The Current AO Process Including Evaluation, Plans for a New AO Outline, and a Few Related Thoughts

Brad Perry and Jay Bergstralh

Langley Research Center

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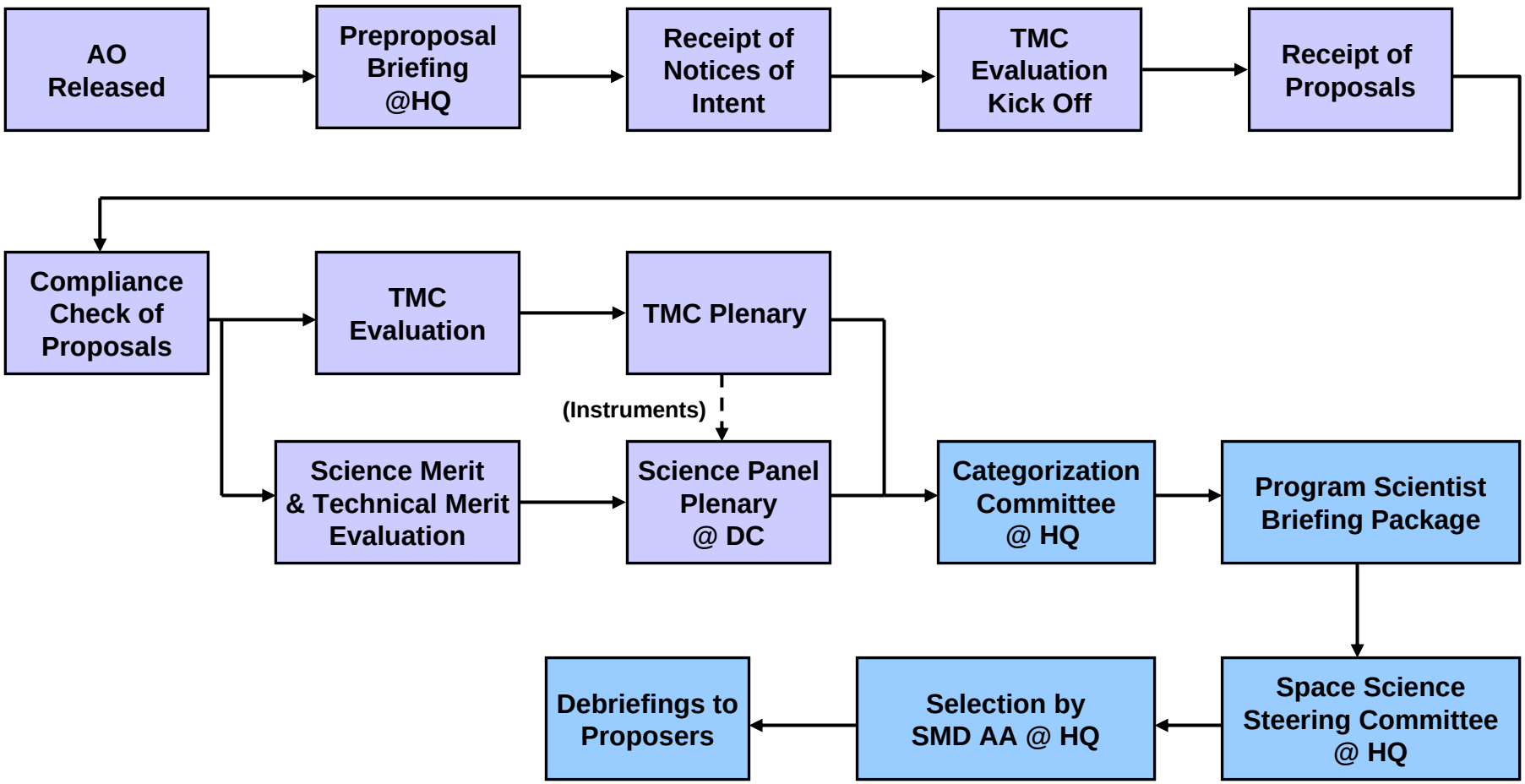
Presentation Overview

- Current AO Process Including Evaluation
- AO Simplification Study Objectives
- TMC Lessons Learned Over the Last Decade
- Current Plans for a New Standard AO

The Current AO Process

- Today's AO process employs a standardized AO outline ; however, AO requirements have grown significantly over the past decade, leading to increased effort, time , and money required to propose.
- The AO requirements are located in the body of the AO, the AO Appendices, and additionally in the AO Program Library. Today, it is an onerous process to identify all of the requirements, as evidenced by the recent SMEX proposal teams stating the number of requirements between 700 and 1,300!
- Today, the bar is indeed high, and we believe that there are a number of examples of "Too High a Pre-Phase A Standard" for proposal teams. Paul Hertz will address a number of these in his presentation.

