National Aeronautics and Space Administration

Announcement of Opportunity NNH19ZDA013O

2019 Heliophysics Explorers Program (HP) Medium-class Explorer (MIDEX) Concept Study Report (CSR) Evaluation Plan

~~*January 14, 2021*~~

(Additions in bold text, deletions struck through – ~~see Slides 9, 17, 18, 26, 35, and 45) [Amended April 15, 2021]~~

see Change Log Slide 48. [Amended August 4, 2021]

Approval

Signed copy on file

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[Amended August 4, 2021]

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Introduction

The Explorers Program is the oldest continuous program in NASA. It comprises a longstanding series of space science missions that are independent but share a common funding and NASA oversight/ insight management structure. Initiated with the Explorer 1 launch in 1958 and including the Nobel Prize-yielding Cosmic Background Explorer (COBE) mission, the Explorers Program has launched over 100 missions.

The purpose of this evaluation plan is to define the ground rules, processes, organizations, and schedules to be used in evaluating the 2019 Heliophysics Explorers Program (HP) Medium-class Explorer (MIDEX) Concept Study Reports (CSRs).

Five Missions were selected for Concept Studies, which constitute each investigation's Concept and Technology Development Phase (Phase A) of the Formulation process as outlined in NPR 7120.5E, *NASA Spaceflight Program and Project Requirements*.

$1.25M and 9 months were allocated for each Concept Study.

Evaluation Plan Overview

- The HPMIDEX19 Announcement of Opportunity (AO NNH19ZDA013O), under which the investigations to be evaluated were selected, was issued on July 2, 2019, and amended on July 23, 2019.
- The Science Office for Mission Assessments (SOMA) at NASA Langley Research Center (LaRC) developed this HPMIDEX19 CSR Evaluation Plan for the Science Mission Directorate (SMD) at NASA Headquarters.
- This CSR Evaluation Plan has been cleared for public release by SMD.
- The HPMIDEX19 Program Scientist is responsible for validating all evaluation processes, responsibility assignments, assumptions, and ground rules.

HPMIDEX19 Missions Selected for Concept Studies

Solar-Terrestrial Observer for the Response of the Magnetosphere (STORM), PI: David Sibeck, NASA Goddard Space Flight Center

STORM would provide the first-ever global view of our vast space weather system in which the constant flow of particles from the Sun – known as the solar wind – interacts with Earth's magnetic field system, called the magnetosphere.

HelioSwarm: The Nature of Turbulence in Space Plasmas, PI: Harlan Spence, University of New Hampshire

HelioSwarm would observe the solar wind over a wide range of scales in order to determine the fundamental space physics processes that lead energy from large-scale motion to cascade down to finer scales of particle movement within the plasma that fills space, a process that leads to the heating of such plasma.

Multi-slit Solar Explorer (MUSE), PI: Bart De Pontieu, Lockheed Martin

MUSE would provide high-cadence observations of the mechanisms driving an array of processes and events in the Sun's atmosphere – the corona – including what drives solar eruptions such as solar flares, as well as what heats the corona to temperatures far above that of the solar surface.

Auroral Reconstruction CubeSwarm (ARCS), PI: Kristina Lynch, Dartmouth University

ARCS would explore the processes that contribute to aurora at size scales that have been rarely studied: at the intermediate scale between the smaller, local phenomena leading directly to the visible aurora and the larger, global dynamics of the space weather system coursing through the ionosphere and thermosphere.

Solaris: Revealing the Mysteries of the Sun's Poles, PI: Donald Hassler, Southwest Research Institute

Solaris would address fundamental questions of solar and stellar physics that can only be answered with a view of the Sun's poles

