Discovery 2014
Announcement of Opportunity
Preproposal Conference

Technical, Management, and Cost Evaluation Overview

November 24, 2014

Washito Sasamoto
Discovery Acquisition Manager
NASA Science Office for Mission Assessments

Outline

Notable Sections and Requirements

Technical, Management, and Cost Evaluation

References

Questions

Notable Sections and Requirements

Notable Sections and Requirements – Commitments

5.3.5 Management and Organization Experience and Expertise

[…]

Proposals shall identify the management positions that will be filled by **Key Management Team** members. These positions **shall include, as a minimum, the PI, PM, PSE, Project Manager Alternate (if named), and, where appropriate, the PS and partner leads for substantial efforts.** For management positions for which Key Management Team members are named (PI, PM, and PSE per Requirement 48, Requirement 49, and Requirement 50), proposals shall describe the qualifications and experience of those team members who occupy those positions. For management positions for which Key Management Team members are not named, proposals shall describe the qualifications and experience required of any candidate to occupy those positions. […]

5.8.1.3 Personal Statements of Commitment

No Personal Statements of Commitment are required in the Step-1 proposal**. No Institutional Letters of Commitment** are required for individuals in the Step-1 proposal, **unless the individual is contributed and part of the Proposal Team**. The Proposal Team is **defined to include, but not be limited to, all members of the Key Management Team and any Co-I who is not part of the Key Management Team.** Proposal Team members are identified on the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) proposal cover page. Proposal Team members indicate their commitment to the proposed investigation through NSPIRES (see Appendix B, Section A.3, for instructions). […]

Notable Sections and Requirements – TRL

5.2.3 New Technologies/Advanced Engineering Developments

This AO solicits flight missions, not technology or advanced engineering development projects. Proposed investigations are generally expected to have mature technologies, with **systems at a Technology Readiness Level (TRL) of six or higher**. For the purpose of TRL assessment, **"systems" are defined as level three WBS payload developments (i.e., individual instruments) and level three WBS spacecraft elements (e.g., electrical power system);** see Figure 3-7 of the *NASA WBS Handbook*, NASA/SP-2010-3404, which can be found in the Program Library. TRLs are defined in NPR 7123.1B *NASA Systems Engineering Processes and Requirements*, Appendix E, which can be found in the Program Library as well.
[…]

Requirement B-19

This section shall describe the instrumentation and the rationale for its selection. It shall identify the **instrument systems (i.e., the individual instruments)**, instrument subsystems, and instrument components, including their characteristics and requirements, and indicate items that are proposed for development, as well as any existing instrumentation or design/flight heritage. It shall […] describe the technology readiness levels and the approach to bring each instrument to technology readiness level (TRL) 6 by the preliminary design review (PDR). […]

Notable Sections and Requirements – TRL

Requirement B-39

This section shall describe any proposed new technologies and/or advanced engineering developments and the approaches that will be taken to reduce their associated risks. Descriptions shall address, at a minimum, the following topics:

- Identification and justification of the TRL for each proposed system (level 3 WBS payload developments and level 3 WBS spacecraft elements) incorporating new technology and/or advanced engineering development at the time the proposal is submitted (for *TRL definitions*, see NPR 7123.1B, *NASA Systems Engineering Processes and Requirements*, Appendix E, in the Program Library);
- Rationale for combining the TRL values of subsystems and components **to derive each full system TRL as proposed, appropriately considering TRL states of integration** (see NASA/SP-4776 2007-6105 Rev 1, *NASA Systems Engineering Handbook*);
- Rationale for the stated TRL value of an element that is an adaptation of an existing element of known TRL;
- The approach for maturing each of the proposed systems to a **minimum of TRL 6, by PDR**:
  - Demonstration (testing) in a relevant environment can be accomplished at the system level or at lower level(s);

Notable Sections and Requirements – TRL

Requirement B-39 (continued)

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

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

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

Notable Sections and Requirements – Classified Appendix

5.8.3 Classified Proposal Appendix Regarding Heritage

In order to increase the capabilities of investigations proposed in response to this AO while minimizing the development and operations risks within the PI-Managed Mission Cost, proposers may choose to leverage technology that was developed by other institutions and agencies as well as technology developed by NASA and NASA-funded partners. It is recognized that some technology relevant to proposed missions may have classified heritage.