Proposal Evaluation Process



Summary Proposal Evaluation Criteria

The criteria used for evaluation are as follows:

- Scientific merit of the investigation (Form A): Accomplished by the Science Panel.
- Technical merit and feasibility of the proposed investigation (Form B): Accomplished by the Science Panel. The TMC Panel may provide input by providing comments to the Science Panel. In addition, the TMC Panel may provide Instrument Evaluation technical support to the Science Panel.
- Feasibility of the proposed approach for mission implementation, including Cost Risk (Form C): Evaluated by the TMC Evaluation Panel. Form C or additional forms *may* also be use to address additional evaluation areas, e.g., Student Collaboration, etc.

Step 1 Evaluation Ground Rules

- All proposals are reviewed to identical standards and without comparison to other proposals.
- The Step One Selection is based primarily on Science.
- The Integrated TMC Risk Assessment is based on a *preliminary concept* with appropriate benefit of the doubt given to the proposer.
- Science and TMC Panel evaluators are peers in the areas of expertise they evaluate.
- All Evaluators verify the accuracy and completeness of their findings throughout the entire process.
- High Risk proposals <u>are not</u> be recommended for selection. Low risk, compelling science is very acceptable; medium risk, compelling science may also be acceptable.

<u>Basic TMC Assumption:</u> Proposer is the expert on their proposal.

- TMC: Task is to try to validate proposer's assertion of Low Risk.
- Proposer: Task is to provide evidence that the project is Low Risk.

AO Simplification Objectives

- SPD-13A has established **experience levels for PIs proposing Small, Medium, and Large Mission Classes**, and NASA is volunteering to pre-screen PIs before they submit proposals. SPD-13A has also established the **requirement for a PI Training Course for all mission PIs** that is being implemented through APPEL.
- AO Simplification is being designed to operate with the established levels for PI experience, and **to require less effort, time, and money for proposal teams to prepare and submit proposals.**
- There are three necessary outcomes that the simplified AO must meet:

  (1) **Ability for NASA to evaluate the science merit** (through science peer review) to guide selection;

  (2) **Ability for NASA to evaluate the feasibility of proposed missions including cost** (through TMC review) to guide selection; and

  (3) **Preparing mission teams to successfully conduct Phase A mission concept studies if they are selected.**

TMC Evaluation Questions That Will Still Need to be Answered

- Will overall mission/project design allow successful implementation of mission as proposed? If not, are there sufficient resources (time & money) to correct identified problems?

- Does proposed design/development allow the mission to have a reasonable probability of accomplishing its objectives? Does it depend on new technology that has not yet been demonstrated? Are requirements within existing capabilities or are advances required? Does the proposal accommodate sufficient resiliency in appropriate resources (e.g., money, mass, power) to accommodate development uncertainties?

- Is there an adequate Risk Management approach to identify problems with sufficient warning to allow for mitigation without impacting the mission objectives? Does proposer understand their known risks and are there adequate fallback plans to mitigate them, including risk of using new technology, to assure that the mission can be completed as proposed?