Handling of Proprietary Data

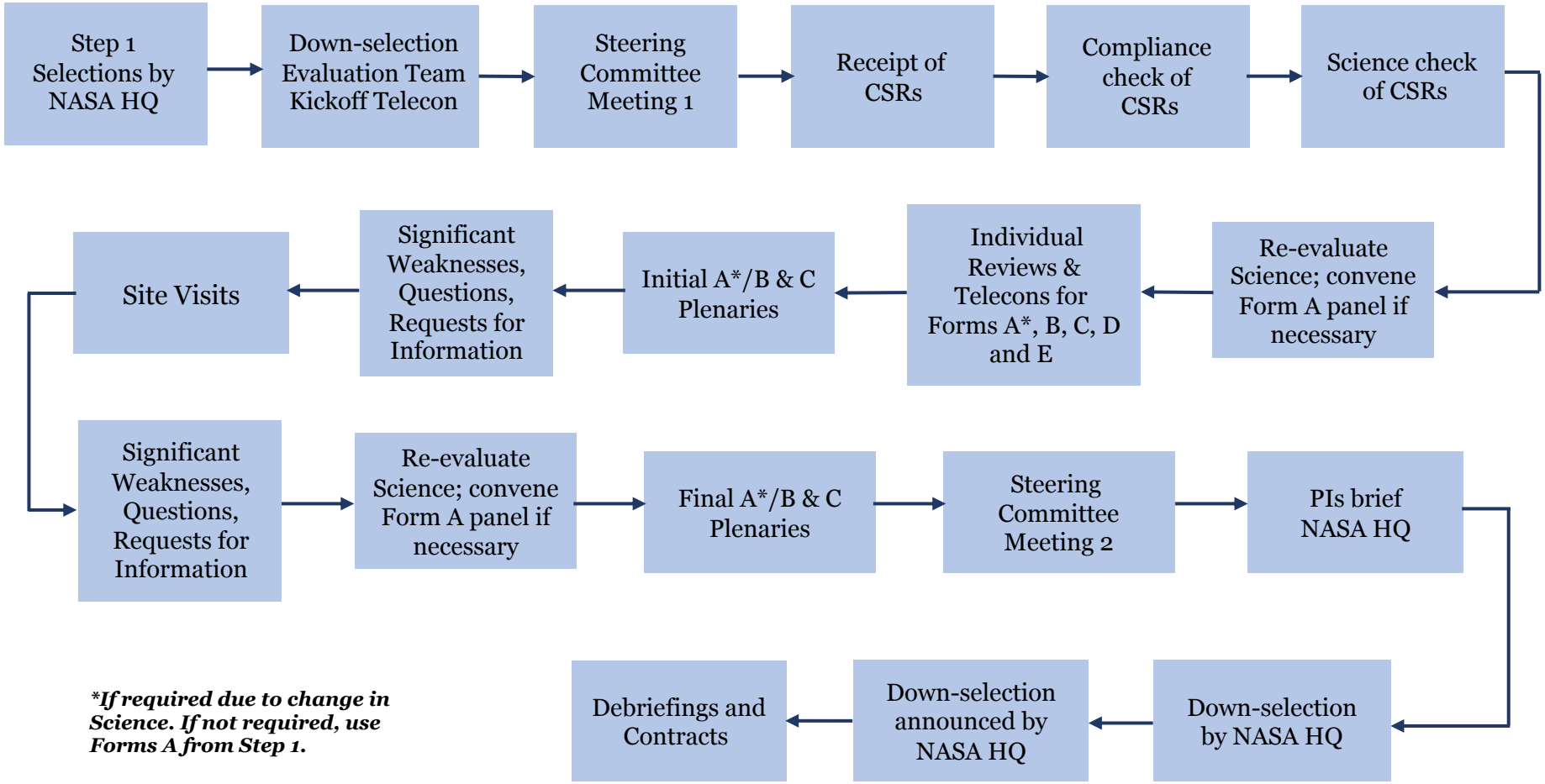
- All CSR related materials will be considered proprietary.
- Only those individuals with a need to know will be allowed to view CSR materials.
- Each non-Civil Servant (CS) or non-Intergovernmental Personnel Act (IPA) Assignee Evaluator will sign a Non-Disclosure Agreement (NDA) which must be on file with NASA Research and Education Support Services (NRESS) or the Evaluations, Assessments, Studies, Services, and Support 3 (EASSS 3) Contractors prior to any CSRs being distributed to that evaluator.

  – CS and IPA Evaluators are not required to sign an NDA.
- All Report Materials in hardcopy format will be numbered and controlled, and a record will be kept of who has been supplied with what materials, both electronic and hardcopy.
- Evaluators and Observers will be briefed at a Kickoff telecon on how to handle the CSR material. Evaluators will be briefed that they are not allowed to discuss CSRs with anyone outside the Evaluation Panels <u>ever</u>, unless authorized by NASA. Evaluators will be briefed to not contact anyone outside of their Evaluation Panel to gain insight on any CSR related matter without expressly getting authorization from the Heliophysics Explorers Program Scientist (Dr. Dan Moses) or the Technical, Management, and Cost (TMC) Panel Chair <u>in advance</u> of making the contact.
- SPD-17 detailing Observers at Review Panels will be followed. Observers will not have access to CSR or evaluation materials.

Handling of Proprietary Data (continued)

- During the Evaluation, all proprietary information that needs to be exchanged between evaluators will be transferred securely via the Remote Evaluation System (RES) website maintained by SOMA, via the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES), via NASA Google docs, via the secure ScienceWorks system maintained by SMD, via controlled WebEx, via NASA's ~~Large File Transfer (LFT) capability~~ **Box service**, or via encrypted email, parcel post, fax, or regular mail. Proprietary information will not be sent via unencrypted email. **[Amended August 4, 2021]**
- Telecon line information is confidential. The phone numbers and pass codes are posted in a file on the Remote Evaluation Site (RES). Participants will be briefed to ensure they do not provide this information to anyone or distribute this information via email.
- When the evaluation process is complete, CSR materials will be collected. Some copies (for archival purposes) will be maintained by the Program Scientist at NASA HQ, and in the SOMA vault. Also, all CSR material from the down-selected mission(s) will be provided to the managing Program Office. All other CSR materials will be destroyed.
- Evaluators' electronic and paper evaluation materials will be deleted/destroyed when the evaluation process is complete. Archival copies will be maintained in the NASA Science Office for Mission Assessments (SOMA) vault.

Proposal Evaluation Flow



If required due to change in Science. If not required, use Forms A from Step 1.

Evaluation Organization

Leadership Team

Dr. Dan Moses, Program Scientist
~~Ezinne Uzo-Okoro~~ **Alan Zide**, Program Executive
HPD, NASA Headquarters

James Florance, Acquisition Manager
Dr. Chauncey Wu, Acquisition Manager
SOMA, NASA Langley Research Center
Amended [August 4, 2021]

Science Panel (Forms A & B)
Chair: Dr. Dan Moses
Co-Chair: ~~Ezinne Uzo-Okoro~~ **Alan Zide**
[Amended August 4, 2021]

TMC Panel (Form C)
Co-Chair: James Florance
Co-Chair: Dr. Chauncey Wu

Student Collaboration (Form D)
Chair: ~~TBD~~ **Kristen Erickson**
Deputy Chair: Dr. Lin Chambers
[Amended April 15, 2021]

Small Business Subcontracting (Form E)
Chair: ~~TBD~~ **Richard Mann**
[Amended April 15, 2021]

Plan to Avoid Conflicts of Interest (COIs)

- Members of Evaluation Panels are cross-checked against the draft list of organizations and individuals provided by the study teams to ensure no individual or organizational COI exists with the planned evaluators. Evaluators are required to raise any potential COIs.
- After the Concept Study Reports (CSRs) are received, all members of the Evaluation Panels will again be cross-checked against the final lists of organizations and individuals on each CSR to ensure no individual or organizational COI exists on the list of evaluators.
- In addition, all evaluators will review the final lists of conflicted organizations and individuals and be required to divulge whether they have any financial, professional, or personal potential conflicts of interest and whether they work for a profit-making company that directly competes with any profit-making proposing organization.
- Any potential COI issue is discussed with the CSR Evaluation Chair and the SMD Deputy Associate Administrator for Research (DAAR) and documented in the HPMIDEX19 Down-select COI Mitigation Plan.
- All Civil Service evaluators will self-certify their COI status by reviewing a combined listing of individuals and organizations associated with the CSRs. The TMC evaluators must notify the TMC Panel Chair if there is a potential conflict. The Science evaluators must notify the Science Panel Chair if there is a potential conflict.

