# 2016 Astrophysics Medium Explorer (MIDEX) & Mission of Opportunity (MO) Solicitations

## Pre-Proposal Conference

## *Technical, Management, and Cost Evaluation*

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# Outline

- Technical, Management, and Cost (TMC) Evaluation
- MIDEX AO & SALMON-2 AO PEA R Highlights
- MIDEX AO Highlights
- SALMON-2 PEA R Highlights
- References
- Questions

# Glossary

| | |
|---|---|
| **AO** | Announcement of Opportunity |
| **SALMON-2** | Stand-ALone Mission of Opportunity Notice-2 |
| **PEA** | Program Element Appendix to SALMON-2 |
| **TMC** | Technical, Management, and Cost |
| **MO** | Mission of Opportunity |

# TMC Evaluation

# TMC Evaluation

## Evaluation criteria

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

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 mission or investigations' technical and management approaches can be successfully implemented as proposed, including an assessment of the likelihood of the completion within the proposed cost and schedule.**

# TMC Evaluation

## TMC Evaluation criteria

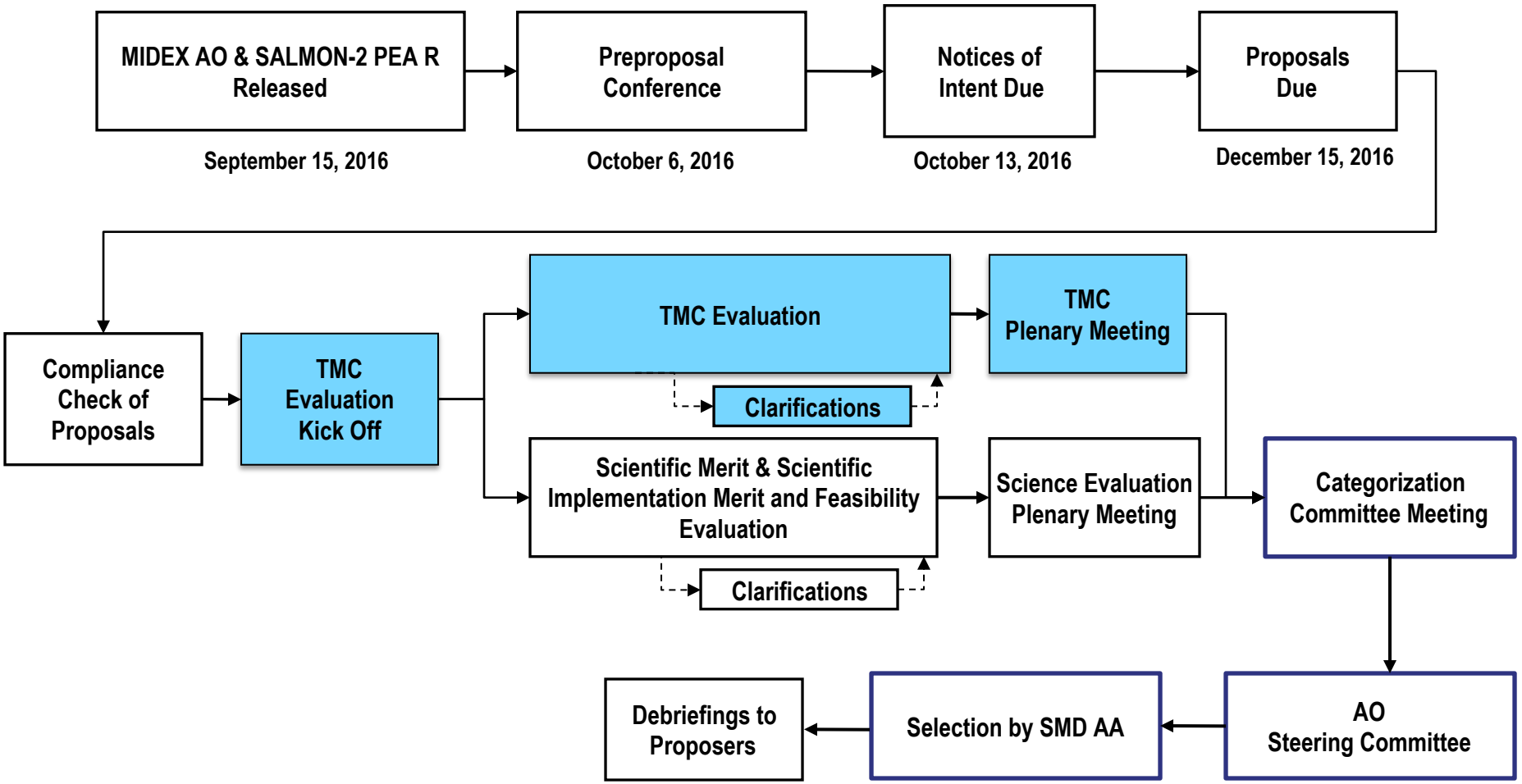
TMC evaluation criteria are stated in the following sections.