TMC Evaluation Questions That Will Still Need to be Answered (concluded)

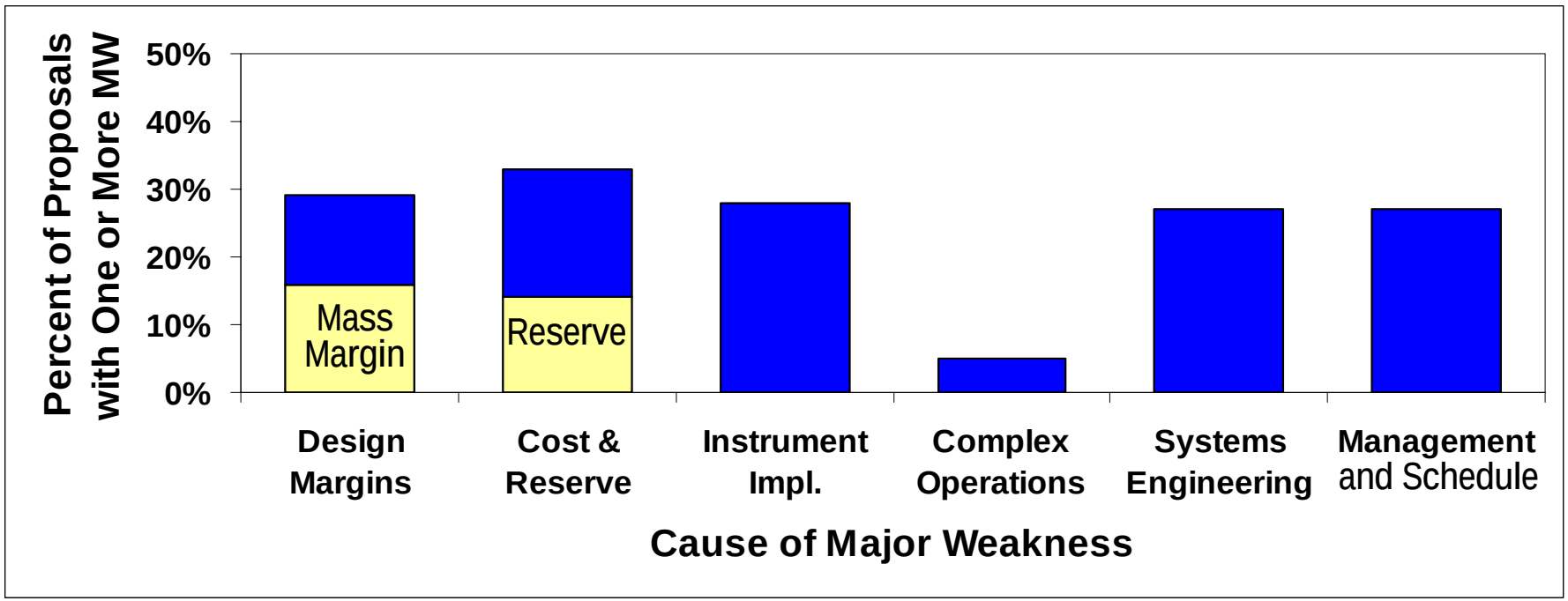
- Is the schedule doable? Does it reveal an understanding of the work to be done and the time it takes to do it? Is there a reasonable probability of launching on time? Does it include schedule margin?

- Will proposed management approach allow successful completion of the mission? Is the PI in charge?

- Does the mission, as proposed, have a reasonable chance of being accomplished within proposed cost? Are proposed costs within appropriate caps and does the cost estimate cover all costs including full-cost accounting for NASA Centers? Are costs reasonably phased? Is there evidence in the proposal to give confidence in the proposed cost? Does the proposer recognize potential risks/threats for additional costs or cost growth?

Lessons Learned Summary
Common Causes of Major Weaknesses

- Common causes for Major Weaknesses can be categorized in six areas noted below.
- The figure also shows the percentage of Step 1 proposals with one or more identified Major Weaknesses in each of these categories.
- Two issues, mass margin and cost reserve, are highlighted for special attention since they are prominent as sources of many Major Weakness findings.



Current Plans for a New Standard AO

- Plans are to have a …

  Draft standard AO outline by the end of March;