Plan to Avoid COIs (continued)

- If any evaluators with potential organizational COI must be used, their respective organizations must submit a plan to address the COI, as required by their contract or SMD waiver, and also provide a mitigation plan. This plan will outline how they will firewall the potentially conflicted evaluator(s) during the evaluation process from the conflicted part of their organization.
- If during the evaluation there is any actual conflict of interest noted, the conflicted member(s) will be notified to stop reviewing CSRs immediately and the HPMIDEX19 Program Scientist will be notified. Steps will be expeditiously taken to remove any actual or potential bias imposed by the conflicted member(s).
- Community standards for conflicts of interest will be applied to all evaluators as directed in SMD Policy Document SPD-01A, *Handling Conflicts-of-Interest for Peer Reviews*. Standards for financial conflicts of interest as specified in 18 U.S.C. § 208 will be applied to Civil Servant evaluators. The HQ Office of General Counsel will be consulted as necessary.

Evaluation Criteria and Additional Selection Factors

- The criteria to evaluate the Concept Study Reports are documented in the **HPMIDEX19 GUIDELINES AND CRITERIA FOR THE PHASE A CONCEPT STUDY** at:
  https://explorers.larc.nasa.gov/HPMIDEX/programlibrary.html
- **Evaluation criteria for the Concept Study**: approximate significance of each criterion is indicated by the percent weighting in parentheses.
  - Criterion A: Scientific merit of the proposed investigation (will not be re-evaluated unless it is determined that the science has changed from that described in the Step 1 proposal) (approximately 20%)
  - Criterion B: Scientific implementation merit and feasibility of the proposed investigation (approximately 30%)
  - Criterion C: TMC Feasibility of the proposed mission implementation (approximately 45%)
  - Criteria D and E: Quality of plans for an optional Student Collaboration, if proposed, and for small business subcontracting (approximately 5% combined)
- **Additional Selection Factors that may be considered by the Selection Official**
  - NASA budget changes and/or other programmatic factors, including but not limited to, career development opportunities to train the next generation of science, engineering and management leaders; changes in scientific mandates, national priorities, and budgetary forecasts that were not evident when the HPMIDEX19 AO was issued.
  - The PI-Managed Mission Cost.

Evaluation Criterion A

Scientific Merit of the Proposed Investigation:

The Heliophysics Explorers Program Scientist will determine whether any issues that may have emerged in the course of the concept study have effected significant changes to the science objectives or other aspects of the proposed Baseline and Threshold Science Missions (see Requirement CS-17 in Section II of the *HPMIDEX19 Guidelines and Criteria for the Phase A Concept Study*) in such a manner as to have impacted the basis for the evaluation of the scientific merit of the investigation as determined by the peer review panel for the Step 1 proposal. If there are no significant changes to the proposed investigation that undermine the basis of this rating, the peer review panel rating for scientific merit of the Step 1 proposal will be the rating for scientific merit of the CSR. If there are significant changes, the Program Scientist will convene a peer review panel to re-evaluate the scientific merit of the objectives in light of these changes. The factors for re-evaluating this criterion will be the same as those used for the Step 1 proposal review (Section 7.2.2 of the AO).

Evaluation Criterion B

Scientific Implementation Merit and Feasibility of the Proposed Investigation: All of the factors defined in Section 7.2.3 of the AO apply to the evaluation of the CSR. Note that details have been added to one of the subfactors of Factor B-1, Merit of the instruments and mission design. Also, an additional subfactor has been added to Factor B-2, Probability of technical success. *Italicized details are added to several factor definitions below for the evaluation of the CSR.*

Factor B-1. Merit of the instruments and mission design for addressing the science goals and objectives. This factor includes the degree to which the proposed mission will address the goals and objectives; the appropriateness of the selected instruments and mission design for addressing the goals and objectives; the degree to which the proposed instruments and mission can provide the necessary data, *including details on data collection strategy and plans*; and the sufficiency of the data gathered to complete the scientific investigation.

Evaluation Criterion B (continued)

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. *This factor includes assessment of technology readiness, heritage, environmental concerns, accommodation, and complexity of interfaces for the instrument design.*

Factor B-3. Merit of the data analysis, data availability, data archiving plan, and/or sample analysis plan. This factor includes the merit of plans for data and/or sample analysis, curation, and data archiving to meet the goals and objectives of the investigation; to result in the publication of science discoveries in the professional literature; and to preserve data, analysis, and samples of value to the science community. Considerations in this factor include assessment of planning and budget adequacy and evidence of plans for well-documented, high-level data products and software usable to the entire science community; assessment of adequate resources for physical interpretation of data; an assessment of the planning and budget adequacy and evidence of plans for the preliminary evaluation and curation of any returned samples; reporting scientific results in the professional literature (e.g., refereed journals); and assessment of the proposed plan for the timely release of the data to the public domain for enlarging its science impact.