- MIDEX AO, Section 7.2.4, "TMC Feasibility of the Proposed Mission Implementation, Including Cost Risk"
- SALMON-2 AO, Section 7.2.4, "TMC Feasibility of the Investigation Implementation, Including Cost Risk"

Note: The 2016 Astrophysics Explorer Mission of Opportunity (MO) solicitation is Program Element Appendix (PEA) R to the SALMON-2 AO. **Those proposing to the Astrophysics MO must read the SALMON-2 AO and the Astrophysics MO PEA R carefully, and proposals must comply with the requirements, constraints, and guidelines contained within these documents.**

# Evaluation, Categorization, and Selection Process

## Proposal Evaluation Flow



## TMC Evaluation Factors

The following are highlights of the criteria listed in the MIDEX AO, Section 7.2.4 and SALMON-2 AO, Section 7.2.4 – TMC Feasibility of the Proposed Mission or Investigation Implementation, including Cost Risk.

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

Factor C-1. Adequacy and robustness of the instrument implementation plan.

Factor C-2. Adequacy and robustness of the mission or investigation 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

## TMC Evaluation Principles

- **Basic Assumption**: **Proposer is the expert on his/her proposal.**
  - Proposer's task is to provide evidence that the investigation implementation risk is low.
  - TMC panel's task is to try to validate proposer's assertion of low risk.
- Merit 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 non-conflicted experts in the areas of the proposals that they evaluate.
- TMC Panels develop findings for each proposal - Findings: "As expected" (no finding), "above expectations" (strengths), "below expectations" (weaknesses).
- The Cost Analysis is integrated into overall risk.
- 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

**There are three possible Risk Ratings: LOW, MEDIUM, HIGH**

**TMC Evaluation** - The purpose of the TMC evaluation is to assess the likelihood that the submitted missions or 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.