Proposals that propose the use of hardware with classified heritage may provide a classified proposal appendix to NASA to allow validation of classified heritage claims. The classified appendix regarding heritage may include Letters of Validation for classified heritage claims from technology development sponsors. **The proposer is responsible for determining what information is classified and what information is unclassified; any classified information provided to NASA must be handled appropriately.**

Notable Sections and Requirements – Trajectory

Requirement B-32

Trajectory: The following information shall be provided in a file or files on the CD-ROM containing the electronic version of the proposal. There is no requirement that this data also be included in the electronic proposal (uploaded PDF file). **Any graphical references, tables, figures, etc. must be presented in a minimum of 150 dots per inch (dpi).**

- Checkout Duration: The minimum duration allocated after launch before the primary propulsion system will be commanded to provide required ΔV.
- Initial Mass Assumptions: Provide the initial mass used for generation of the trajectories including propellant loading assumptions.
- Event Basics: Provide the date/time of each trajectory event with a brief event description (e.g., Launch, Gravity Assist, Fly-by, Rendezvous, Mid-Course Burn) and the appropriate data for the event (e.g., flyby altitude, flyby angle, flyby/intercept velocity, delta-v magnitude). These data should be included for three different scenarios corresponding to the Open, Middle, and Closing time of the proposed launch window.
- Event Body Ephemeris: Provide ephemeris data for all event bodies (fly-by planet, asteroid fly-by, comet rendezvous, etc.). Include the source of the ephemeris data and the epoch for the actual ephemeris point used for a particular event.

Notable Sections and Requirements – Trajectory

Requirement B-32 (continued)

For investigations using solar-electric propulsion, the following information should also be included:

- Power model for performance based on solar distance: Provide the functional relationship showing the performance of the solar arrays as a function of the spacecraft's distance from the Sun.
- EP Throttling Model: Provide the throttling model used to generate EP engine performance at any point during the trajectory and a brief explanation of the approach.
- Assumed Engine Duty Cycle: Provide the overall Duty Cycle for the EP engines and if applicable provide the duty cycle over each trajectory segment.
- Number of Engines: Provide the maximum number of engines on the spacecraft that could be operating simultaneously. In addition, provide the number of engines operating throughout each phase of the trajectory.

Any other trajectory specific information not called out above that would be **relevant to reviewers attempting to validate the trajectory** should also be included.

Notable Sections and Requirements – Cost Model Inputs

5.6.3 Cost Estimating Methodologies and Cost Reserve Management

[…] To improve the ability of NASA to validate proposed costs in the absence of detailed discussions with proposers, NASA has designated two parametric cost models as common benchmarks: **SEER for Software** and SEER for Hardware, Electronics and Systems Core (SEER-H) with Electro-Optical Sensors and Integrated Circuits extended capabilities or PRICE® TruePlanning™ Cost Estimating Framework. Proposers must apply one of these models to their proposed investigation. This should not be construed to limit proposers own discretion in the method(s) chosen to estimate and validate costs.
[…]

Requirement B-55

Input file(s) and results for a single parametric cost model shall be provided on each CD-ROM submitted. The parametric cost model shall be one of: **SEER for Software** and SEER for Hardware, Electronics and Systems Core (SEER-H) with Electro-Optical Sensors and Integrated Circuits extended capabilities or PRICE® TruePlanning™ Cost Estimating Framework. Rationales for individual inputs and settings should be provided within the input file(s). The parametric cost model results may be the basis for the proposed cost or a validation of the proposed cost – if applicable, indicate which within the input file(s). There is no requirement that the input data also be included in the electronic proposal.

Notable Sections and Requirements – MS Project Schedule

Requirement B-43

The project schedule shall be additionally provided in Microsoft Project format on each CD-ROM submitted. Although the project schedule foldout(s) in Requirement B-42 does not need to have been generated in Microsoft Project, the project schedule provided on each CD-ROM shall address the items specified in Requirement B-42 **at a level of detail commensurate with that of the graphical foldout**. The Microsoft Project schedule **is not intended to be a fully Integrated Master Schedule** for the project, but rather, it is to be a representation of the summarized schedule foldout that provides a quantified data set that will facilitate understanding of the proposed flow of development activities, timelines, milestones, schedule reserves, and risk. Although tasks in this high-level summary schedule are not expected to be fully linked to their predecessor and successor tasks, **the level of linkage detail should support the assignment of the critical path in the graphical foldout**. Task links are also needed to identify points of assembly, integration, and testing in the schedule and links to major milestones.