Evaluation Criterion B (continued)

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 (Co-I) 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. The inclusion of career development opportunities to train the next generation science leaders will also be evaluated.

Evaluation Criterion B (continued)

AO Factor A-3 will also be re-evaluated as a factor for Scientific Implementation Merit and Feasibility; it has been renumbered as Factor B-6 below.

Factor B-6. Likelihood of scientific success. This factor includes how well the anticipated measurements support the goals and objectives; the adequacy of the anticipated data to complete the investigation and meet the goals and objectives; and the appropriateness of the mission requirements for guiding development and ensuring scientific success.

Three new evaluation factors that are not described in the AO, and therefore were not evaluated for Step-1 proposals, will also be considered. Factors B-7 to B-9 will be evaluated for the CSRs in addition to the factors specified in Sections 7.2.2 and 7.2.3 of the AO (repeated or updated above as Factors B-1 through B-6).

Factor B-7. Scientific Implementation Merit and Feasibility of any Science Enhancement Options (SEOs), if proposed. This factor includes assessing the **potential and** appropriateness of the selected activities to enlarge the science impact of the mission and the costing of the selected activities. Although evaluated by the same panel as the balance of Scientific Implementation Merit and Feasibility factors, this factor will not be considered in the overall criterion rating. **[Amended April 15, 2021]**

Evaluation Criterion B (continued)

<u>Factor B-8</u>. Scientific Implementation Merit and Feasibility of any PI-Team-Developed Enhancing Technology Demonstration Opportunities (TDOs), if proposed. This factor includes assessing the **potential and** appropriateness of the TDO to enlarge the impact of the investigation and/or add value to future investigations. There will be no penalty for potential low inherent maturity of the TDO itself. Although evaluated by the same panel as the balance of Scientific Implementation Merit and Feasibility factors, this factor will not be considered in the overall criterion rating. **[Amended April 15, 2021]**

<u>Factor B-9</u>. Maturity of proposed Level 1 science requirements and Level 2 project requirements. This factor includes assessment of whether the Level 1 science requirements are mature enough to guide the achievement of the objectives of the Baseline Mission and the Threshold Mission, and whether the Level 2 requirements are consistent with the Level 1 requirements. The Levels 1 and 2 requirements will be evaluated for whether they are stated in unambiguous, objective, quantifiable, and verifiable terms that do not conflict and for whether they are traceable to the science objectives. They will be evaluated for the adequacy, sufficiency, and completeness, including their utility for evaluating the capability of the instruments and other systems to achieve the mission objectives. The stability of the Level 1 science requirements and Level 2 project requirements will be assessed including whether the requirements are ready, upon initiation of Phase B, to be placed under configuration control with little or no expected modifications for the lifecycle of the mission.

Evaluation Criterion C

TMC Feasibility of the Proposed Investigation Implementation:

- All of the factors defined in AO Section 7.2.4 apply to the evaluation of the CSR. All of these factors are interpreted as including an assessment as to whether technical, management, and cost feasibility are at least at a Phase A level of maturity. *Italicized details are added to several factor definitions below for the evaluation of the CSR.*

- Note that the communications analysis, ground systems and facilities aspects of the Step-1 evaluation's Factor C-2, Adequacy and robustness of the mission design and plan for mission operations, have been deleted from Factor C-2 and included in a new evaluation factor, Factor C-7, Ground systems. The deleted ground systems subfactor in Factor C-2 is indicated by the struck-through text in that factor definition.

- Note that the risk management aspects of the Step-1 evaluation's Factor C-4, Adequacy and robustness of the management approach and schedule, including the capability of the management team, have been removed from Factor C-4 and included in a new evaluation factor, Factor C-6, Adequacy of the risk management plan.

Evaluation Criterion C (continued)

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.

Evaluation Criterion C (continued)

<u>Factor C-2.</u> 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, ΔV, and propellant), the concept for mission operations (including ~~communication,~~ *operational scenarios, timelines and team responsibilities)*, navigation/ tracking/ trajectory analysis, ~~and ground systems and facilities),~~ *an operations plan*, 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.

Evaluation Criterion C (continued)

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 (continued)

Factor C-4. Adequacy and robustness of the management approach and schedule, including the capability of the management team. 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, PSE, 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, PSE, 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. 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, *along with the small business subcontracting plan including small disadvantaged businesses*. The inclusion of career development opportunities to train the next generation of engineering and management leaders will also be evaluated.

If tailoring of program and project management requirements is proposed, evaluators will comment on the CSR team's justification for that tailoring, but will not consider it a part of the risk rating.

Evaluation Criterion C (continued)

<u>Factor C-5.</u> 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 will be evaluated; 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.

Evaluation Criterion C (continued)

When appropriate, Factor C-2 will include an assessment of proposed planetary protection provisions to avoid potential biological contamination (forward and backward) that may be associated with the mission. An evaluation of the implementation of these provisions in the preparation or processing of proposed instruments, the development of the flight system, in project management and to proposed costs will be included in the evaluations of Factors C-1, C-3, C-4, and C-5, as appropriate.

The risk management subfactors of AO Factor C-4 are removed and expanded as a new Factor C-6, as presented below. Expanded text is italicized below for the evaluation of the CSR.

Factor C-6. Adequacy of the risk management plan. The adequacy of the proposed risk management approach will be assessed, 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; *when no mitigation is possible, this should be explicitly acknowledged. The stability and reliability of proposed partners, and the appropriateness of any proposed contribution, is not assessed as a management risk but will be assessed by SMD as a programmatic risk element of the investigation.*

Evaluation Criterion C (continued)

Two new evaluation factors that are not described in the AO, and therefore were not evaluated for Step-1 proposals, will also be evaluated. Factors C-7 and C-8 below will be evaluated for the CSRs in addition to the factors given in AO Section 7.2.4 (repeated or updated as Factors C-1 through C-6).