**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. Mission 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.

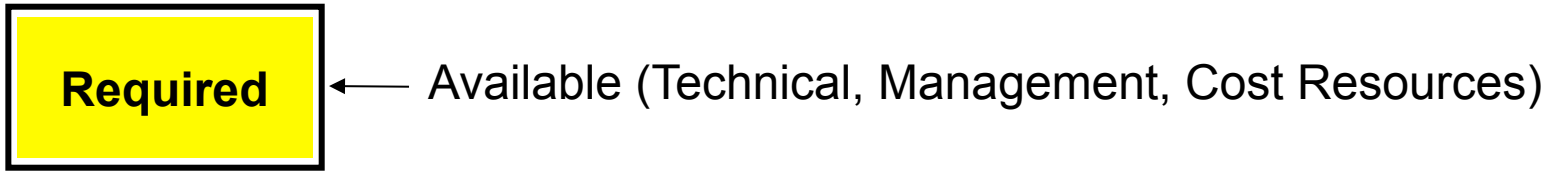
# TMC Evaluation

## TMC Envelope Concept

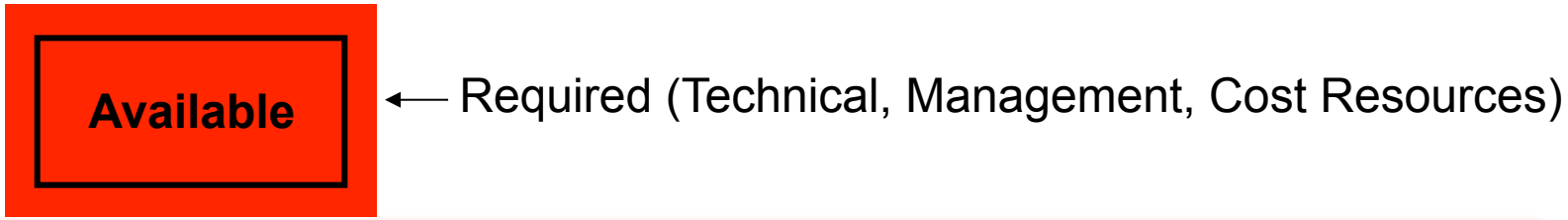
**Envelope:** Contains all TMC Resources available to handle known and unknown development problems that occur. Includes schedule and funding reserves; reserves and margins on physical resources such as mass, power, and data; descope options; fallback plans; and personnel.

**LOW Risk:** Required resources fit well within available resources.


**MEDIUM Risk:** Required resources just barely inside available resources.




**HIGH Risk:** Required resources DO NOT fit inside available resources.



# 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 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.

# TMC Evaluation

## Clarifications

- NASA will request clarification of potential major weaknesses identified during the evaluation process of the Science Merit of the Proposed Investigation, the Science Implementation Merit and Investigation Feasibility, and the TMC Feasibility of the Mission Implementation.
- NASA will request such clarification uniformly, from all proposers.
- 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.
- PIs whose proposals have no potential major weaknesses will receive an email informing them.
- 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.

The PI will be given at least 48 hours to respond to the request for clarification. Any response that goes beyond a clarification will be deleted and will not be shown to the evaluation panel.

# Highlights from 2016 Astrophysics MIDEX AO and SALMON-2 PEA R that are Common to Both

## 5.2.3 New Technologies/Advanced Engineering Development, MIDEX AO (5.3.4 in SALMON-2, 4.6.1 in PEA R)

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 6 or higher. For the purpose of TRL assessment, systems are defined as level 3 WBS payload developments (i.e., individual instruments) and level 3 WBS spacecraft elements (e.g., electrical power system);

Proposals with a limited number of less mature technologies and/or advanced engineering developments are permitted as long as they contain a plan for maturing systems to TRL 6 by no later than PDR and adequate backup plans that will provide mitigation in the event that the systems cannot be matured as planned.

**Requirement 20 (MIDEX AO).** Proposals that use systems currently at less than TRL 6 shall include a plan for system maturation to TRL 6 by no later than PDR and a backup plan in the event that the proposed systems cannot be matured as planned (Requirement B-37 provides additional detail regarding TRL).

**Requirement R-16 (PEA R).** Language same as Requirement 20 of the MIDEX AO (Requirement R-39 provides additional detail regarding TRL).

## 5.8.3 Classified Proposal Appendix regarding Heritage (5.10.3 in SALMON-2 AO)

"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 Cap, 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."

*Note: Please let NASA know ASAP if you plan to submit a Classified Appendix regarding Heritage*.

## 6.1.2 Notice of Intent to Propose (Section 3 in PEA R)

- To assist the planning of the proposal evaluation process, NASA requires all prospective proposers to submit a Notice of Intent (NOI) to propose.
- NOIs will help the evaluation teams to plans and secure the services of well qualified evaluators earlier in the evaluation cycle.
- Include the names of as many team members as possible

# MIDEX AO & SALMON-2 PEA R Highlights

**The Heritage Appendix will be limited to 30 pages.**

- MIDEX AO – Appendix B, page B-2, Proposal Structure and Page Limits Table
- MO - This supersedes page B-2 of the SALMON-2 AO.
  - Requirement R-35 further clarifies proposal heritage claims presented in Requirement B-70 of the SALMON-2 AO