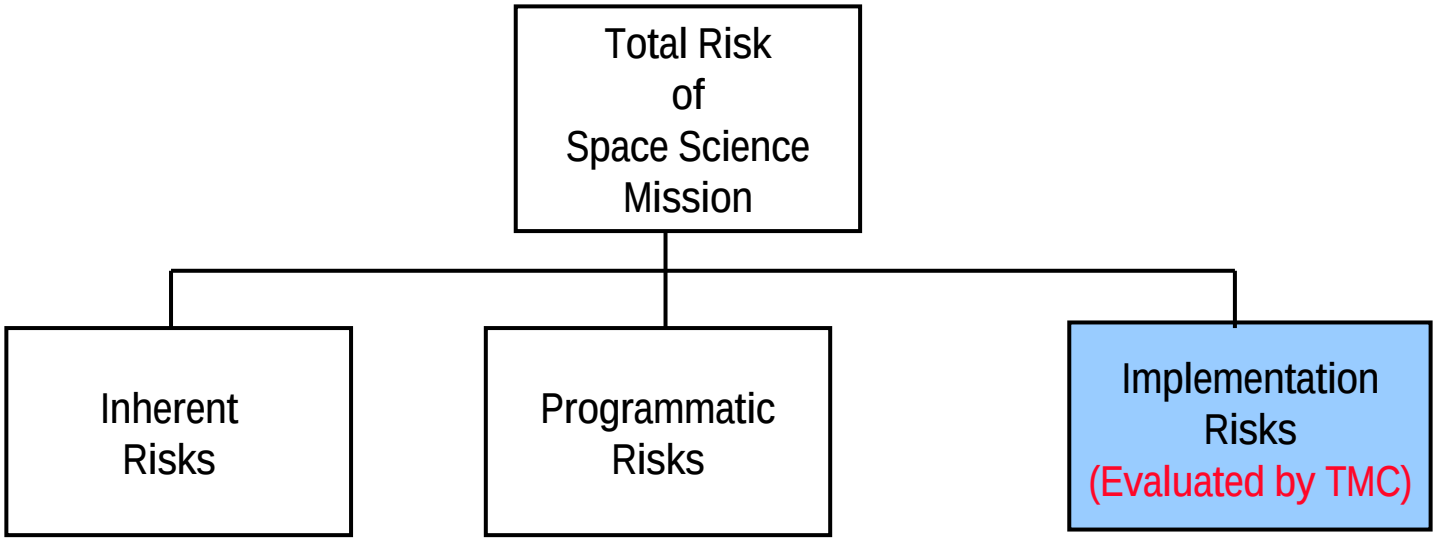
  Draft standard AO for proposal community comment in April, and a draft white paper describing the AO Simplification Process; and

  And a New Standard AO and finalized white paper in June.

- The new Standard AO initially for the upcoming New Frontiers AO (Draft in the summer).

Supplemental Information

Space Science Mission Risks



Risks that are unavoidable to do the investigation:

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

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
- Etc.

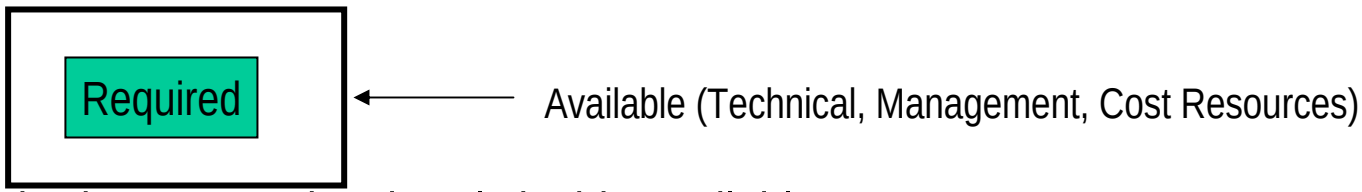
Risks that are associated with implementing the investigation:

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

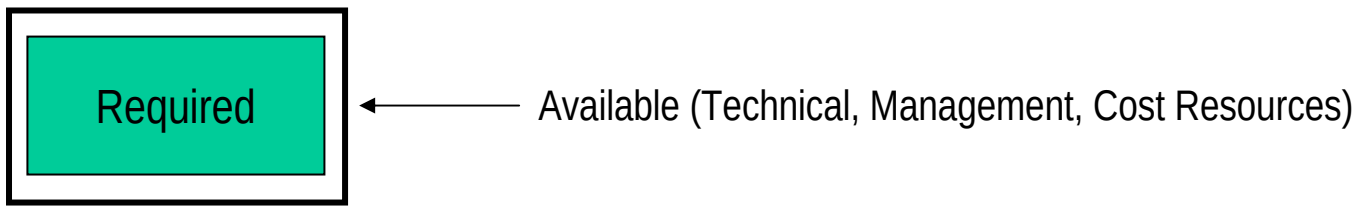
TMC Risk Envelope Concept

Envelope: All TMC Resources available to handle known and unknown development problems that occur.