Factor C-7. Ground Systems. This factor includes an assessment, including heritage and planned new development, of the proposed operations facilities, hardware, and software (*i.e.*, those for mission operations and science operations), and a telecommunications analysis, ground network capability and utilization plan, and navigation plans.

Factor C-8. Approach and feasibility for completing Phase B. The completeness of Phase B plans and the adequacy of the Phase B approach will be assessed. This assessment will include evaluation of the activities/products, the organizations responsible for those activities/products, and the schedule to accomplish the activities/products.

- Except for any impact to the ~~primary~~ **Baseline Science ~~m~~Mission** due to inclusion of Enhancing TDO(s) and/or SEO(s), which will be included in the factors above, TMC feasibility of Enhancing TDO(s) ~~and SEO(s)~~ will be evaluated using the same criteria as the ~~primary~~ **Baseline Science ~~m~~Mission** on a separate form. The Enhancing TDO and/or SEO evaluation will be provided to the Selection Official separate from the ~~primary~~ **Baseline Science ~~m~~Mission** evaluation and will not be included in the determination of the ~~primary~~ **Baseline Science ~~m~~Mission** risk. **[Amended April 15, 2021]**
- **The incentive value for each TDO is capped at $5M FY19, and as stated in the AO, costs up to the incentive value of TDO(s) will not count against the PI-Managed Mission Cost (PIMMC) and will be included in the Enhanced PIMMC, up to $5M FY19 per TDO. [Amended April 15, 2021]**

Evaluation Criteria D & E

The following are new evaluation factors that are not described in the AO and were not evaluated for Step 1 proposals. These factors will be evaluated for CSRs.

Evaluation Criterion D

Merit of the Student Collaboration (SC), if proposed:

- This factor will include an assessment of whether the scope of the SC follows the guidelines in AO Section 5.5.3. The criteria to be used to evaluate the SC component and a discussion of those criteria are described in the document SPD-31, available in the Program Library.
- There is no minimum and no maximum allowable cost for a**n** SC. NASA is providing a student collaboration incentive that is defined to be 1% of the PIMMC. The proposed cost of the SC, up to the student collaboration incentive, is considered outside of the PIMMC. If the SC costs more than the student collaboration incentive, then the rest of the cost of the SC must be within the PIMMC. The SC incentive shall not be used for the investigation's implementation, nor to solve cost overrun issues. The SC provides no cost savings to a NASA investigation. **[Amended August 4, 2021]**

Evaluation Criterion E

Merit of the Small Business Subcontracting Plans:

This factor will be evaluated on the participation goals and quality and level of work performed by small business concerns overall, as well as that performed by the various categories of small business concerns listed in FAR 52.219-9.

CSR Evaluation Panel Products

Form A (if necessary) and Form B for all CSRs

- Grades: Excellent, Very Good, Good, Fair, or Poor
- Polling is held for the 5 categories above
- The reported grade reflects the median
  - A median score that falls between two grades will be reported as the combination of those two grades (e.g., 10 Good votes and 10 Fair votes = Good/Fair grade)

Form C for all CSRs

- Grades: Low Risk, Low/Medium Risk, Medium Risk, Medium/High Risk, or High Risk
- Polling is held for the 5 categories above
- The reported Risk Rating grade reflects the median
  - A median score that falls between two risk ratings will be "rounded" to the higher risk rating.

Form D (Student Collaboration)

- Separable from the main mission: Yes or No
- Grades: Meritorious or Not Meritorious

Form E (Small Business Subcontracting Plans)

- Grades: Acceptable or Needs Work

Grade Definitions - Forms A and B

Form A and B Grade Definitions

- **Excellent:** A comprehensive, thorough, and compelling CSR 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 CSR of very high merit that fully responds to the objectives of the AO, whose strengths fully outbalance any weaknesses.
- **Good:** A competent CSR that represents a credible response to the AO, having neither significant strengths nor weaknesses and/or whose strengths and weaknesses essentially balance.
- **Fair:** A CSR that provides a nominal response to the AO but whose weaknesses outweigh any perceived strengths.
- **Poor:** A seriously flawed CSR 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).

Evaluators are polled on the grades defined above.

Definitions of Criterion A*/B Findings

Major Strength: An aspect of the CSR response that is judged to be of superior merit and can substantially contribute to the Science Implementation Merit and Feasibility of the Investigation.

Minor Strength: An aspect of the CSR that is judged to contribute to the Science Implementation Merit and Feasibility of the Investigation.

Major Weakness: A deficiency or set of deficiencies taken together that are judged to substantially weaken the Science Implementation Merit and Feasibility of the Investigation.

Minor Weakness: A deficiency or set of deficiencies taken together that are judged to weaken the Science Implementation Merit and Feasibility of the Investigation.

Unlike in Step 1, minor findings can influence ratings. Significant minor findings are those minor findings that do influence ratings and are specifically identified in evaluation forms.

If required due to change in Science. If not required, use Forms A from Step 1.

Science Feasibility Impact

- The Science Feasibility Impact of Criterion B Major Weaknesses will be considered.
  - **Factors B-1** to **B-8:**

    "This weakness is anticipated to have a {small, modest, serious} impact on the ability of the proposed mission to achieve {some, all} of {one, several, all} science objective(s)."
  - **Factor B-9:**

    "This weakness is anticipated to have a {small, modest, serious} impact on the ability to measure progress of the proposed mission in achieving {some, all} of {one, several, all} science objective(s)."

- Goal is to be clear on the severity of a Criterion B Major Weakness.

