404. The categories are defined in NFS 1872.404(k) as follows:

Category I. Well-conceived, meritorious, and feasible investigations pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that data can be properly reduced, analyzed, interpreted, and published in a reasonable time. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.

Category II. Well-conceived, meritorious, and feasible investigations that are recommended for acceptance, but at a lower priority than Category I, whatever the reason.

Category III. Meritorious investigations that require further development. Category III investigations may be funded for further development and may be reconsidered at a later time for the same or other opportunities.

Category IV. Proposed investigations which are recommended for rejection for the particular opportunity under consideration, whatever the reason.

Steering and Selection

Steering

NASA will convene a Steering Committee, composed wholly of CS and IPA appointees (some of whom may be from Government agencies other than NASA), appointed by the Associate Administrator for the Science Mission Directorate. The Steering Committee will then review the results of the evaluations and categorizations. The Steering Committee will conduct an independent assessment of the evaluation and categorization processes regarding their compliance to established policies and practices, as well as the completeness, self-consistency, and adequacy of all supporting materials.

Selection Process

After the review by the Steering Committee, the final evaluation results will be presented to the Associate Administrator for the Science Mission Directorate, who will make the final selection(s). As the Selection Official, the SMD Associate Administrator may consult with senior members of SMD and the Agency concerning the selections.

The results of the proposal evaluations based on the criteria and the categorizations will be considered in the selection process. Additional selection factors are described in AO Section 7.3.

As part of the selection process, a decision will be made as to whether or not any Category III proposals will receive funding for technology development.

Observers

Observers Approval and Compliance

Under special circumstances, Civil Servants, IPAs, and/or contractors with downstream implementation responsibilities may be invited to participate as observers to panel meetings.

- Observer participation must be approved by the Program Scientist and the Deputy Associate Administrator for Research.
- Observers must comply with SMD Policy Document SPD-17, Statement of Policy on Observers at Panel Reviews of Proposals. This policy is provided to all approved observers who have implementation responsibilities.

Approval

Odilyn Luck
Acquisition Manager, Science Office for Mission Assessments

Cindy Daniels
Director, Science Office for Mission Assessments

Linda Sparke
Program Scientist
Astrophysics Division, SMD

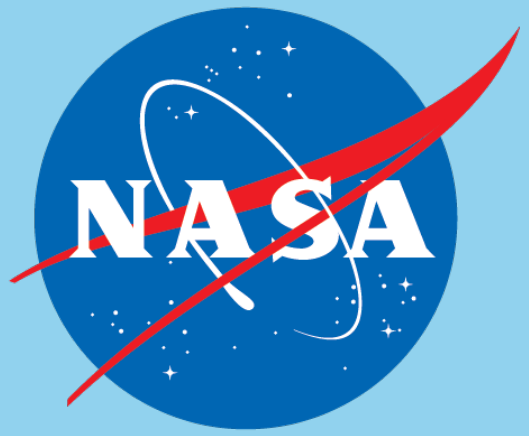
Paul Hertz
Director
Astrophysics Division, SMD

Michael New
Deputy Associate Administrator for Research, SMD

Signed copy on file

Change Log

Rev #	Date	Change
1	November 2, 2021	Baseline
2	January 11, 2022	Page 5 • Added Tony Tyler to TMC Evaluation Panel Leadership Team Page 41 • Added the cost threat minimum threshold for Phase E • Removed Phase E from the Very Minimal Cost Impact column


NASA