    **Requirement R-35.** Proposals shall conform to the page limits specified in the *Proposal Structure and Page Limits* table, except that the Heritage Appendix is limited to 30 pages…

# 2016 Astrophysics MIDEX AO Highlights

## 5.6 Cost Requirements and Constraints

- The PI-Managed Mission Cost is defined in Section 4.3.1 of the AO.
- The AO cost cap for an Astrophysics Medium Explorer mission is $250 million in Fiscal Year (FY) 2017 dollars, not including the cost of the Expendable Launch Vehicle (ELV) or any contributions.
- Any launch services beyond the standard launch services offered must be funded out of the PI-Managed Mission Cost.
- Contributed launch services cannot be proposed or considered under this AO.

## 7.4 Two-step competitive process

- Proposals submitted in response to this AO will be selected for flight nominally through a **two-step competitive process**.
- Proposals submitted in response to this AO will undergo the first step evaluation.
  - As the outcome of the first step evaluation, NASA intends to fund one or more MIDEX investigations to proceed to an 9 month Phase A concept study capped at $2 Million Fiscal Year 2017 (FY) dollars (Section 5.6.2).
- In the second step, NASA will conduct an evaluation of the Phase A concept study reports. From this evaluation, NASA expects to downselect one MIDEX investigation to proceed into Phase B and subsequent mission phases.

# 2016 Astrophysics SALMON-2 AO PEA R Highlights

## 1.3 Overview of this Program Element Appendix, Two-step competitive process

- Proposals submitted in response to this PEA will be selected for flight nominally through a **two-step competitive process**.
- Proposals submitted in response to this PEA will undergo the first step evaluation.
  - As the outcome of the first step evaluation, NASA intends to fund one or more MO investigations to proceed to a 9-month Phase A concept study capped at $500K Fiscal Year 2017 (FY2017) dollars.
- In the second step, NASA will conduct an evaluation of the Phase A concept study reports. From this evaluation, NASA expects to downselect one or more MOs to proceed into Phase B and subsequent mission phases.

## 4.2 Types of Mission of Opportunity

Three Mission of Opportunity types may be proposed in response to this solicitation:

(1) Partner Missions of Opportunity (PMOs)

(2) New Missions using Existing Spacecraft (NMESs)

(3) Small Complete Missions (SCMs)

SCMs include investigations on the International Space Station (ISS), suborbital-class missions (investigations requiring flight on high-altitude scientific balloon platforms, on suborbital Reusable Launch Vehicles (sRLVs), or using CubeSats), investigations launched as secondary payloads, or investigations launched as hosted payloads.

See Section 5.1 of the SALMON-2 AO for complete descriptions of these types of MOs as well as constraints and requirements for proposals.

## 4.5.1 Cost Requirements and Constraints

The PI-Managed Mission Cost is defined in Section 4.3.1 of the SALMON-2 AO.

Except for suborbital class missions (high-altitude scientific balloon missions, missions on sRLVs, and CubeSats), the PI-managed Mission Cost cap for an Astrophysics Explorer Mission of Opportunity, including all mission phases and the cost of accommodation on and/or delivery to the host mission, if applicable, is $70M in Fiscal Year (FY) 2017 dollars.

The PI-managed Mission Cost cap is $35M in FY 2017 dollars for suborbital class missions.

Requirement R-11. Proposals shall include detailed plans and budgets for Phases A-F for costs that are within the PI-Managed Mission Cost.

## 4.5.2 Schedule Requirements and Constraints

For Partner MOs, the proposing PI must provide evidence that the sponsoring organization intends to fund the primary host mission and that the NASA commitment for U.S. participation is required by the sponsoring organization prior to January 2022. The launch date itself for a Partner MO is not constrained.

For Small Complete Mission (SCM) MOs, proposers must specify the launch date in the proposal, which is to be no later than December 31, 2022. Astrophysics Explorers SCM MO investigations with an anticipated launch date requirement later than December 31, 2022 should be proposed in response to a subsequent opportunity.