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.

Some Characteristics Applicable to a Low Risk Rating

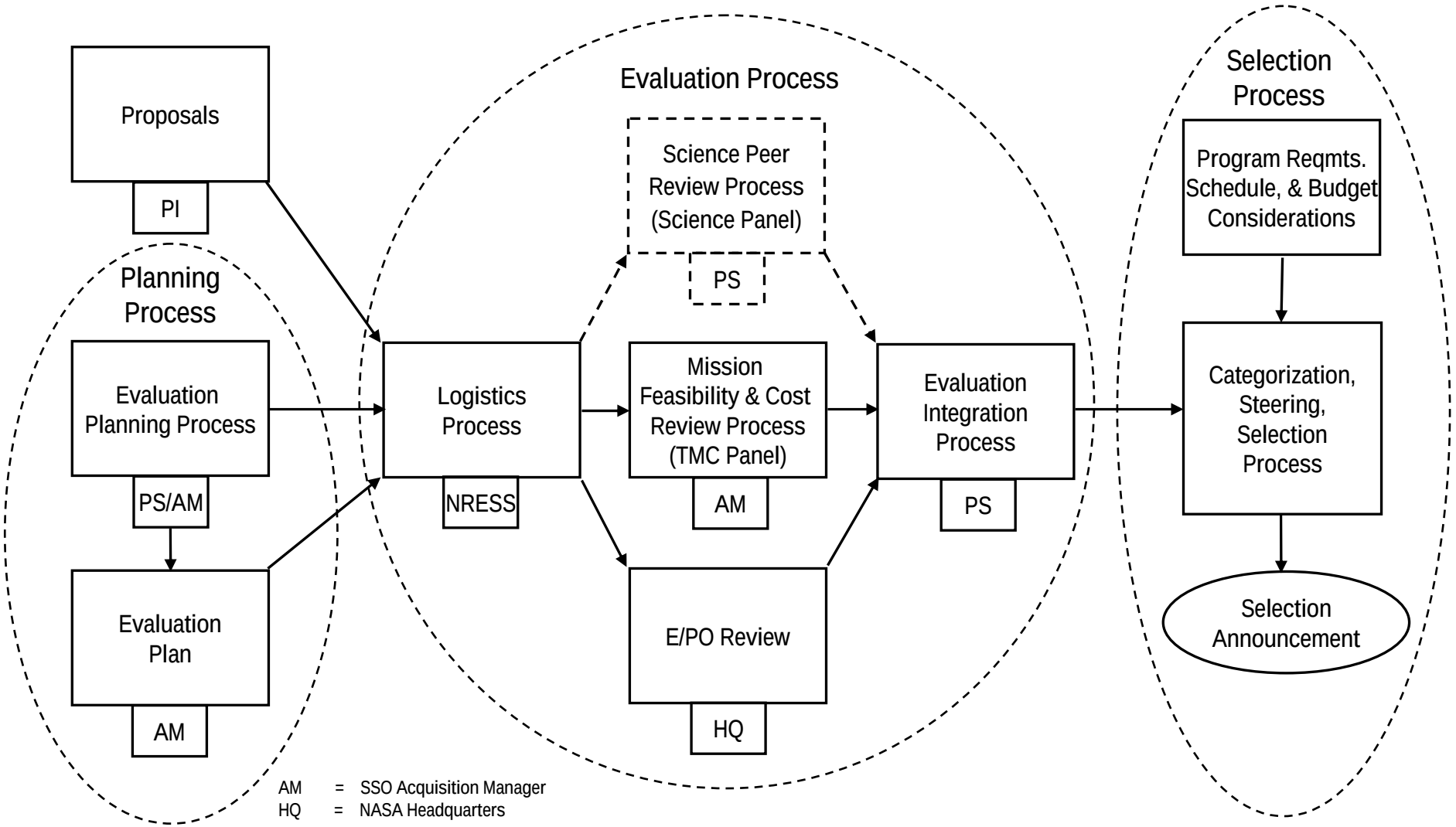
- All risks for the project have been/are being identified and managed by the proposal team, with plans to reduce or retire the risk before launch.
- No risk exists for which there is neither a workaround planned, nor a very sound plan to develop and qualify the risk item for flight.
- The proposed Project 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 proposal team has thoroughly analyzed all project requirements, and the resulting resources proposed 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.
- Reserve time exists in the schedule to find and fix problems if things do not go according to plan.
- Any contributed assets for the project are backed by letters of commitment.
- The proposal team understands the seriousness of failing to meet technical, schedule, or cost commitments for the project in today's environment.