TMC Evaluation

TMC Evaluation

Evaluation Criteria

Evaluation Criteria:

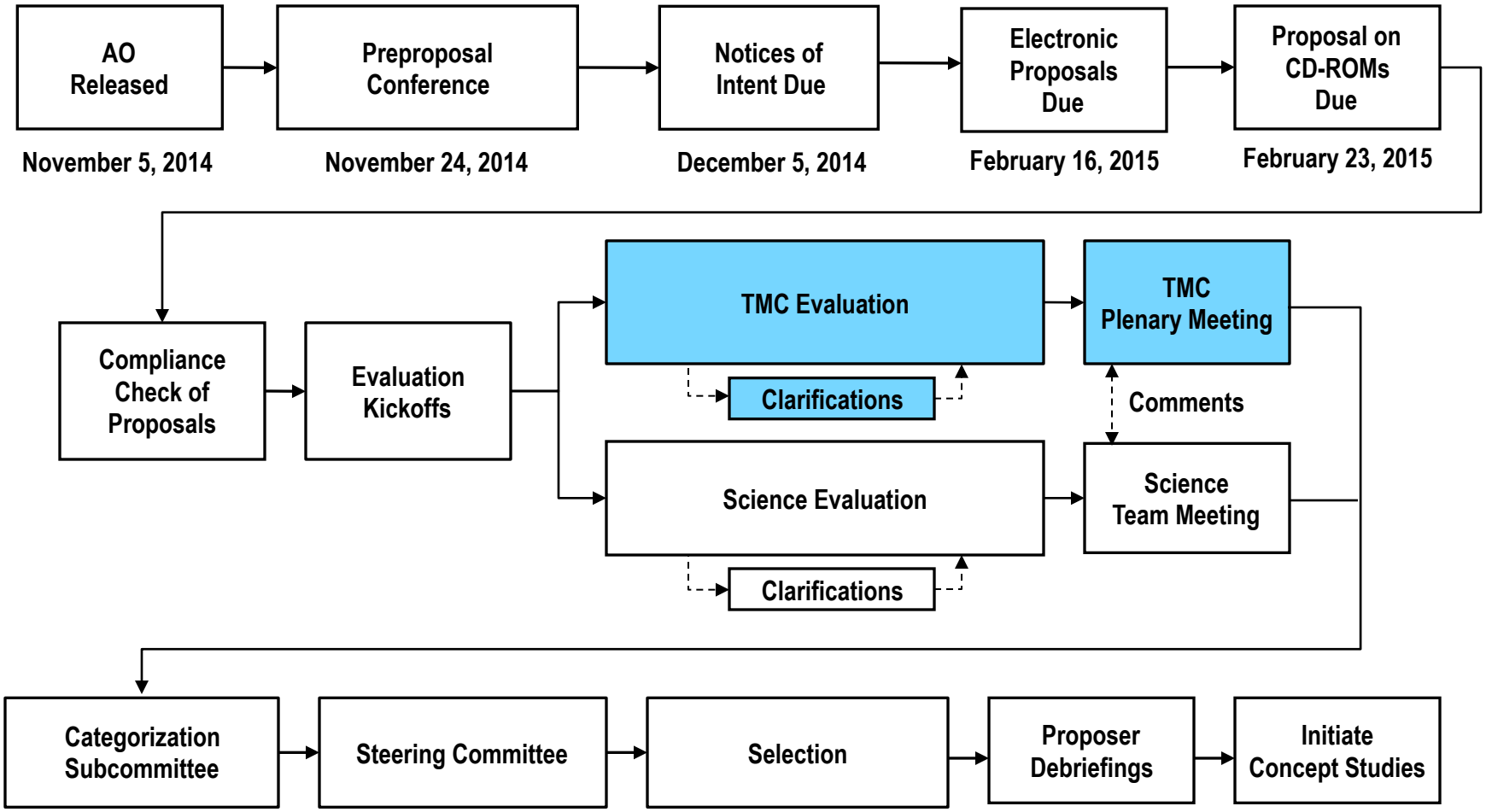
- Intrinsic Science or Exploration Technology Merit of the Proposed Investigation
- Experiment Science or Exploration Technology Merit and Feasibility of the Investigation
- **TMC Feasibility of the Investigation Implementation, Including Cost Risk**

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

TMC Evaluation: The purpose of the TMC evaluation is to assess the likelihood that the submitted investigations' technical and management approaches can be successfully implemented as proposed, including an assessment of the likelihood of their completion within the proposed cost and schedule.