Risk Ratings Definitions - Form C

The following definitions are indicators of risk. Evaluators must consider these definitions and input available for their consideration (e.g., cost model applicability, uncertainty of the cost models error bars and schedule analyses, uncertainty of the cost threats, mitigating factors such as major strengths, etc.) together with their judgment in determining the appropriate risk for a particular mission.

Rating	Definition
Low Risk	Resources for technical, management, schedule, and cost are at or above the appropriate levels, with at least one resource significantly above, even after taking into account any problems that have been identified in the Phase A evaluation. No risks with unquantified cost threats* have been identified.
Low/Medium Risk	No problems have been identified in the Phase A evaluation that reduce the technical, management, schedule, and cost resources below the appropriate levels. Any identified risks with unquantified cost threats have a low probability of occurrence.
Medium Risk	Problems have been identified in the Phase A evaluation that reduce one of the resources slightly below the appropriate levels for: technical, management, schedule, or cost. Sound management and effective application of engineering resources will be required to solve the problems. Any identified risks with unquantified cost threats have a probability of occurrence that is not high.
Medium/High Risk	Problems have been identified in the Phase A evaluation that reduce one or more of the resources below the appropriate levels for: technical, management, schedule, and/or cost. The problems identified may not be solvable within the resources proposed, even with the use of sound management and effective application of engineering resources.
High Risk	Problems have been identified in the Phase A evaluation that reduce one or more of the resources significantly below the appropriate levels for: technical, management, schedule, and/or cost. The problems identified are deemed unsolvable within the resources proposed.

***Risks with unquantified cost threats** are defined in the grades above as those major weaknesses whose cost to fix cannot be quantified, but is large. The impacts of these risks are significant because they could lead to not achieving the baseline mission with the resources available.*

Criterion C Panel Evaluation Principles

- ~~**Basic assumptions for Step 1:**~~ **[Amended April 15, 2021]**
  - ~~Proposing team is the expert on their proposal.~~ **[Amended April 15, 2021]**
  - ~~Proposing team's task is to provide evidence that the project is Low Risk.~~ **[Amended April 15, 2021]**
  - ~~Criterion C Panel's task is to try to validate proposing team's assertion of Low Risk.~~ **[Amended April 15, 2021]**
  - ~~Proposing team given the benefit of the doubt.~~ **[Amended April 15, 2021]**
- **CSR Feasibility and Risk Assessment in Step 2:**
  - ~~Tasks are the same as for Step 1, but expectations are higher.~~ **[Amended April 15, 2021]**
  - ~~Study team's task is to provide evidence that the project is Low Risk.~~ **[Amended April 15, 2021]**
  - Criterion C Panel's task is to ~~try to validate study team's assertion of Low Risk~~ **assess the feasibility of implementing the mission or investigation based on all the material provided by the Phase A concept study team**. **[Amended April 15, 2021]**
  - The study team <u>is not</u> given the benefit of the doubt in the down-select.
- All CSRs will be reviewed to identical standards.
  - All CSRs shall receive same evaluation treatment in all areas.
- The Criterion C Panel is made up of evaluators who are subject matter experts in the areas of the CSRs that they evaluate.
- The Criterion C Panel develops findings for each CSR that are based on individual comments and reflect the general agreement of the entire panel.

  - Comments that are *as expected* are not included as findings. Comments that are *above expectations* result in strengths. Comments that are *below expectations* result in weaknesses.

Definitions of Criterion C Findings

Major Strength: A facet of the implementation response that is judged to be well above expectations and can substantially contribute to the ability to meet technical requirements on schedule and within cost.

Minor Strength: A strength that is worthy of note and can be brought to the attention of the study team in debriefings.

Major Weakness: A deficiency or set of deficiencies taken together that are judged to substantially weaken the ability to meet 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 the study teams during debriefings.

Unlike in Step 1, minor findings can influence risk ratings. Significant minor findings are those minor findings that do influence risk ratings and are specifically identified in evaluation forms, and will be marked as such in the Form C. The term "Significant Weakness" includes both Major Weaknesses and Significant Minor Weaknesses.

Cost Evaluation

- All information from the entire evaluation process will be considered in the final cost assessment.
- An independent cost verification of the proposed cost for Phases A-D will be performed using three independent cost models.
- An independent cost verification of the proposed cost for Phase E will be performed using at least two cost models.
- The evaluation will assess 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.
- The likelihood and cost impact of significant weaknesses and cost analysis findings will be assessed.
- Cost threat impacts to the proposed unencumbered reserves will be assessed (see Cost Threat Matrix slide 39).
- The adequacy of the remaining unencumbered reserves will be assessed.
- Draft Forms C and Cost Evaluation Summaries (CESs) will be completed on all CSRs prior to the Initial Form C Plenary.
- During the Form C Plenaries, the entire panel will participate in Cost deliberations.
- All significant Cost Findings will be 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 a 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 $1M.

			Cost Impact (CI) % of PI-Managed Mission Cost to complete Phases B/C/D or % of Phase E not including unencumbered cost reserves or contributions					
	Likelihood of Occurrence	**Weakness**	**Very Minimal** 0.5% < CI ≤ 2.5% ($0M < CI ≤ $0M) 1% < CI ≤ 2.5% ($0M < CI ≤ $0M)	**Minimal** 2.5% < CI ≤ 5% ($0M < CI ≤ $0M) 2.5% < CI ≤ 5% ($0M < CI ≤ $0M)	**Limited** 5% < CI ≤ 10% ($0M < CI ≤ $0M) 5% < CI ≤ 10% ($0M < CI ≤ $0M)	**Moderate** 10% < CI ≤ 15% ($0M < CI ≤ $0M) 10% < CI ≤ 15% ($0M < CI ≤ $0M)	**Significant** 15% < CI ≤ 20% ($0M < CI ≤ $0M) 15% < CI ≤ 20% ($0M < CI ≤ $0M)	**Very Significant** CI > 20% (CI > $0M) CI > 20% (CI > $0M)
Likelihood (L, %)	Almost Certain (L > 80%)							
	Very Likely (60% < L ≤ 80%)							
	Likely (40% < L ≤ 60%)							
	Possible (20% < L ≤ 40%)							
	Unlikely (L ≤ 20%)							

Note: Each instance of "$0M" in the table above is converted to dollars according to the associated percentage, on a CSR-by-CSR basis. Depending on proposed PI-Managed Mission Cost, some columns may not apply.