Definition: Step 1 TMC Weaknesses

- 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.

- Major Weakness: A deficiency, or set of deficiencies taken together, judged to substantially affect the proposer's ability to meet the technical objectives within the proposed cost and schedule.
  - Major Weaknesses as well as Major Strengths *are* a discriminator in the assessment of risk. Minor Weaknesses and Strengths *are not* a discriminator in the assessment of risk.
  - It is not the number of Major Weakness that convinces the TMC evaluation team that a proposal is High Risk. There are two items that are considered when judging Major Weaknesses:
    1. How serious is the Major Weakness?
    2. Can the Major Weakness be fixed within the budgeted cost cap and within schedule limitations?
  - One Major Weakness, if serious enough, could warrant a proposal to be judged to be High Risk.

Step One
Evaluation Responsibility Diagram

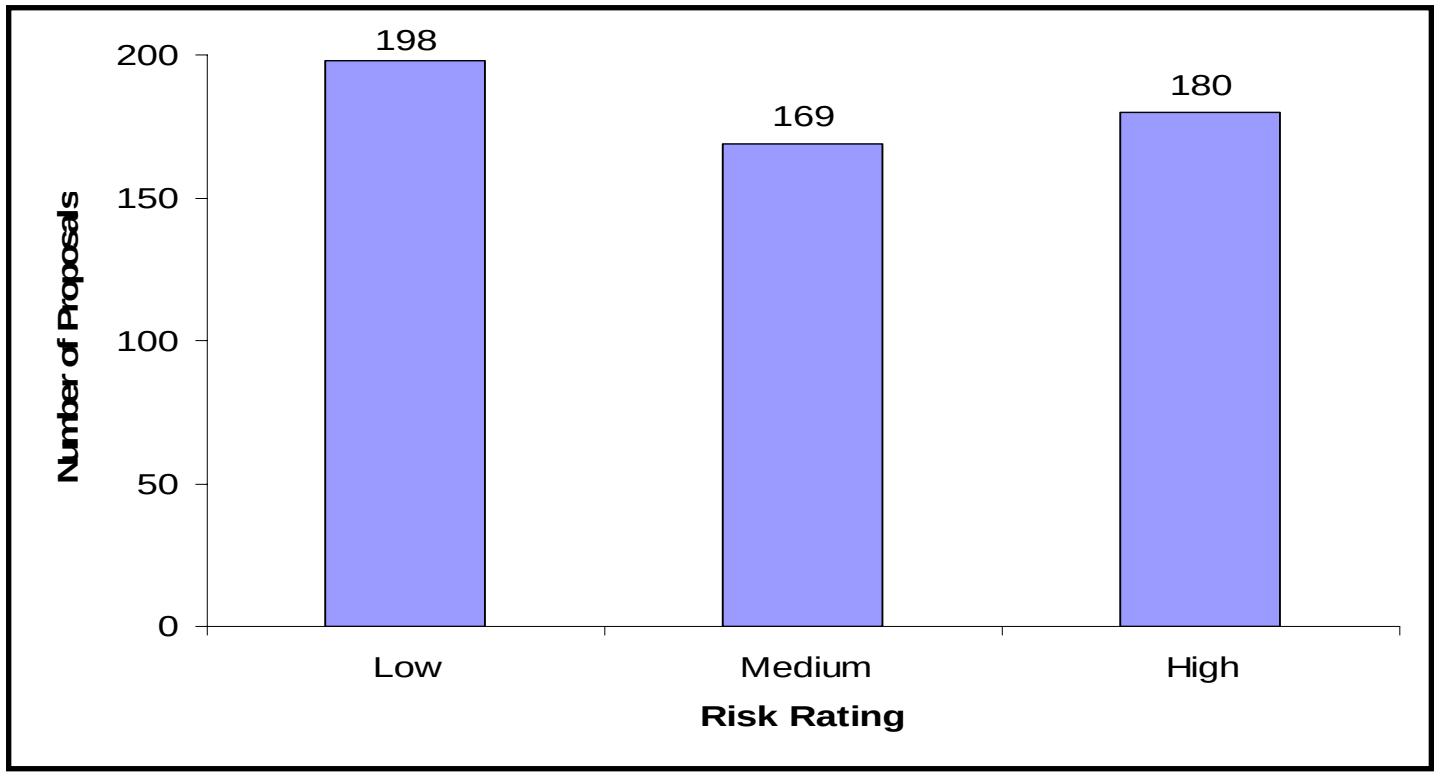


AM = SSO Acquisition Manager
HQ = NASA Headquarters
NRESS = NASA Research & Education Support Services
PI = Principal Investigator
PS = Program Scientist

Lessons Learned Summary
Historical Risk Ratings

A **Low Risk** proposal is one that TMC reviewers expect will accomplish its goals within the schedule and cost proposed.

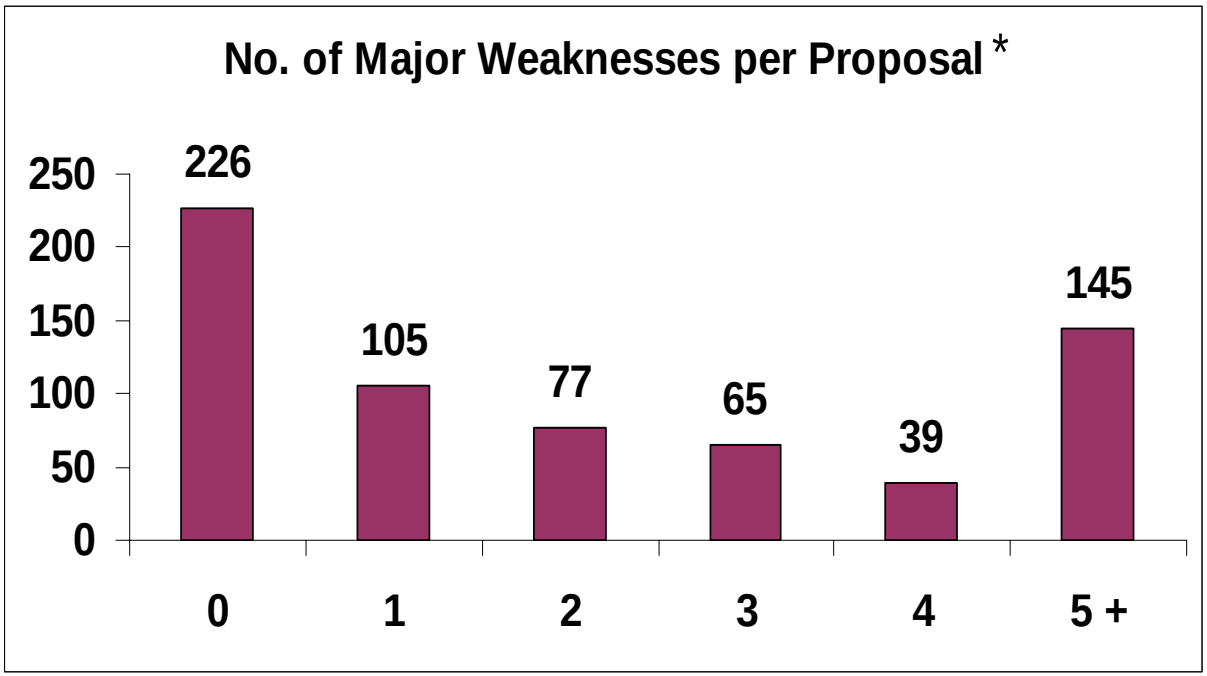
- Of the 547 proposals given a Risk Rating, only 198 (36%) received a Low Risk Rating.
- No full missions rated as High Risk by TMC have been selected for implementation.



Summary of Risk Ratings for Step 1 Proposals

Lessons Learned Summary
Major Weaknesses per Proposal

- Only 34% of proposals reviewed were judged to have no Major Weaknesses.
- The number and severity of Major Weaknesses directly affect the overall implementation Risk Rating.