TMC Evaluation

AO Flow



TMC Evaluation

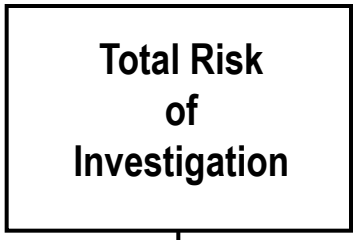
TMC Evaluation Factors:

TMC Feasibility of the Investigation Implementation, including Cost Risk:

- 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.

TMC Evaluation

What is evaluated?



Inherent Risks

Risks that are unavoidable to do the investigation:

- Launch environments
- Space environments
- Mission durations
- Technologies or technology extensions
- Unknowns
- Etc.

Programmatic Risks

Risks that are uncertainties due to matters beyond project control:

- Environmental Assessment approvals
- Budgetary uncertainties
- Political impacts
- Late/non-delivery of NASA provided project elements
- Stability and reliability of proposed partners and their contributions
- Etc.

Implementation Risks (Evaluated by TMC)

Risks that are associated with implementing the investigation:

- Adequacy of planning
- Adequacy of management
- Adequacy of development approach
- Adequacy of schedule
- Adequacy of funding
- Adequacy of Risk Management (planning for the known and unknown)

TMC Evaluation

Evaluation Principles

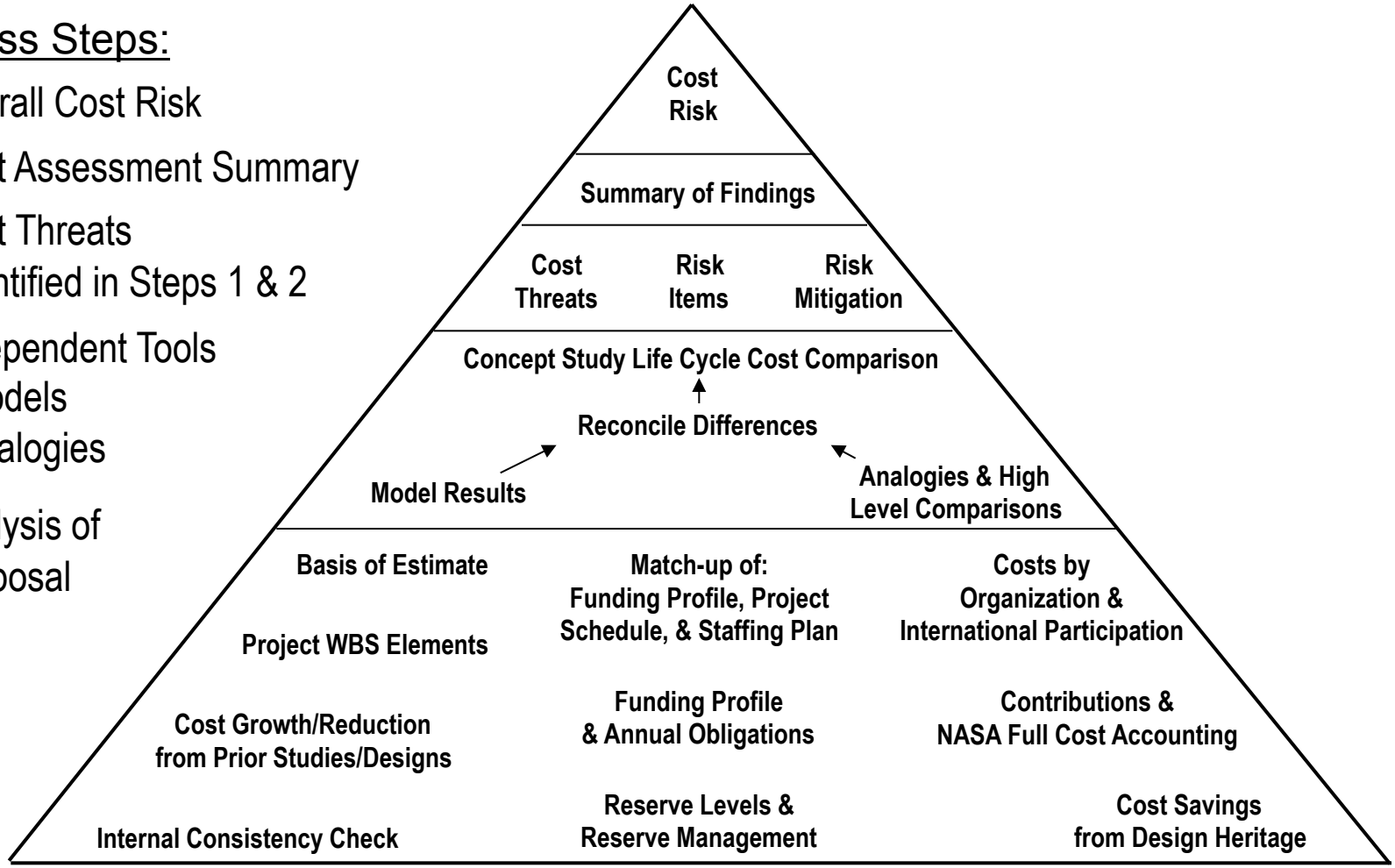
- Basic Principles:
  - It is assumed that the proposer is the expert on his/her proposal.
  - Proposer's task is to demonstrate that the investigation implementation risk is LOW.
  - TMC panel's task is to try to validate proposer's assertion of LOW risk.
- Risk is to be assessed on the basis of material in the proposal. All Proposals are evaluated to identical standards and not compared to other proposals.
- TMC Panels consist of evaluators who are experts in the factors that they evaluate.
- The Cost Analysis is integrated into the overall Risk Rating.
- Proposal Risk Assessment: Proposals are based on Pre-Phase-A concepts; TMC Risk Assessments give appropriate benefit of the doubt to the proposer.