Proposers should be aware that it may be necessary for NASA to adjust the launch date and definition phasing of selected investigations from that proposed in order to conform to the available Astrophysics Explorers Program budget profile and/or NASA's ability to negotiate a launch opportunity to the International Space Station, for a high-altitude scientific balloon mission, for launch opportunities on reusable launch vehicles, or for CubeSat launches; therefore, the degree of launch date flexibility must be indicated in the proposal.

# PEA R Highlights

- Deferred from SALMON-2 AO for this Step One of the Two Step proposal process.
  - Section 5.3.10 *End-of-Mission Spacecraft Disposal*
  - Requirement B-21 regarding a schedule-based end-to-end data management plan.
  - Request for costs in RY dollars
- This PEA does not require an Education and Public Outreach program.

<u>READ the PEA R and the SALMON-2 AO closely!</u>

# References

# MIDEX and MO Reference Material

## 2016 Astrophysics MIDEX and MO Acquisition Page

The 2016 Astrophysics Explorer MIDEX and MO acquisition home page is available at http://explorers.larc.nasa.gov/APMIDEX2016/

The contents of the web site include the following:

- Links to MIDEX and MO pages
- 2016 Astrophysics MIDEX and MO major milestones
- Community announcements
- FBO
- Teaming interest
- Preproposal conference

# MIDEX Reference Material

## 2016 Astrophysics MIDEX Acquisition Home Page

The 2016 Astrophysics MIDEX Acquisition Home Page available at http://explorers.larc.nasa.gov/APMIDEX2016/MIDEX/index.html, will provide updates and any addenda during the solicitation process. The contents of the MIDEX acquisition page include the following:

- Links to the NSPIRES for access to the solicitation
- Program library
- Evaluation plan
- Q&A

## 2016 Astrophysics MIDEX Program Library

The Library provides additional regulations, policies, and background information. The Library is accessible at http://explorers.larc.nasa.gov/APMIDEX2016/MIDEX/programlibrary.html

# MO Reference Material

## 2016 Astrophysics Explorer MO Acquisition Home Page

The 2016 Astrophysics Explorer AO Acquisition Home Page available at http://explorers.larc.nasa.gov/APMIDEX2016/MO/index.html, will provide updates and any addenda during the solicitation process. The contents of the Astrophysics Explorer MO acquisition page include the following:

- Links to the NSPIRES for access to the solicitation
- Program library
- Evaluation plan
- Q&A

## 2016 Astrophysics Explorer MO Program Library

The Library provides additional regulations, policies, and background information. The Library is accessible at http://explorers.larc.nasa.gov/APMIDEX2016/MO/programlibrary.html. Use Table B3b template in the program library to develop cost funding profile.

# Questions?

**All further questions pertaining to the MIDEX AO or PEA R MUST be addressed to:**

**Dr. Wilton Sanders**
**Astrophysics Explorers Program Scientist**
**Science Mission Directorate**
**NASA Headquarters**
**Washington, DC 20546**
**wilton.t.sanders@nasa.gov**
**(subject line to read “MIDEX AO or PEA R as applicable")**
**202.358.1319**

# Supplemental Information

# TMC Evaluation

The **NASA Science Mission Directorate (SMD) Science Office for Mission Assessments (SOMA)** was established in 1996 by the Office of Space Science to support the Discovery and Explorer Programs, now also supports the New Frontiers, Mars Scout, Earth System Science Pathfinder (ESSP), and others such as SALMON-2.

- The TMC process is a standard process used by SOMA to support all SMD evaluations.
- Lessons learned from each evaluation are incorporated into the process for continuous improvement.

# TMC Evaluation

## TMC Evaluation Panel Composition

- The TMC panel is chaired by the Acquisition Manager, who is a civil servant in the NASA Science Office for Mission Assessments (SOMA) at NASA Langley Research Center (LaRC).
  - NASA SOMA works directly for NASA Headquarters, and is firewalled from the rest of NASA LaRC.

- TMC evaluators are generally a mix of non-conflicted contractors, consultants, and civil servants who are the best experts in their respective areas of technology, management, or cost.