History of Major Weaknesses per Proposal Evaluated

* This chart includes 657 proposals. This number is greater than the 547 proposals as noted on the previous slide, since not all evaluations resulted in a TMC Risk Rating.

Common Causes of Major Weaknesses
Design Margins

Mass and power margins were the most prevalent areas of concern:

Mass: Common reasons for Major Weaknesses:

1. Unable to verify the margin.
2. No mass margin was identified or the proposal contained conflicting statements.
3. Mass margins were too low based on the maturity of the proposed design, or required elements were omitted.
4. Confusion between mass contingency and mass margin.

The TMC review teams look for a competent engineering design that includes appropriate levels of contingency *and* margin, along with suitable rationale for the size of both.

Power: Common reasons for Major Weaknesses:

1. Margins were not calculated against the most critical or demanding operating mode.
2. Maneuver impulse budgets and propellant requirements could not be verified.
3. Could not verify and assess suitability of stated margins for both high-thrust and low-thrust propulsion systems.

Common Causes of Major Weaknesses
Cost and Reserves

There are three common reasons why proposals received a cost Major Weakness:

1. Cost Reserve is too low.
   - A reserve level (percent of cost-to-go) is below the stated AO requirement.
   - Liens already identified against the reserves.
   - Reserves are too low to cover cost threats identified during evaluation.
   - Phasing of reserves in the funding profile is too late to be useful.
2. Basis of Estimate is flawed: Rationale and method is unconvincing or deficient.
3. Unable to validate proposer's cost estimate:
   - Multiple independent cost analyses are developed for each proposal.
   - A large uncertainty bar is added giving the benefit of doubt to the proposer.
   - A proposed cost that falls outside this cost range is likely to be flagged as a Major Weakness.

Common Causes of Major Weaknesses
Instrument Implementation

Areas of concern that produce Major Weaknesses include:

1. Complex new designs for which the development risks are not adequately addressed.
2. Inadequate or inconsistent description and detail that preclude a reasonable TMC evaluation.
3. Weak heritage claims.
4. Inconsistencies between instrument requirements and the spacecraft instrument accommodation capabilities.
5. Insufficient integration and test program including an end-to-end verification test.
6. Issues with pointing performance (knowledge, accuracy, etc.) and potential for detector contamination during flight.

Common Causes of Major Weaknesses
Complex Operations

Major Weaknesses related to the complexity of the proposed operations included:

1. Complex observing sequences for instruments:
   - For payloads consisting of several instruments that must be operated sequentially.
   - Where many critical events must occur in a short period of time.
2. Proposed landers that present additional operational challenges that may not be adequately planned.
3. Concept of operations not clearly defined and inadequate or incomplete explanation of how the operations planning will be developed and tested.

Common Causes of Major Weaknesses
Systems Engineering

Major Weaknesses for Systems Engineering seem to occur more often in earlier proposals. Recent experience seems to indicate an improvement in the number of Major Weaknesses in this area, perhaps in response to firm AO requirements for a traceability matrix to flow down science requirements to instruments, payload accommodations and flight systems.

More recent concerns that continue to produce Major Weaknesses in systems engineering are:

1. Incomplete or unconvincing plan for how systems engineering responsibilities will be executed across the entire project.
2. Implementation plan not providing for adequate resources for all participating organizations to successfully accomplish this function.
3. Underestimates of the cost of this function.

Common Causes of Major Weaknesses Management and Schedule

The common causes of Major Weaknesses in project management are as follows.

1. Confusing organizational roles and responsibilities for the participating institutions or key individuals.
2. Unclear lines of authority within the project, or between the project and the participating institutions.
3. Lack of demonstrated organization or individual expertise for the specific role identified.
4. Low time commitments for essential members of the core management team.

Common Causes of Major Weaknesses Management and Schedule (concluded)

The common causes for Major Weakness in schedule are as follows:

1. Insufficient detail from which to perform a reasonable assessment of whether the proposer understands how all of the work will be accomplished in time.
2. The master schedule shows no margin or inadequate margin to address potential delays.
3. TMC assesses whether the proposed schedule reflects realistic expectations based on recent experiences in flight system and payload development.