Grade Definitions - Form D, Student Collaboration (SC)

The merit of any Student Collaboration (SC) will be given a Yes/No grade and one of two adjectives: Meritorious, or Not Meritorious

- **Is the SC separable from the Baseline and Threshold missions?** (Yes/No)

- **Meritorious:** The student collaboration proposed has achievable education goals and objectives and an implementation/oversight/management approach that will provide students with a rich hands-on education experience.

- **Not Meritorious:** The student collaboration proposed has not articulated achievable education goals and objectives and/or the implementation/oversight/management approach limits the likelihood of success for student's opportunities for hands-on experience.

Grade Definitions - Form E, Small Business Subcontracting (SBS)

The merit of the Small Business Subcontracting Plans will be rated as either Acceptable, or Needs Work

- **Acceptable:** The subcontracting plan adequately addresses all required elements of a subcontracting plan, and the proposed subcontracting percentage goals and the quality level of the work to be performed by small business concerns is sufficient.

- **Needs Work:** The subcontracting plan does not address all required elements of a subcontracting plan, or the proposed subcontracting percentage goals and quality of work to be performed by small businesses is not sufficient, and further participation must be negotiated if this mission is selected.

Criteria B & C Panel Evaluation Processes

- Evaluation panel members review assigned CSRs and perform an individual review before discussing findings with other members of the panel.
- The SOMA Remote Evaluation System (RES) will be used for:
  - Entering individual evaluation panel member's comments for Criterion C.
  - Developing draft and final Forms C for each CSR.
  - A repository for all final Forms for the evaluation (Forms B, C, D, and E).
- Only Evaluators who have participated in the Form C Initial Plenary, the Site Visits, and the Form C Final Plenary may participate in polling on Form C.
  - Participation is defined as in person or virtually.
  - Specialist Evaluators* are not polled.
  - Form B form leads may participate in Form C polling.
- Evaluation and polling on Form B will be restricted to Form B Evaluators, with the exception of Form C form leads and Form C instrument experts if designated by the HPMIDEX19 Program Scientist as Form B Evaluators.
- Only Evaluators who have participated in the Form B Initial Plenary, the Site Visits, and the Form B Final Plenary may participate in polling on Form B.
  - Participation is defined as in person or virtually

** Specialist Evaluators (to provide special technical expertise to Criterion B/C/D/E Panels) and External/Mail-In Evaluators (to provide special science/technology expertise to the Criterion B Panel) may be utilized, respectively, based on the specific technology and science that is proposed.*

Criteria B & C Panel Evaluation Processes (continued)

Consistency Review for Form C findings and Form B findings.

- **Form B consistency**
  - Form B Consistency Checker(s) will review all Form Bs and questions at the Initial Plenary, and all Form Bs at the Final Plenary.
- **Form C consistency**
  - A Form C Consistency Group will review all Form Cs and questions at the Initial Plenary, and all Form Cs at the Final Plenary.
    - Form C Evaluators will review all CSRs. Specialist Evaluators may review a subset of CSRs.
- **Form B and Form C consistency**
  - At least one Form B Evaluator for each CSR will participate in the Form C discussions for each mission at the plenary meetings
  - Some Form C instrument experts will participate in Form B discussions.
  - Consistency of findings between Forms B and C will be reviewed and adjudicated at the Initial and Final Plenaries.

Initial Plenary

The Initial Plenary is used to identify significant issues related to Criterion B and Criterion C based on the initial evaluation of the CSR. Initial Form Bs and Cs are reviewed.

- The Goal of the Initial Plenary is:
    1. Identify the Major Weakness, Minor Weaknesses, Major Strengths and Minor Strengths of each CSR.
    2. If necessary, develop questions and/or requests for information in addition to the Significant Weaknesses to give each Study Team an opportunity to clarify any misunderstanding.
- The main topic areas are the implementation issues in Criterion B and Criterion C.
- No polling on grades occurs at the Initial Plenary (Criterion B and Criterion C).
- The Significant Weaknesses, Questions, and Requests for Information List (SQRL) will be sent to each Study Team 7 days prior to its Site Visit.
- Criterion D (Student Collaboration) and Criterion E (Small Business Subcontracting) are reviewed as required by Criterion-specific panels prior to the Initial Plenary. Site Visit questions for Criterion D and Criterion E are prepared and provided no later than the Initial Plenary to the CSR Evaluation Chair.

Significant Weaknesses, Questions, and Requests for Information List (SQRL)

- **Site Visits SQRLs**
  - All SQRLs developed at the Initial Plenary will be sent to each Study Team 7 days prior to its Site Visit.
  - The SQRL is preliminary and may change based on Site Visit information and further discussion by Evaluation Panels.
  - Questions may also be sent to the study team or verbalized during the Site Visit.
  - Questions must be of significance to a Form A, B, C, D, or E rating.
- **The CSR Evaluation Chair will approve all SQRLs developed at the Initial Plenary. Three types of responses to SQRLs are planned. These types may be combined for a given Significant Weakness (SW), Question, or RFI.**
  - Written response prior to Site Visit: SWs, Questions, or RFIs provided to the Study team that must be addressed in writing prior to the Site Visit. The nature of some SWs, Questions, or RFIs require data that must be reviewed prior to the Site Visit.
  - Written response at Site Visit: SWs, Questions, or RFIs that require documentation, but not extensive review.
  - Oral presentation at Site Visit: SWs, Questions, or RFIs that must be addressed the day of the Site Visit by way of presentation.
- Evaluation Team members will ask questions during the Site Visit to ensure they understand the response to a SW, Question, or RFI, or to clarify any significant issues.