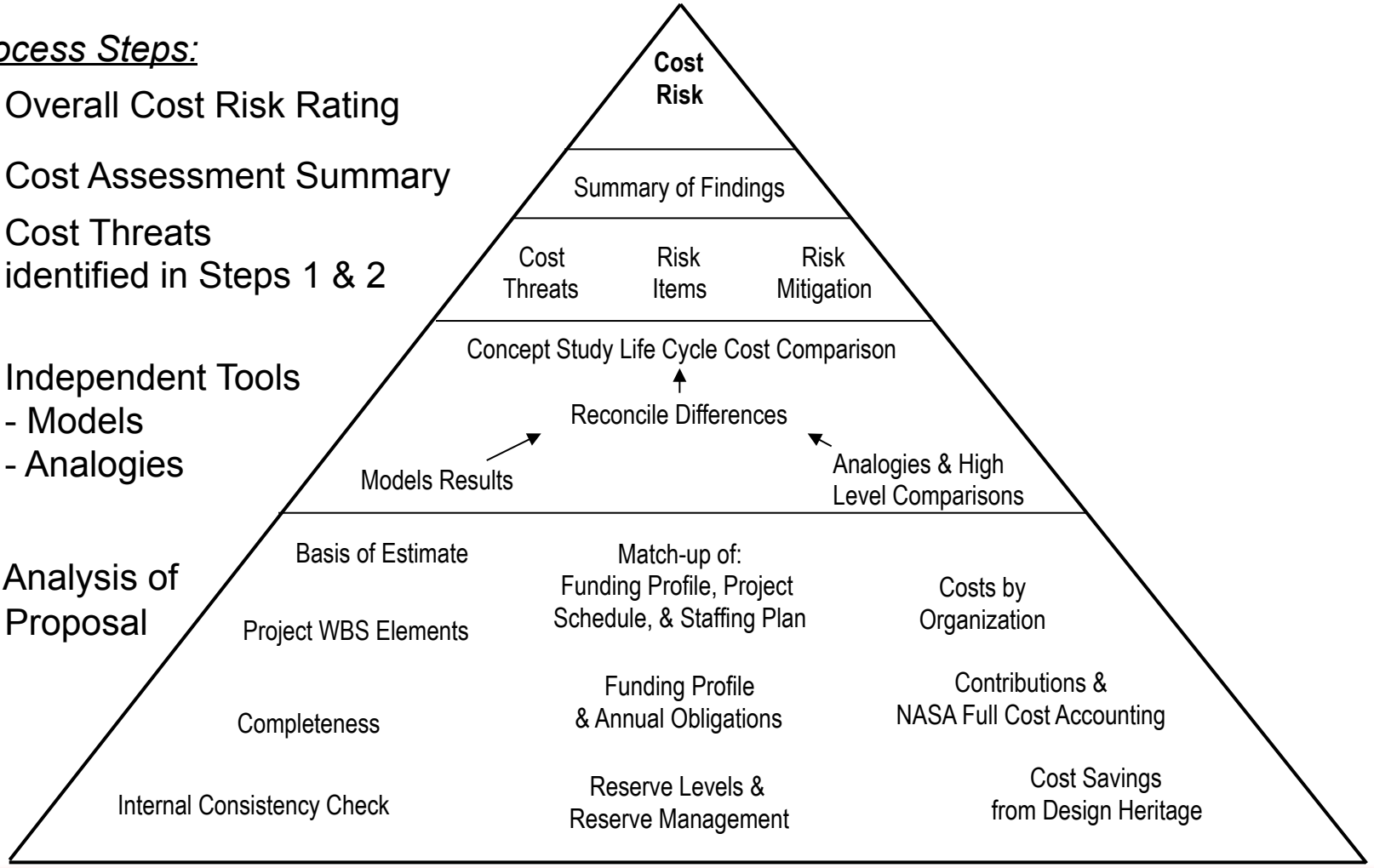
- If technical expertise that is not represented in the panel is required, specialist evaluators may be called upon to assist with one or more proposals.
  - Specialist evaluators assess only those parts of a proposal that are pertinent to their particular areas of technical expertise.