TMC Evaluation

TMC Cost Analysis: The Pyramid

Process Steps:

5. Overall Cost Risk
4. Cost Assessment Summary
3. Cost Threats
   identified in Steps 1 & 2
2. Independent Tools
   - Models
   - Analogies
1. Analysis of
   Proposal



TMC Evaluation

TMC Evaluation Findings

Major and minor strengths and weaknesses are defined as follows:

- **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 significant 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 significant discriminator in the assessment of risk.

Note: Items that are considered "as expected" will not be documented as findings.

TMC Evaluation

TMC Evaluation Clarifications

NASA will request clarification of potential major weaknesses and significant cost findings in the TMC Feasibility of the Investigation Implementation that have been identified by the TMC evaluation panel.

- NASA will request such clarification uniformly, from all proposers.
  - PIs whose proposals have no potential major weaknesses or significant cost findings will receive an email informing them of the fact.
  - All requests for clarification from NASA, and the proposer's response, will be in writing.
- The ability of proposers to provide clarification to NASA is extremely limited, as NASA does not intend to enter into discussions with proposers. The form of the clarifications is strictly limited to a few types of responses:
  - Identification of the locations in the proposal (page(s), section(s), line(s)) where the potential major weakness is addressed
  - Noting that the potential major weakness is not addressed in the proposal.
  - Stating that the potential major weakness is invalidated by information that is common knowledge and is therefore not included in the proposal.
  - Stating that the analysis leading to the potential major weakness is incorrect and identifying a place in the proposal where data supporting a correct analysis may be found.
  - Stating that a typographical error appears in the proposal and that the correct data is available elsewhere inside or outside of the proposal.
- PIs will be given at least 24 hours to respond to the request for clarification. Any response that goes beyond a clarification will be deleted or redacted, and will not be shown to the evaluation panel.

TMC Evaluation

TMC Evaluation Risk Ratings Definitions

The purpose of the TMC evaluation is to assess the likelihood that the submitted investigations' technical and management approaches can be successfully implemented as proposed, including an assessment of the likelihood of their completion within the proposed cost and schedule.

Based on the narrative findings, each proposal will be assigned one of three Risk Ratings:

- **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.

TMC Evaluation

TMC Evaluation Risk Ratings: Envelope Concept

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

LOW Risk: Required resources fit well within available resources

MEDIUM Risk: Required resources fit within available resources.

HIGH Risk: Required resources DO NOT fit within available resources.

References

Discovery 2014 Program Library

It is incumbent upon the proposer to ensure that the documents used in proposal preparation are of the date and/or revision as listed in the Program Library (http://discovery.larc.nasa.gov/dpl.html).

A Change Log has been implemented, and will document any further updates to the documents.

Questions

Questions

Any subsequent questions pertaining to the TMC Evaluation of Discovery 2014 AO proposals must be addressed to:

Dr. Michael H. New
Discovery Program Lead Scientist
Planetary Science Division
Science Mission Directorate
National Aeronautics and Space Administration
Washington, DC 20546-0001
Telephone: 202-358-1766
FAX: 202-358-3097
E-mail: michael.h.new@nasa.gov
(subject line to read “Discovery 2014 AO”)