Site Visits

- **Virtual** Site Visits with Oral Briefings will be used to clarify implementation details and commitments. The study team may address weaknesses identified in the concept study and provide updates on the concept study since submission of the Concept Study Report. **[Amended April 15, 2021]**
- Site Visit**s will be virtual** ~~locations~~ and dates are negotiated with the PI. **[Amended April 15, 2021]**
- Briefings at each Site Visit will be limited to **9 presentation** ~~7~~ hours with **30** ~~1~~ additional **minutes** ~~hour~~ for a **virtual** site tour or demonstration, 15 additional minutes for SC if necessary~~, 1 hour for lunch,~~ and **multiple** 15-minute breaks **over two days** ~~in the morning and afternoon~~. **A s**~~S~~uggested ~~a~~ schedule of ~~8:30~~ **11** a.m. – ~~6:15~~ **5:00** p.m. **ET on the first day and 11 a.m. – 3:30 p.m. on the second day. [Amended April 15, 2021]**
- All Site Visit presentations/briefings should be in a plenary session with all Evaluation Team members attending – no splinter sessions – unless authorized by the CSR Evaluation Chair or TMC Panel Chair.
- A written SQRL will be submitted to the PI 7 days before the Site Visit. All teams will have the same lead time.
- As part of the Site Visit process, NASA may send additional SQRLs to study teams the day after their respective Site Visits, and possibly during the Final Plenaries, if necessary, to resolve any issue or clear up potential misunderstandings. Responses will typically be due within 4 days for post-Site Visit SQRLs, and within 24 hours for the Final Plenary SQRLs.
- Any additional information provided to NASA by the investigation team at the Site Visit, in response to the NASA-identified weaknesses and questions, or in response to NASA requests for additional information, will be treated as updates and clarifications to the CSR.

Final Plenary Products

- Finalize all evaluation Forms based on the information in the CSRs, as well as updates to the CSRs and clarifications.
- Both Major and Minor Strengths and Weakness will be considered in the Grade for all Forms.

Form B

- Polling will be held twice on the Form B grade. The final polling is recorded. For the final polling, the individual grades are recorded, and the median grade is calculated and recorded as the final polling. A median score that falls between two grades will be reported as the combination of those two grades (e.g., 10 Good votes and 10 Fair votes = Good/Fair grade. If there is a divergence of opinion, there may be additional rounds of discussion and polling.
  - Significant Weaknesses, Questions, and/or Requests for Information generated during the Final Plenary may result in additional rounds at or after the Final Plenary.

Form C

- Form C will be reviewed three times. Polling will be held twice on the Form C risk rating. The final polling is recorded and reported. For the final polling, the individual grades are recorded, the median calculated and the final grade recorded which reflects the Form C risk rating of the median of the polling. A median score that falls between two risk ratings will be "rounded" to the higher risk rating.
- If there is a divergence of opinion, there may be additional rounds of discussion and polling.
- Significant Weaknesses, Questions, and/or RFIs generated during the Final Plenary may result in additional rounds at or after the Final Plenary.

Form D, Student Collaboration

- Representatives from the SC Panel will consider the Merit of proposed Student Collaborations.

Form E, Small Business Subcontracting

- **HQ Office of Small Business Programs**~~GSFC Procurement~~ Personnel will evaluate this criterion.

[Amended August 4, 2021]

Observers and Transition Briefing

- CSs, IPAs, and Contractors with downstream implementation responsibilities may attend panel meetings and Site Visits as Observers.
- All invited observers must be approved by both the SMD Deputy Associate Administrator for Research and the Program Officer.
  - Observers must comply with SMD Policy Document SPD-17, *Statement of Policy on Observers at Panel Reviews of Proposals*. This policy will be provided to all approved observers.
- Approved Observers include (this list will be updated as Observers are approved):
  - **Nick Chrissotimos, Gregory Frazier, Christine Hinkle, and David Carter** ~~TBD~~, Explorers Program Office, GSFC **[Amended August 4, 2021]**
  - The above listed Program Office individuals are invited due to their positions in organizations which will oversee implementation of the down-selected mission(s). Their participation as Observers will provide early knowledge of any potential implementation challenges for the down-selected mission(s).
- After down-selection is announced, Transition Briefings will be provided by a subset of the Evaluation Team to CSs, IPAs, and Contractors at NASA HQ and in the Program Offices who have implementation responsibilities.

Change Log

Summary of changes, April 15, 2021

Slide	Change(s)
9	Added Form D Chair and Deputy Chair and Form E Chair
17	Expanded Evaluation Factor B-7 to include evaluation of the potential of SEOs to enlarge mission impact
18	Expanded Evaluation Factor B-8 to include evaluation of the potential of Enhancing TDOs to enlarge mission impact
26	TMC evaluation of Enhancing TDO feasibility is clarified to define the Enhancing TDO cost cap, and to exclude evaluation of SEOs
35	Updated Criterion C Evaluation Principles for Step 2
45	Specified that Site Visits will be held virtually

Summary of changes, August 4, 2021

Slide	Change(s)
2	Added Alan Zide as Program Executive
7	Removed Large File Transfer information and replaced with Box information
9	Added Alan Zide as Program Executive
28	Added an “n” before SC in the first line of the second bullet item
46	Corrected Form E evaluator organization
47	Added names of Observers
48	Added Change Log