# TMC Independent Cost Assessment

## *"The Pyramid"*

*Process Steps:*

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



# Typical TMC Evaluation Questions

- Will overall investigation approach allow successful implementation as proposed?
- If not, are there sufficient resources (time & funds) to correct identified problems?
- Does proposed design/development allow the investigation to have a reasonable probability of accomplishing its objectives and include all needed tools?
- Are requirements within existing capabilities or are advances required?
- Does the proposal accommodate sufficient resiliency in appropriate resources (e.g., funds, mass, power) to accommodate development uncertainties?
- Is there a Risk Management approach adequate to identify problems with sufficient warning to allow for mitigation without impacting the investigation's objectives?
- Does the proposer understand the known risks, including risk of using new developments, and are there adequate fallback plans to mitigate them, to assure that investigation can be completed as proposed?

# Typical TMC Evaluation Questions

- Is the schedule workable?
- Does it reflect an understanding of work to be done and the time it takes to do it?
- Is there a reasonable probability of delivering the investigation on time to meet the proposed dates?
- Does it include schedule margin?
- Will proposed management approach (e.g., institutions and personnel, as known, organization, roles and responsibilities, experience, commitment, performance measurement tools, decision process, etc.) allow successful completion of investigation? Is the PI in charge?
- Does the investigation, as proposed, have a reasonable chance of being accomplished within proposed cost?
- Are proposed costs within appropriate caps and profiles and does cost estimate cover all costs including full-cost accounting for NASA Centers?
- Are costs phased reasonably?
- Is there evidence in the proposal to give confidence in the proposed cost?
- Does the proposer recognize all potential risks/threats for additional costs or cost growth (e.g., late deliveries of components)?

# Characteristics of LOW Risk Ratings



- All risks for the project have been/are being identified and managed by the team, with plans to reduce or retire the risk before launch.
- No risk exists for which neither a workaround is planned, nor a very sound plan to develop and qualify the risk item for flight.
- The proposed project team and each of its critical participants are competent, qualified, and committed to execute the project.
- The project will be self managed to a successful conclusion while providing reasonable visibility to NASA for oversight.
- The team has thoroughly analyzed all project requirements, and consequently the proposed resources are adequate to cover the projected needs, including an additional percentage for growth during the design and development, and then a margin on top of that for unforeseen difficulties.
- The schedule includes reserve time, to find and fix problems if things do not go according to plan.
- All contributed assets for the project are backed by letters of commitment.
- The team understands the seriousness of failing to meet technical, schedule, or cost commitments for the project in today's environment.

# Characteristics of HIGH Risk Ratings

Technical Design Margins (Mass, Power, etc.)

- Insufficient data provided from which to independently verify the margins.
- No margin provided or conflicting data provided.
- Margin provided deemed too low based on the maturity of the design.

Cost

- Concerns relating to cost reserve (Below AO requirement, too low based on liens/threats, phasing inconsistent with anticipated needs).
- Unable to validate proposed cost
- Insufficient Basis of Estimate

Instrument Implementation

- Heritage claims not substantiated/development risks not adequately addressed.
- Inadequate/inconsistent description and detail.
- Inconsistencies between instrument requirements and bus capabilities.

# Characteristics of HIGH Risk Ratings



Complex Operations
- More common in payloads containing multiple instruments that required tight scheduling/sequential operations. Operations not adequately addressed.

Systems Engineering
- Incomplete flow-down of science requirements to payload/flight system accommodations.
- Incomplete description of how the systems engineering function will be executed.
- Inadequate resources allocated to accomplish this function.

Management Plans
- Conflicting organizational roles and responsibilities.
- Lack of demonstrated organizational/individual expertise for specified role.
- Insufficient time commitments for key personnel.

Schedules
- Insufficient detail from which to perform an independent assessment.
- Inadequate/no schedule reserve identified.
- Overly ambitious schedules that are not consistent with recent experiences.